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Preventing a Risk/Risk Trade-off: An Analysis of the Measures Necessary to Increase U.S. Pollinator Numbers

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NOTE

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I. INTRODUCTION

Honeybees and other pollinators have played a pivotal role in human survival. Honey-gathering is depicted in cave paintings that date back to the Neolithic Age.[1] Ancient Egyptians floated honeybee hives on rafts down the Nile River as a way of transporting bees from one crop to another.[2] While honeybees (*Apis mellifera*) are not native to North America, honeybees were important enough to the pilgrims that they brought honeybees across the Atlantic around 1622.[3] Today, honeybees are an agricultural commodity valued at 19 billion dollars in the United

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1. T. DOUGLAS PRICE, EUROPE BEFORE ROME: A SITE-BY-SITE TOUR OF THE STONE, BRONZE, AND IRON AGES 214-15 (2013).

2. NOAH WILSON-RICH ET AL., THE BEE: A NATURAL HISTORY 16 (2014).

3. Tom Turpin, *Honeybees Not Native to North America*, PURDUE U. EXTENSION (Nov. 11, 1999), https://www.agriculture.purdue.edu/agcomm/news columns/archives/OSL/1999/November/111199OSL.html [http://perma.cc/W576-YXVR].

States (U.S.), where bees are responsible for one out of every three bites of food eaten.[4]

In the past few years, the number of honeybee colonies has plummeted—not only in the United States, but throughout the world.[5] Since 2006, beekeepers all over the world have seen an annual loss of 30 to 90 percent of their honeybee colonies.[6] Wild pollinators have also been affected; many wild bee, butterfly, and moth species are experiencing similar population declines.[7]

This severe decline in pollinator numbers is worrisome due to the key role bees and other pollinators play in food production. Honeybees assist in the production of more than 90 commercially grown crops in the United States.[8] Globally, 87 of the leading 115 food crops, or 35 percent of the global food production, is dependent on pollinators.[9] Much of the food we take for granted—such as apples, almonds, onions, broccoli, and many other fruits, vegetables and nuts—would simply cease to exist without honeybee pollination.[10]

This massive honeybee die-off is now recognized as Colony Collapse Disorder (CCD). Researchers have spent years trying to find the cause of CCD, with the hopes that finding its cause will lead to a solution that will increase pollinator populations. Recent studies show that CCD does not have a sole cause, as previously expected, and may instead be caused by the accumulation of stress

4. *What Is a Pollinator?*, U.S. NAT'L PARK SERV., http://www.nps.gov/subjects/pollinators/what-is-a-pollinator.htm [http://perma.cc/M44U-J5CY] [hereinafter *Pollinator Report*].

5. Telisport W. Putsavage, *Bees Getting Stung: Law and Science Uncertain, Food at Risk,* LAW360 (July 17, 2015, 11:07 AM), http://www.law360.com/articles/679742/bees-getting-stung-law-and-science-uncertain-food-at-risk?article_related_content=1 [http://perma.cc/UUB3-HXG3].

6. *Honey Bee Health and Colony Collapse Disorder,* AGRIC. RESEARCH SERV., U.S. DEP'T OF AGRIC., Http://www.ars.usda.gov/News/docs.htm?docid=15572 [http:// perma.cc/US5Z-UB6H] [hereinafter *Honey Bee Health & CCD Report*].

7. J. Jelle Lever et al., *The Sudden Collapse of Pollinator Communities,* 17 ECOLOGY LETTERS 350, 350 (2014).

8. Press Release, Office of the Press Sec'y, The White House, Fact Sheet: The Economic Challenge Posed by Declining Pollinator Populations (June 20, 2014), https://www.whitehouse.gov/the-press-office/2014/06/20/fact-sheet-economic-challenge-posed-declining-pollinator-populations [http://perma.cc/QSM3-E5XH].

9. *Id.*

10. Ferris Jabr, *The Mind-Boggling Math of Migratory Beekeeping,* SCI. AM. (Sept. 1, 2013), http://www.scientificamerican.com/article/migratory-beekeeping-mind-boggling-math [http://perma.cc/K56T-8WVS].

that the use of neonicotinoid-based pesticides, viruses, mite infestations, poor nutrition, and other events inflict on beehives.[11]

As a response to the declining pollinator population, the U.S. government, environmental organizations, farmers, concerned citizens, and the industries relying on pollinators are proposing several different measures to both increase pollinator populations and lower the use of neonicotinoids and other pesticides in the United States. Some organizations and researchers suggest that a complete ban on the use of neonicotinoids is the best way to increase honeybee populations.[12] This Article will discuss the risks of solely relying on a neonicotinoid ban, and will present alternative legal and administrative actions that can be put in place to protect bees and increase their population size.

This Note will proceed in four parts. Part II will discuss the importance of pollinators and the possible reasons for their declining numbers. Part III will delve into the current and proposed actions to increase pollinator populations that are taking place in the United States. Part IV will then discuss the generally desired and widely accepted solution: a ban on neonicotinoids. This Part will introduce the implementation and results of a neonicotinoid ban in the European Union, and the risk/risk trade-off presented by a neonicotinoid ban. Finally, Part V will compile the solutions discussed in Parts III and IV, and present possible legal and administrative solutions that can be put in place to protect bees, modeled after the legal actions that have successfully increased monarch butterfly populations while avoiding the issues the European Union faced with its neonicotinoid ban. Part V will conclude that banning neonicotinoids is not the save-all solution to pollinator decline, and propose that focusing on a multiplicity of avenues—both legal and administrative—that tackle the many reasons why pollinator populations are in decline is more likely to increase pollinator numbers than focusing on one single factor.

11. John Bryden et al., *Chronic Sublethal Stress Causes Bee Colony Failure*, 16 ECOLOGY LETTERS 1463, 1467 (2013); Gayathri Vaidyanathan, *Stress Alone Can Lead to Bee Colony Collapse*, SEEKER (Oct. 7, 2013, 5:48 AM), http://www.seeker.com/stress-alone-can-lead-to-bee-colony-collapse-1767916740.html [https://perma.cc/AH6Q-GYQJ].

12. *See, e.g.*, Kate Colwell, *White House Pollinator Strategy Won't Solve Bee Crisis,* FRIENDS OF THE EARTH (May 19, 2015), http://www.foe.org/news/news-releases/2015-05-white-house-pollinator-strategy-wont-solve-bee-crisis [http://perma.cc/PZ4K-HQHY].

This Note in no way supports the unregulated or excessive use of neonicotinoids. It instead warns against implementing a neonicotinoid ban before ensuring that the industries relying on neonicotinoids have a safe and effective substitute pesticide. A middle ground—with regulated, and limited use of neonicotinoids, alongside other measures to protect pollinators—will both be more achievable in the current political climate, and more likely to be implemented by the agricultural industry than a neonicotinoid ban.

II. BACKGROUND ON POLLINATORS: THEIR IMPORTANCE AND DECLINE

Before discussing the possible legal solutions to declining pollinator populations, it is important to first define and understand the problem itself. This Part will present the background information necessary to do so. First, this Part will provide information on pollinators and bees. Second, this Part will present information on Colony Collapse Disorder and its attributed causes: neonicotinoids, parasites, loss of habitat, and inadequate nutrition. Finally, this Part will discuss new research on Colony Collapse Disorder, and its more likely cause—stress on beehives.

A. Pollinators and Agriculture

Pollinators are insects, birds, and small mammals—such as bees, wasps, moths, butterflies, birds, flies, and bats—that "help[] carry pollen from the male part of the flower to the female part of the same or another flower."[13] This movement of pollen is necessary for plant fertilization, by which plants produce fruits, seeds, and other plants.[14] Bees intentionally collect and distribute pollen, whereas other pollinators like butterflies, birds, and bats move pollen accidentally.[15] Pollinators provide an important ecosystem service, as they pollinate both wildflowers and agricultural crops.[16] At least 75 percent of the flowering plants on

13. *Pollinator Report*, *supra* note 4.
14. *Id.*
15. *Id.*
16. Bryden, *supra* note 11, at 1463.

Earth are pollinated by insects, birds, and mammals— amounting to $215 billion in food production.[17]

In commercial agriculture, the most important and widely used pollinator is the honeybee. Honeybees used in commercial agriculture begin their lives as larvae in honeycomb compartments.[18] These larvae mature into "hive" bees, which help maintain the hive by building cells, cleaning cells, and ventilating the hive.[19] After 21 days, hive bees mature into "forager" bees, which are responsible for finding and collecting nectar and pollen.[20] After another 21 days, the forager bees die.[21] At this point, other hive bees replace the deceased forager bees.[22]

In the past, honeybees' assistance in pollination was generally a side benefit of the honey-making industry for beekeepers. Now, beekeepers make around half their income—not from selling honey—but from renting their hives to farmers to pollinate crops.[23] Long gone are the days of permanent beehives; today, bees used in agricultural pollination are transported in large trucks from crop to crop, a practice known as "migratory beekeeping."[24] Almonds, avocados, plums, pears, cantaloupes, cucumbers and many other nuts, fruits, and vegetables are now mainly pollinated by "migrant" honeybees.[25]

B. Colony Collapse Disorder and its Possible Causes

1. What is Colony Collapse Disorder?

Colony Collapse Disorder refers to the "sudden die-off of bee colonies brought on by the disappearance of adult bees from their

17. Dave Goulson et al., *Bee Declines Driven By Combined Stress From Parasites, Pesticides, and Lack of Flowers*, 347 SCI. MAG. 1435, 1436 (2015).

18. Vaidyanathan, *supra* note 11.

19. *Id.*

20. *Id.*

21. *Id.*

22. *Id.*

23. Jabr, *supra* note 10.

24. *Id.*

25. Josh Dzieza, *Save the Honeybee, Sterilize the Earth,* PAC. STANDARD (Jan. 5, 2015), http://www.psmag.com/navigation/nature-and-technology/save-the-honeybee-sterilize-the-earth-pollination-industrial-complex-95566 [http://perma.cc/P4MX-ZNGU].

hives."[26] Honeybee hive die-offs are not a new phenomenon.[27] Bee colonies have suffered severe die-offs in the past, most notably in the 1980's due to mite infestations.[28] What is different is that in past die-offs, beehives contained the deceased adult bees.[29] In comparison, a hive affected by CCD is completely devoid of adult bees, as they fail to return to their hive.[30] The adult bees seemingly "disappear" from the hive, leaving behind food, larvae, and the queen.[31]

In the United States, honeybee numbers decreased from 5 million hives in 1988 to 2.5 million hives in 2015.[32] From 2010 to 2015, honeybee die-offs hit 42, 34, 46, 29, and 36 percent, respectively.[33] That means that during these 5 years, more than one in every three honeybee colonies died each winter.[34] For comparison, a winter decline of around 19 percent is considered normal.[35]

No single factor has been identified as the cause of CCD.[36] Research points to the use of neonic pesticides (neonicotinoids), disease, parasites, poor nutrition, habitat change, and habitat loss

26. *Journey with Nature: Bees & Agriculture*, NATURE CONSERVANCY, http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/indiana/journeywithnature/bees-agriculture.xml [http://perma.cc/RGJ7-HEU6].

27. *Id.*

28. RENÉE JOHNSON, CONG. RES. SERV., HONEY BEE COLONY COLLAPSE DISORDER 5 (2010), https://fas.org/sgp/crs/misc/RL33938.pdf [https://perma.cc/4GTG-MX3F].

29. *Honey Bee Health & CCD Report*, *supra* note 6.

30. *Id.*; JOHNSON, *supra* note 28.

31. *Colony Collapse Disorder*, U.S. ENVTL. PROT. AGENCY [EPA] (Sept. 16, 2016), https://www.epa.gov/pollinator-protection/colony-collapse-disorder [https://perma.cc/8WR4-E4JA].

32. Australian Academy of Science, *The Death of Bees Explained—Parasites, Poison and Humans*, YOUTUBE (July 9, 2015), https://youtu.be/GqA42M4RtxE.

33. Kim Kaplan, *Bee Survey: Lower Winter Losses, Higher Summer Losses, Increased Total Annual Losses*, AGRIC. RES. SERV., U.S. DEP'T OF AGRIC., (May 13, 2015), http://www.ars.usda.gov/is/pr/2015/150513.htm [http://perma.cc/ 3UFV-49N2]; David Wallace-Wells, *The Blight of the Honey Bee*, N.Y. MAG. (June 17, 2015), http://nymag.com/daily/intelligencer/2015/06/bees-are-literally-worry ing-themselves-to-death.html [http://perma.cc/QH8U-F29U].

34. Wallace-Wells, *supra* note 33.

35. Geoffrey Mohan, *Bees Threatened by a Common Pesticide, EPA Finds,* L.A. TIMES (Jan. 6, 2016), http://www.latimes.com/business/la-fi-pesticide-bees-20160106-story.html [http://perma.cc/5ZLB-XX8J]; *see* Kaplan, *supra* note 33.

36. Bryden, *supra* note 11, at 1463.

as the most likely causes of CCD.[37] At one point, even cellphone signals and diesel fumes were thought to affect bees' health.[38]

2. What Are Neonicotinoids?

Neonicotinoids were approved as a crop pesticide in the early 1990's as an alternative to the pesticide dichlorodiphenyltrichloroethane (DDT).[39] Neonicotinoid insecticides include clothianidin, thiamethoxam, imidacloprid, acetamiprid, and nithiazine, which are marketed under various trade names.[40] Neonicotinoids are chemically similar to nicotine and contain nicotine's addictive properties.[41] Rather than avoiding neonicotinoids—just like humans who cannot stop smoking—bees are attracted to, and seem to prefer, neonicotinoid-treated plants.[42]

Unlike other insecticides and pesticides, neonicotinoids are generally not sprayed on crops; seeds are instead coated with neonicotinoids.[43] A plant that sprouts from a seed coated with neonicotinoids absorbs the insecticide into its tissue as it grows.[44] The insecticide eventually ends up in the plant's nectar and pollen, where it comes into contact with pollinators as they collect the plant's pollen and drink its nectar.[45] Bees can also come into contact with neonicotinoids from exposure to dust released into the air when planting coated seeds,[46] and through pesticide-contaminated water.[47] As forager bees bring back nectar and

37. *Id.*

38. *Honey Bee Health & CCD Report*, *supra* note 6; Vaidyanathan, *supra* note 11.

39. Anne Fairbrother et al., *Risks of Neonicotinoid Insecticides to Honeybees*, 33 ENVTL. TOXICOLOGY & CHEMISTRY J. 719, 723 (2014).

40. *Id.* at 722.

41. Sébastien Kessler et al., *Bees Prefer Foods Containing Neonicotinoid Pesticides*, 521 NATURE 74, 74-76 (2015) (describing the possible connection between bees' nicotinic acetylcholine receptors and neonicotinoids).

42. *Id.*

43. Maj Rundlöf et al., *Seed Coating with a Neonicotinoid Insecticide Negatively Affects Wild Bees*, 521 NATURE 77, 77 (2015).

44. Fairbrother, *supra* note 39, at 723.

45. Mohan, *supra* note 35.

46. *Id.*

47. *See* Olivier Samson-Robert et al., *Neonicotinoid-Contaminated Puddles of Water Represent a Risk of Intoxication for Honey Bees*, PLOS ONE, Dec. 1, 2014.

pollen containing neonicotinoids, the neonicotinoids accumulate in the hive and slowly affect the entire colony.[48]

Neonicotinoids are the most widely used insecticide in the world, with 1.5 billion dollars in sales in 2008, and comprising 24 percent of the worldwide insecticide market in 2015.[49] Crops regularly treated with neonicotinoids include wheat, barley, millet, oats, peas, and other food staples.[50] An estimated 92 to 95 percent of corn, and 70 percent of soybeans in the U.S. and Canada—two of North America's major crops, with the highest value of production and most planted acreage—are planted with neonicotinoid-coated seeds.[51]

Neonicotinoids attack insects by harming their nervous systems.[52] In extremely high doses, neonicotinoids cause bees to suffer from convulsions, paralysis, and death.[53] Several studies have focused on the effects of sub-lethal exposure to neonicotinoids, and the results range from findings that neonicotinoids have little effect on bees, to studies demonstrating that minimal exposure to neonicotinoids is ultimately lethal.[54] A general consensus appears to be that—at a minimum—in sub-lethal doses, neonicotinoids

48. Fairbrother, *supra* note 39, at 729.

49. Australian Academy of Science, *supra* note 32.

50. Memorandum from the Reg'l Chief, Nat'l Wildlife Refuge Sys., Region 1, U.S. Dep't of the Interior on Guidelines Regarding the Interim Use and Phase Out of Neonicotinoid Insecticides to Grow Agricultural Crops for Wildlife on NWRs in the Pacific Region to Refuge Project Leaders, Region 1 at 3 (July 9, 2014), http://www.centerforfoodsafety.org/files/guidelines-for-interim-use-and-phase-out-of-neonicotinoid-insecticides-in-refuge-farming-for-wildlife-programs-signed-kf-7914_67415.pdf [https://perma.cc/3RFJ-RJ53] [hereinafter Dep't of the Interior Memo].

51. *Id.*

52. Fairbrother, *supra* note 39, at 719.

53. *Id.* at 724.

54. *See* Mark J.F. Brown & Robert J. Paxton, *The Conservation of Bees: A Global Perspective*, 40 APIDOLOGIE 401, 413 (2009) (finding that effects of neonicotinoid misuse in Germany are largely unknown yet likely profound). *Compare* Galen P. Dively et al., *Assessment of Chronic Sublethal Effects of Imidacloprid on Honey Bee Colony Health*, PLOS ONE, Mar. 18, 2015 (describing the negative effects of imidacloprid on honeybees), *with* Christoph Sandrock et al., *Impact of Chronic Neonicotinoid Exposure on Honeybee Colony Performance and Queen Supersedure*, PLOS ONE, Aug. 1, 2014 (describing the lack of negative effects of neonicotinoids on queen bees). According to the U.S. Department of Agriculture, some studies that have reported negative effects of neonicotinoids on honeybees relied on large, unrealistic pesticide doses, and gave bees no other choice for pollen, which does not reflect the real world conditions honeybees face. *Honey Bee Health & CCD Report*, *supra* note 6.

affect the way bees navigate the world, and impair bees' orientation skills.[55] No study has yet to demonstrate a direct correlation between neonicotinoids and CCD.[56]

3. Other Factors Affecting Honeybees: Parasites, Disease, and Malnutrition

Honeybee populations are also affected by parasitic mites, mainly *Acarapis woodi* and *Varroa destructor*.[57] *Acarapis woodi* is a microscopic mite that lays its eggs in the trachea of bees.[58] Once inside a bee, these mites puncture the trachea and feed on the bee's fluids, which weakens the infected bee.[59] *Varroa destructor* is a parasitic mite that lays its eggs on honeybee larvae before they pupate.[60] Varroa mites spread to other parts of the hive once infected honeybee larvae develop into hive bees and begin moving throughout the hive.[61] Once spread, the mites suck the blood of both honeybee larvae and adult bees.[62] *Varroa destructor* not only weakens honeybees, but also transmits viruses that harm bees.[63]

Both parasites have been found in dead or abandoned honeybee colonies affected by CCD.[64] Other viruses, pathogens, and fungi, such as *Nosema apis, Paenibacillus larvae*, and *Nosema ceranae,* have also been found "in the guts of recoverable dead

55. *See* Sally M. Williamson et al., *Exposure to Neonicotinoids Influences the Motor Function of Adult Worker Honeybees*, 23 ECOTOXICOLOGY 1409 (2014) (investigating how prolonged exposure to neonicotinoids affects bees' basic motor functions); Johannes Fischer et al., *Neonicotinoids Interfere with Specific Components of Navigation in Honeybees*, PLOS ONE, Mar. 19, 2014.

56. *Honey Bee Health & CCD Report*, *supra* note 6.

57. JOHNSON, *supra* note 28, at 5.

58. *Id.*

59. *Id.*; *see* H.A. Denmark et al., *Honey Bee Tracheal Mite*, U. FLA. ENTOMOLOGY & NEMATOLOGY DEP'T (July 2014), http://entnemdept.ufl.edu/creatures/misc/bees/tracheal_mite.htm [https://perma.cc/CF44-VBTM].

60. Ric Bessin, *Varroa Mites Infesting Honey Bee Colonies*, U. KY, ENTOMOLOGY DEP'T (April 2016), https://entomology.ca.uky.edu/ef608 [https://perma.cc/9VH6-HCPX]; *see* Greg Hunt, *Parasitic Mites of Honey Bees*, PURDUE U. EXTENSION 1-2 (2010), https://extension.entm.purdue.edu/publications/E-201.pdf [https://perma.cc/V28X-QUBW].

61. Hunt, *supra* note 60, at 1-2.

62. Bessin, *supra* note 60.

63. Fairbrother, *supra* note 39, at 722; JOHNSON, *supra* note 28, at 10.

64. JOHNSON, *supra* note 28, at 9-10.

bees,"[65] and hives destroyed by CCD.[66] It is uncertain whether *Varroa destructor, Acarapis woodi,* or if other viruses, pathogens, and fungi cause CCD, as these have been found in both failing and surviving colonies—both exposed to and unexposed to field pesticides.[67]

Nutrition also plays a major role in individual honeybee and colony longevity.[68] A nutrition-poor diet can make bees more susceptible to disease and parasites.[69] Additionally, researchers and beekeepers contend that migratory beekeeping is affecting bees' nutrition, as migratory bees are forced to gather pollen and nectar from a single crop, which deprives them of the diverse and nourishing diet provided by wild habitats.[70] Furthermore, bringing so many bees together in agricultural sites leads to the spread of viruses, mites, and fungi as bees from different hives collide midair and crawl over each other in their attempts to reach a flower.[71]

C. New Colony Collapse Disorder Research and Findings

New research on Colony Collapse Disorder shows that the possible causes of CCD—neonicotinoids, parasites, viruses, and poor nutrition—all have one thing in common: they stress bees.[72] Chronic exposure to these multiple interacting stressors appears to be linked to honeybee colony losses and declines of wild pollinators.[73] Each of these stressors alone is already a problem for beehives, but when combined, the stress of all these events on honeybee colonies could account for CCD.[74]

Exposure to a single stressor in a low dose is not enough to kill honeybees.[75] Rather, the stress inflicted by a single stressor causes

65. *Id.*
66. Fairbrother, *supra* note 39, at 722.
67. *See* Bryden, *supra* note 11, at 1468; JOHNSON, *supra* note 28, at 9-10.
68. Jabr, *supra* note 10.
69. *See* Goulson, *supra* note 17; *Honey Bee Health & CCD Report*, *supra* note 6.
70. Jabr, *supra* note 10.
71. *Id.*
72. Vaidyanathan, *supra* note 11. In this note, neonicotinoids, parasites, viruses, poor nutrition and other factors affecting beehives are referred to as "stressors."
73. Goulson, *supra* note 17, at 1435; *see* Bryden, *supra* note 11, at 1468.
74. *See* JOHNSON, *supra* note 28, at 8-9.
75. Vaidyanathan, *supra* note 11.

orientation and mobility issues that make bees exhibit erratic behavior "as though the [sic] they are slightly boozed."[76] These stressors—which honeybee hives might survive if the hives could face them one at a time—are affecting hives en masse, thereby delivering a one-two punch that initially weakens, and ultimately destroys, honeybee colonies.[77]

New research has also found that exposure to multiple stressors does not just add to the amount of stress experienced by bees, it multiplies the stress and negative effects on bees.[78] The effect of these stressors is amplified by bees' social nature;[79] stress experienced by individual bees over a prolonged period of time ultimately affects the entire colony. "Because honeybees are social insects, the aggregate effect of the colony changes how individual bees are exposed and how they protect themselves" from toxics, pests, and other stressors.[80] Once a hive reaches a critical level of stress—a tipping point—due to a combination of any of the possible stressors, the colony begins to fail and die off.[81]

These new studies explain why finding the link between CCD and a single specific cause has proven elusive. It appears that there is no sole cause of CCD; instead, the accumulation of stress from multiple factors that bees are exposed to over the course of their lifespans is what leads to CCD.[82] Humans have molded honeybees into agriculture's ideal worker, all to the bees' detriment. Due to crop monoculture, poor nutrition, forced travelling, and loss of habitat, bees are at a prime weakened state[83] where they are easily stressed and susceptible to CCD.

76. *Id.*

77. *Honey Bee Health & CCD Report*, *supra* note 6.

78. *See* Bryden, *supra* note 11.

79. Vaidyanathan, *supra* note 11.

80. Fairbrother, *supra* note 39, at 723.

81. Bryden, *supra* note 11, at 1463. An accumulation of multiple different stressors can push the colonies over the critical threshold of collapse. Vaidyanathan, *supra* note 11.

82. *See* Goulson, *supra* note 17, at 1435; Bryden, *supra* note 11, at 1463.

83. Matina Donaldson-Matasci, *Honeybees and Monoculture: Nothing to Dance About*, SCI. AM. (June 7, 2013), https://blogs.scientificamerican.com/guest-blog/honey-bees-and-monoculture-nothing-to-dance-about [https://perma.cc/H9F7-N8CG] ("By planting crops in monoculture, we've increased the scale of flower patches so much that a honey bee colony can't effectively search across many patches: they're stuck in just one. That patch blooms for a short period of time, and then the bees have nothing else to eat. So instead of letting the honey bees

If the accumulation of stress outright killed bees, more hives might be able to survive CCD. Honeybee colonies are efficient powerhouses; they are capable of withstanding honeybee deaths, as dead individuals can quickly be replaced within the colony.[84] The problem is that the bees in hives impaired by CCD force themselves to continue to work.[85] Instead of being replaced by healthy bees, the impaired bees continue to work slowly and inefficiently, which hinders the colony's chance of survival.[86] These impaired bees eventually fly—and ultimately die—away from their hive, which also decreases a colony's chance of survival, as the colony is not aware that the bee is dead.[87] At the tipping point, more bees die than are born, leading to a shortage of adult bees available to forage and care for the larvae and queen, and the colony succumbs to CCD.[88]

III. CURRENT AND PROPOSED ACTIONS AFFECTING POLLINATORS

As a response to the declining pollinator population, the federal and state government, environmental organizations, farmers, and concerned citizens have proposed several different measures to both increase pollinator populations and lower the use of neonicotinoids and other pesticides in the United States. Some of the measures addressing the decline in pollinators included former President Obama's "National Strategy to Promote the Health of Honey Bees and Other Pollinators"[89] and the

move themselves around on a scale of several miles, we're forced to truck ailing colonies across states. This is terrible for the bees: too much stress and poor nutrition make them more vulnerable to pesticides and diseases.").

84. Vaidyanathan, *supra* note 11.

85. *Id.*

86. *Id.*

87. Australian Academy of Science, *supra* note 32.

88. *Id.*

89. POLLINATOR HEALTH TASK FORCE, THE WHITE HOUSE, NATIONAL STRATEGY TO PROMOTE THE HEALTH OF HONEY BEES AND OTHER POLLINATORS i (May 19, 2015), https://www.whitehouse.gov/sites/default/files/microsites/ostp/Pollinator%20Health%20Strategy%202015.pdf [https://perma.cc/JQ4C-QBC8]. This National Strategy planned to reduce honeybee colony losses to no more than fifteen percent within ten years and increase the Eastern population of monarch butterflies to 225 million. *Id.* It also planned to "[r]estore or enhance 7 million acres of land for pollinators over the next 5 years through Federal actions and public/private partnerships." *Id.*

Environmental Protection Agency's (EPA) guidance for assessing pesticide risks to bees.[90] In response to concerns regarding the safety of wild honeybees on federal land, the U.S. Department of the Interior planned to phase out neonicotinoid use on the 150 million acres it manages.[91]

The judicial system also involved itself in the fight for pollinators. In September 2015, the Ninth Circuit vacated the EPA's decision to unconditionally register sulfoxaflor, a neonicotinoid pesticide that could harm honeybee populations.[92] In response to this lawsuit, EPA announced that it would not approve new outdoor use of other neonicotinoid-based pesticides "until the data on pollinator health have been received and appropriate risk assessments completed."[93] These separate measures culminated in the listing of seven bee species found throughout the United States to the endangered species list.[94]

It is uncertain whether these and other federal measures will remain in place or be carried out now that there is a new administration in power. Environmental groups and conservationists fear that Trump's disdain for the EPA and his

90. *EPA Actions to Protect Pollinators*, EPA, http://www2.epa.gov/pollinator-protection/epa-actions-protect-pollinators [https://perma.cc/Y22U-LMNT].

91. Dep't of the Interior Memo, *supra* note 50, at 1; Memorandum from the Chief, Nat'l Wildlife Refuge Sys., to the Regional Refuge Chiefs, Regions 1-8, Regarding the Use of Agricultural Practices in Wildlife Management in the National Wildlife Refuge System (July 17, 2014), http://www.centerforfoodsafety.org/files/agricultural-practices-in-wildlife-management_20849.pdf [https://perma.cc/UU4B-9V36].

92. Juan Carlos Rodriguez, *EPA Approval of Bee-Harming Pesticide Nixed by 9th Circ.*, LAW360 (Sep. 10, 2015, 11:54 AM), http://www.law360.com/articles/701339?sidebar=true [https://perma.cc/5DD2-T3QY]. The court based its decision on the fact that the EPA's choice to unconditionally register the neonicotinoid was not supported by substantial evidence. *Id.*

93. Letter from EPA to Registrants of Nitroguanidine Neonicotinoid Products (Apr. 2, 2015), http://www2.epa.gov/sites/production/files/2015-04/documents/neonicotinoid-new-use.pdf [https://perma.cc/TT27-QAX9] (addressing the new and pending submissions for outdoor uses of products containing the nitroguanidine neonicotinoids imidacloprid, dinotefuran, clothianidin, and thimethozam).

94. Lauren Bennett, *7 Species of Bees Added to the Endangered List*, CLIMATE INST. (Mar. 6, 2016), http://climate.org/7-species-of-bees-added-to-endangered-list [https://perma.cc/NR82-TLJS].

promise to reduce the number of overall regulations will affect pollinators and impede their population growth.[95]

Outside of whatever actions—or lack thereof—occur in the political field, private industry has taken note of the general consumer's interest in protecting pollinators. Looking to attract environmentally-conscious buyers, certain hardware and gardening companies have ceased selling neonicotinoids and plants treated with neonicotinoids.[96] Some food and beverage companies are also requiring their producers to ensure that their agricultural practices do not harm pollinators.[97] Both beekeepers and farmers are focusing their efforts on educating the general public about declining pollinator numbers, debunking misconceptions about bees, and promoting pollinator-friendly community projects. Outside of raising public interest in pollinators, beekeepers and farmers have also filed lawsuits seeking to prevent the use of neonicotinoid pesticides.[98]

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95. Elizabeth Grossman, *As Trump's EPA Takes Shape, Here's Your Pesticide Cheat Sheet*, CIVIL EATS (Feb. 2, 2107), http://civileats.com/2017/02/02/as-trumps-epa-takes-shape-heres-your-pesticide-cheat-sheet/ [https://perma.cc/LU6P-FURH]. The possible effects of the Trump administration on pollinators and other political hurdles to enacting measures to increase pollinator numbers will be further discussed *infra* Part IV(B).

96. *Lowe's Commits to Decisive Action to Protect Bees and Other Pollinators*, DOMINI SOC. INVS. (Apr. 17, 2015), https://domini.com/why-domini/domini-news/lowes-commits-decisive-action-protect-bees-and-other-pollinators [https://perma.cc/7ANY-AWRC]. Lowe's, Home Depot, Whole Foods, and BJ's Wholesale Club worked with several environmental groups to see what their stores could do to help pollinators. *Id.* All of these stores have made the commitment to eliminate neonicotinoid pesticides and plants treated with neonicotinoids from their stores. *Id.* Lowe's is going even further and taking other actions, including: funding of pollinator gardens, time-bound phase out of neonicotinoids by 2019, redoubling pesticide management efforts, and consumer education initiatives. *Id.*

97. Certain manufacturing companies whose products are sold in other stores are also supporting these actions, and working to increase pollinator numbers, including Clif Bar, Stonyfield, and other food manufacturers. Rebecca Randall, *Pests Invade Europe After Neonicotinoids Ban, With No Benefit to Bee Health*, GENETIC LITERACY PROJECT (Jan. 27, 2015), http://www.geneticliteracyproject.org/2015/01/27/pests-invade-europe-after-neonicotinoids-ban-with-no-benefit-to-bee-health/ [https://perma.cc/7SQD-Z3EE]. Cheerios even pulled its bee mascot from cereal boxes to bring awareness to declining bee populations. Madison Park, *Here's Why Honey Nut Cheerios Pulled its Mascot,* CNN (Mar. 16, 2017), http://www.cnn.com/2017/03/16/health/bees-cheerios-campaign [https://perma.cc/ QMH7-QJQ4]. Cheerios is also providing wildflower seeds to consumers to that they can start their own pollinator gardens. *Id.*

98. Victoria Schlesinger, *Can a Lawsuit Save America's Bees?*, MOD. FARMER (May 7, 2013), http://modernfarmer.com/2013/05/can-a-lawsuit-save-americas-

Tired of waiting for stronger federal action, many states are listening to their constituents and implementing their own measures to protect pollinators and beekeepers. Minnesota,[99] Maryland,[100] and Oregon[101] are leading these efforts and have passed laws restricting neonicotinoid use.

IV. ANALYSIS OF A LEGAL SOLUTION TO COLONY COLLAPSE DISORDER: NEONICOTINOID BAN

A complete ban on neonicotinoids is a frequently mentioned possible solution to increase pollinator numbers, as certain studies have shown a decrease in pollinator numbers when exposed to high levels of neonicotinoids.[102] The fight for a neonicotinoid ban in the U.S. gained momentum after the European Union (E.U.) passed its own neonicotinoid ban in 2013.[103] An argument can be made that the United States is falling behind in regard to implementing actions to increase pollination populations. The argument follows that since the European Union has a ban, the U.S. should follow suit.

This Part will present the idea that, even though a ban has been established in the E.U., banning neonicotinoids is not the best

bees [https://perma.cc/N87A-YYHQ]; *see also* Pollinator Stewardship Council v. U.S. Envtl. Prot. Agency, 800 F.3d 1176 (9th Cir. 2015).

99. *News Release: New Plant Labeling Law is in Effect to Protect Pollinators*, MINN. DEP'T OF AGRIC. (July 14, 2014), http://www.mda.state.mn.us/en/news/releases/2014/nr20140715-bees.aspx [https://perma.cc/M8Q8-W46M]. Minnesota has recently revised 18H.14, its Nursery Label/Pollinator Statute, to protect pollinators from exposure to toxic levels of insecticides. *Id.* The revised law requires that plants advertised as "beneficial to pollinators" must be free of detectable levels of certain systemic insecticides. *Id.*

100. Kathy Lundy Springuel, *Maryland is First State to Ban Neonicotinoids,* BLOOMBERG (May 31, 2016), https://www.bna.com/maryland-first-state-n57982073298/ [https://perma.cc/M2VW-AQGF] (banning the commercial use of neonicotinoids starting on January 1, 2018).

101. *New Rule Bans Certain Product Applications to Linden Trees,* OR. DEP'T OF AGRIC., http://www.oregon.gov/ODA/programs/Pesticides/RegulatoryIssues/Pages/PollinatorIssues.aspx [https://perma.cc/VB7Q-9D6X] (prohibiting "the application of any product containing dinotefuran, imidacloprid, thiamethoxam, or clothianidin, regardless of application method, to linden trees, basswood trees or other *Tilia* species").

102. *See supra* Parts III(B)(2), III(C).

103. Peter F. McGrath, *Politics Meets Science: The Case of Neonicotinoid Insecticides in Europe,* S.A.P.I.EN.S, July 1, 2014, at 1.

method for the U.S. to increase pollinator numbers due to the risk/risk trade-off that could arise from such a ban. In order to discuss a possible risk/risk trade-off, this Part will first analyze the effects of the E.U.'s ban on the United Kingdom (U.K.), and Italy. Secondly, this Part will present the aspects of the United States' agricultural and political systems that control the likelihood of a neonicotinoid ban. This information will then be used in conjunction with the discussion in Part III to develop a multifaceted plan to increase pollinators numbers that is more likely to be accepted in the U.S. than a neonicotinoid ban.

A. Lessons from the European Union's Neonicotinoid Ban and its Resulting Risk/Risk Trade-off

A risk/risk trade-off occurs when measures or regulations that are put in place to reduce one risk introduce or increase another risk.[104] In some situations, the repercussions from the new risk are enough to partially or completely outweigh the intended benefits of the initial risk reduction.[105] In insecticide and pesticide regulation, a risk/risk trade-off may occur from the use of more dangerous substitute pesticides or other dangerous pest-control practices in lieu of a banned pesticide.[106] The risk/risk trade-off that may occur in the United States due to a well-intended neonicotinoid ban has already occurred in the United Kingdom due to the European Union's 2013 ban on neonicotinoids.

104. CFSAN Risk Analysis Working Group, *Initiation and Conduct of All "Major" Risk Assessments within a Risk Analysis Framework*, U.S. FOOD & DRUG ADMIN. (Mar., 2002), https://www.fda.gov/Food/FoodScienceResearch/RiskSafetyAssessment/ucm475127.htm [https://perma.cc/H28W-2TGC] ("In risk-risk assessments, a trade off of one risk for another is considered, i.e., reducing the risk of one hazard increases the risk of another."); *see* George M. Gray & James K. Hammitt, *Risk/Risk Trade-offs in Pesticide Regulation: An Exploratory Analysis of the Public Health Effects of a Ban on Organophosphate and Carbamate Pesticides*, 20 RISK ANAL. 665, 665 (2000).

105. W. Kip Viscusi, *Risk-Risk Analysis*, 8 J. RISK & UNCERTAINTY 5, 6 (1994). Take, for example, food preservation. *See* Gray & Hammitt, *supra* note 104. In the U.S., multiple laws were passed that required better and safer preservation of food in order to protect citizen's health. *Id.* These food preservation laws led companies to overuse nitrates in their preservation methods, which were later found to be carcinogenic. *Id.* The risk/risk trade-off presented in this situation is that laws seeking to protect citizen's health instead increased citizens' contact with a carcinogen, which outweighed the food safety that the preservation laws sought to provide citizens with in the first place. *Id.*

106. *See* Gray & Hammitt, *supra* note 104, at 666.

The E.U. implemented a complete ban on certain neonicotinoids after a 2008 event in Germany where neonicotinoid use on corn seeds led to the die-off of hundreds of nearby honeybee colonies.[107] The E.U.'s decision provides for a ban on clothianidin, thiamethoxam, and imidacloprid – the three most heavily used neonicotinoids in rapeseed, corn, and sunflower crops.[108] The ban prohibits the use and sale of seeds treated with these neonicotinoids.[109]

Studies completed two years after the establishment of the E.U.'s neonicotinoid ban demonstrated that honeybee populations had not substantially changed within that time period.[110] Supporters of the ban argue that honeybee population growth has not been as conclusive as expected, due to the persistence of neonicotinoids in the ground. These supporters also argue that when the E.U. banned neonicotinoids, it did not set up a proper system to assess whether the ban would have a measurable impact on honeybee populations, and that there is a lack of substantial funding to research whether bees and other pollinator numbers are increasing.[111] The E.U. has not proposed to conduct research or implement a funding program following the ban.[112] Therefore,

107. *Honey Bee Health & CCD Report*, *supra* note 6.

108. 2013 O.J. (L 139) 485; *see also* European Commission Press Release IP/13/379, Bees & Pesticides: Commission to Proceed with Plan to Better Protect Bees (Apr. 29, 2013), http://europa.eu/rapid/press-release_IP-13-379_en.htm [https://perma.cc/G26F-334E].

109. 2013 O.J. (L 139) 485. The neonicotinoid ban was up for review in 2016. Damian Carrington, *Europe Poised for Total Ban on Bee-Harming Pesticides*, GUARDIAN (Mar. 23, 2017), https://www.theguardian.com/environment/2017/mar/23/europe-poised-for-total-ban-on-bee-harming-pesticides [https://perma.cc/FXQ3-T2UT]. There are new proposals in place that wish to expand the ban, and only allow the use of clothianidin, thiamethoxam, and imidacloprid on plants entirely grown in greenhouses. *Id.*

110. Jon Entine, *Bee Deaths Reversal: As Evidence Points Away from Neonics as Driver, Pressure Builds to Rethink Ban,* FORBES (Feb. 8, 2014, 1:30 PM), http://www.forbes.com/sites/jonentine/2014/02/05/bee-deaths-reversal-as-evidence-points-away-from-neonics-as-driver-pressure-builds-to-rethink-ban/ [https://perma.cc/NQB2-6BTT].

111. Andrew Amelinckx, *Ban of Neonicotinoids in UK Costs Farmers Millions,* MOD. FARMER (Sept. 11, 2015), http://modernfarmer.com/2015/09/neonicotinoids-ban-uk [https://perma.cc/SW3L-SAJA].

112. Dave Goulson, *Neonicotinoid Ban Won't Fix All Bees' Problems,* CONVERSATION (Nov. 29, 2013, 9:27 AM), http://theconversation.com/neonicotinoid-ban-wont-fix-all-bees-problems-20984 [https://perma.cc/R3CA-PRLR]. There is also no plan in place to monitor wild honeybee populations. *Id.*

even if the ban does lead to an increase in pollinator numbers, it will be difficult to demonstrate the increase.[113]

Since the start of the neonicotinoid ban, European farmers have found that other insects are wreaking havoc on their crops.[114] After ceasing the use of neonicotinoid-coated seeds to plant rapeseed crops, farmers in the United Kingdom found flea beetles in their crops for the first time in almost a decade.[115] Due to the ban on neonicotinoids, E.U. farmers were forced to apply older, less-potent, chemicals on their rapeseed crops—chemicals that still kill bees and affect honeybee colonies—but are technically not against the law.[116] So far, the ban on neonicotinoids has cost the European rapeseed industry almost 900 million euros a year in alternative pesticide use, lost crops, and replanting costs.[117]

As a result of the increase in flea beetles and other insects found in rapeseed crops, in 2015, the E.U. temporarily lifted the ban on neonicotinoid pesticides in certain parts of the United Kingdom, after the National Farmers Union applied for a temporary lift of the ban to combat cabbage stem flea beetles.[118] U.K. farmers were allowed to spray two of the three banned

113. *Id.*

114. Whitney McFerron, *Bugs Invade Europe as Save-Bees Cry Spurs Pesticide Ban*, BLOOMBERG (Jan. 8, 2015, 8:13 AM), http://www.bloomberg.com/news/articles/2015-01-08/bugs-invade-europe-as-save-bees-cry-spurs-pesticide-ban [https://perma.cc/8B9W-USZT].

115. *Id.*

116. *See id.* An English farmer dealing with the flea beetle situation in his rapeseed crops explained, "[w]hen we remove a tool from the box, that puts even more pressure on the tools we've got left . . . . More pesticides are being used, and even more ridiculous is there will be massively less rapeseed." *Id.*

117. Ian Johnston, *Pesticide Ban: New Evidence Shows 'Strong Case' for Ban on Chemicals Linked to Bird and Bee Deaths*, INDEPENDENT (Jan. 11, 2017) http://www.independent.co.uk/news/science/pesticides-ban-evidence-death-birds-bees-grows-stronger-agriculture-partial-report-a7522391.html [https://perma.cc/FG8X-R2GK]. U.K. rapeseed farmers have suffered 29 million dollar loss in alternative pesticide use, lost crops, and replanting costs. CHARLES SCOTT & PAUL BILSBORROW, AN INTERIM IMPACT ASSESSMENT OF THE NEONICOTINOID SEED TREATMENT BAN ON OILSEED RAPE PRODUCTION IN ENGLAND: A REPORT FOR RURAL BUSINESS RESEARCH 1 (2015), http://www.fbspartnership.co.uk/documents/Interim%20Assessment%20of%20Neonicotinoid%20Ban%20on%20Oilseed%20Rape.pdf [https://perma.cc/8VKR-QVXG].

118. Claire Marshall, *Ban Lifted on Controversial 'Neonic' Pesticide*, BBC NEWS (July 23, 2015), http://www.bbc.com/news/science-environment-33641646 [https://perma.cc/NEY7-H5JM].

neonicotinoid pesticides for 120 days on about five percent of England's oilseed rape crops.[119]

Other countries in continental Europe also faced issues with returning pests after the establishment of the neonicotinoid ban. In Italy, the banned neonicotinoids were coated on maize seeds.[120] Although Italian farmers also experienced some setbacks from the ban, instead of returning to older, more dangerous pesticides, they turned to other farming methods, such as rotating crops.[121] As a response to other European nations' successful adaptation to the ban, U.K. farmers groups argued that U.K. farmers do not have the economic ability to rotate crops—as they solely sell one crop—and that the pests which affect maize crops are easier to control without neonicotinoids than those which affect rapeseed crops. Ultimately, U.K. farmers' difficulty dealing with the ban, coupled with Brexit and other political events, have put into question whether the E.U.'s neonicotinoid ban even has a future in the U.K. post Brexit.[122]

The reappearance of the flea beetle in U.K. rapeseed crops is a textbook example of a risk/risk trade-off. Not only did the European Union's neonicotinoid ban defeat its intended purpose of protecting pollinators, but also led to fewer crops and increased agricultural costs. The United Kingdom is now applying other measures to increase pollinator numbers alongside the neonicotinoid ban. The U.K. is working with businesses to introduce initiatives to encourage pollinators on their property.[123]

119. *Id.* Environmental groups are fighting this decision, and asking UK's highest court to review the decision. Emma Howard, *Government Permission to Use Banned Pesticides Face Legal Challenge*, GUARDIAN (Aug. 25, 2015, 7:02 AM), http://www.theguardian.com/environment/2015/aug/25/government-permission-to-use-banned-pesticides-face-legal-challenge [https://perma.cc/A7EP-MZ82].

120. Sergio Pistoi, *Lessons from the Italian Ban on Pesticides*, PHYS.ORG (May 3, 2013), http://phys.org/news/2013-05-lessons-italian-pesticides.html [https://perma.cc/MN7J-G544].

121. *Id.*

122. *See* Whitney McFerron, *Bees Would Suffer from Brexit, Say Campaigners,* GUARDIAN (June 15, 2016, 5:36 AM), https://www.theguardian.com/environment/2016/jun/15/bees-would-suffer-from-brexit-say-campaigners [https://perma.cc/6BR4-FE2C]; Keith Tyrell, *Fighting the Brexit Threat to Pesticide Laws*, ECOLOGIST (Feb. 8, 2017), http://www.theecologist.org/campaigning/2988623/fighting_the_brexit_threat_to_pesticide_laws.html [https://perma.cc/DCM2-63H9].

123. James Murray, *Government Urges Public and Businesses to Help Meet "Bees' Needs"*, BUSINESSGREEN (July 18, 2014), http://www.businessgreen.com/bg/

The U.K. government is also working with unions and farmers to provide information about what they can do to decrease pesticide usage, including the use of alternative farming methods.[124]

B. Risks and Likelihood of a Neonicotinoid Ban in the United States

Even if a neonicotinoid ban in the U.S. did not present the possibility of a risk/risk trade-off, the expense of implementing a neonicotinoid ban and the lack of industry support make a complete moratorium or ban on neonicotinoids unlikely. The E.U.'s ban has cost rapeseed farmers almost 900 million euros a year.[125] In the U.S., neonicotinoids are used in its two largest and most valuable crops—corn and soybeans[126]—and so the costs of a neonicotinoid ban could be disastrous for U.S. agriculture.

The U.S. pesticide industry will not lie down and accept a ban on neonicotinoids without a fight. According to Bayer CropScience, makers of imidacloprid, EPA's recent decision to suspend the use of its neonicotinoid until further research is completed "appears to overestimate the potential for harmful exposures in certain crops, such as citrus and cotton, while ignoring the important benefits these products provide."[127] Dow AgroSciences, makers of sulfoxaflor, are also fighting back against EPA's decision to prohibit further sales of sulfoxaflor.[128] Dow AgroSciences argues that although a ban could make sense in crops that attract bees, such as citrus and strawberries, the ban is useless on other crops like lettuce, which do not attract bees.[129]

news/2355875/government-urges-public-and-businesses-to-help-meet-bees-needs [https://perma.cc/34U2-Z6HB].

124. *Id.*

125. Johnston, *supra* note 117.

126. *Crops*, U.S. DEP'T OF AGRIC. ECON. RES. SERV., https://www.ers.usda.gov/topics/crops [https://perma.cc/P57T-BFAF].

127. Mohan, *supra* note 35.

128. Press Release, Cancellation Order Issued for Sulfoxaflor, U.S. Envtl. Prot. Agency (Nov. 13, 2015), http://www.epa.gov/pesticides/cancellation-order-issued-sulfoxaflor [http://perma.cc/56QQ-SE35]. EPA took this decision as a result of the Ninth Circuit's vacate of the EPA's decision to unconditionally register sulfoxaflor. *Id.*

129. Geoffrey Mohan, *EPA Bans Sale of Pesticide That's Toxic to Honey Bees,* L.A. TIMES (Nov. 13, 2015, 3:45 PM), http://www.latimes.com/business/la-fi-epa-pesticide-20151113-story.html [https://perma.cc/26BL-9L4L]; Maura Dolan & Geoffrey Mohan, *Poison Barred as Threat to Bees*, L.A. TIMES (Sept. 11, 2015),

Further aiding pesticide companies in their fight against a neonicotinoid ban is the influence these companies currently have on the EPA and federal government. Due to Dow Chemical's influence, Scott Pruitt and the Trump administration are setting aside results from government studies demonstrating that organophosphates created by Dow Chemical and other companies negatively affect endangered species and impact infant development.[130] These studies exposed a stronger connection between the negative impacts and organophosphates than has been proven between pollinator deaths and neonicotinoids. Therefore, if even the strong correlation involving organophosphates can be ignored by the current administration due to its ties to the pesticide industry, the possible correlation between neonicotinoids and bee deaths is even more likely to be disregarded. As pesticide makers are exceedingly influential in the development of environmental legislature, policies establishing a full ban—which could increase pollinator numbers—would not be implemented for years to come, thus driving pollinators even further from recovery. Environmentalists and conservationists should instead focus on less stringent policies that stand a chance at passing in order to begin the restoration of bee populations.

V. ANALYSIS OF A LEGAL SOLUTION TO COLONY COLLAPSE DISORDER: LIMITS ON NEONICOTINOID USE AND MULTIFACETED ATTACK ON OTHER STRESSORS

Due to the possibility of a risk/risk trade-off, agricultural industry backlash, and lack of federal support, banning neonicotinoids is not the best solution to increase U.S. pollinator numbers. A planned attack against multiple bee stressors,

https://www.pressreader.com/usa/los-angeles-times/20150911/281835757480818 [https://perma.cc/33MW-RCFE].

130. Sy Mukherjee, *Dow Chemical Asks Trump Officials to Ignore Damning Pesticide Reports,* FORTUNE (Apr. 20, 2017, 5:40 PM), http://fortune.com/2017/04/20/white-house-environment-dow-chemicals [https://perma.cc/LSJ3-S55U]; Bess Levin, *Dow Chemical Donates $1 Million to Trump, Asks Administration to Ignore Pesticide Study*, VANITY FAIR (Apr. 20, 2017, 10:13 AM), http://www.vanityfair.com/news/2017/04/dow-chemical-endangered-species [https://perma.cc/5PBW-VEVZ]; *Dow Chemical is Pushing Trump Administration to Ignore Studies of Pesticide*, L.A. TIMES (Apr. 20, 2017, 10:25 AM), http://www.latimes.com/business/la-fi-dow-pesticides-trump-20170420-story.html [https://perma.cc/3LX8-56TQ].

including limitations on neonicotinoid use, is a better and more likely solution than a total neonicotinoid ban. A combined response from industry, environmental groups, and federal/state/local governments tackling the multiple reasons why pollinator populations are declining is the best way to lessen pollinator decline. A great example of what can be accomplished with a planned attack on multiple stressors is the meteoric comeback of the monarch butterfly population.

A. Lessons from the Monarch Butterfly Regulations

Every year, monarch butterflies embark on a three thousand mile migration from the grasslands of Canada to the volcanic slopes of the Sierra Mountains in Central Mexico.[131] Over the past 20 years, the number of monarch butterflies that return to Central Mexico's forests has decreased by more than 90 percent.[132] This massive drop in the monarch butterfly population is largely attributed to the disappearance of milkweed, which is used by monarch butterflies both as a food source and as a nursery.[133]

The use of genetically altered crops allows farmers to spray crops with glyphosate indiscriminately, which not only kills unwanted weeds, but milkweed as well.[134] The growing demand to produce corn for ethanol has also increased the amount of land

131. *Monarch Butterfly Population Rejuvenated After Last Year's Record Low,* NPR NEWS (Mar. 4, 2015), http://www.npr.org/2015/03/04/390757757/monarch-butterfly-population-rejuvenated-after-last-years-record-low [https://perma.cc/2FAB-2YLH] [hereinafter *NPR Transcript*].

132. Emily DeMarco, *Monarch Butterfly Studies Tell a Perplexing Tale*, SCI. MAG. (Aug. 5, 2015, 7:00 AM), http://news.sciencemag.org/climate/2015/08/monarch-butterfly-studies-tell-perplexing-tale [https://perma.cc/95ES-2H9E]. Monarch butterfly numbers hit a high of 1.1 billion in 1996, and have decreased to a paltry 33 million in 2014. Tim Johnson, *Saving the Monarch Butterfly*, MIAMI HERALD (Feb. 20, 2014, 12:35 PM), http://www.miamiherald.com/latest-news/article1960590.html [https://perma.cc/L2XP-CJL4].

133. Darryl Fears, *As Pesticides Wipe Out Monarch Butterflies in the U.S., Illegal Logging is Doing the Same in Mexico,* WASH. POST (Aug. 26, 2015), https://www.washingtonpost.com/news/energy-environment/wp/2015/08/26/nearly-a-billion-monarch-butterflies-have-vanished-now-their-haven-in-mexico-is-also-disappearing/ [https://perma.cc/M3QG-WAGZ].

134. Elizabeth Malkin, *North American Leaders Urged to Restore Monarch Butterfly's Habitat*, N.Y. TIMES (Feb. 14, 2014), http://www.nytimes.com/2014/02/14/world/americas/north-american-leaders-urged-to-restore-monarch-butterflys-habitat.html [https://perma.cc/A3QE-5AGH]. Glyphosate is safe for genetically modified crops, but kills all other plants. *Id.*

planted with corn—leaving less space for milkweed to grow and thereby support butterflies migrating through the U.S.[135] Illegal logging, drought, and natural disasters have also severely diminished the areas where monarch butterflies can hibernate in Mexico.[136]

In 2014, Mexico, the U.S., and Canada jointly agreed to protect monarch butterflies.[137] This governmental action was initiated by a group of prominent scientists and writers, who wrote a proposal and urged the leaders of Mexico, Canada, and the US to commit to restoring the monarch butterflies' habitat.[138] As a result of this proposal, the three countries established a working group to ensure the conservation of the monarch butterfly.[139] These countries focused on multilateral action: Canada and the United States focused on massive planting of milkweed along roadsides and the establishment of toxin-free buffer zones, while Mexico took on illegal logging.[140] Thanks to measures established by the working group, in the 2015 migrating season, monarch butterflies occupied 1.13 hectares of Mexican forest—a significant increase from the paltry 0.67 hectares the butterflies occupied in the 2013-14 migrating season.[141] In 2016, the working group claimed another victory, as the group's actions quadrupled the number of monarchs that are expected to reach Mexico this migration

135. *Id.*

136. Fears, *supra* note 133.

137. Press Release, Office of the Press Sec'y, The White House, Joint Statement by North American Leaders—21st Century North America: Building the Most Competitive and Dynamic Region in the World (Feb. 19, 2014), https://www.whitehouse.gov/the-press-office/2014/02/19/joint-statement-north-american-leaders-21st-century-north-america-buildi [https://perma.cc/ZSD7-UTX4] [hereinafter North American Leaders Press Release].

138. Malkin, *supra* note 134.

139. North American Leaders Press Release, *supra* note 137.

140. Malkin, *supra* note 134. The Fish & Wildlife Service also allocated 2 million dollars to monarch butterfly conservation, and planned to enhance more than 200 acres of habitat for monarch butterflies, and support over 750 neighborhood and schoolyard pollinator gardens. North American Leaders Press Release, *supra* note 137.

141. Carola Sole, *Monarch Butterfly Population May Quadruple in Mexico*, SEEKER (Nov. 13, 2015, 9:03 AM), https://www.seeker.com/monarch-butterfly-population-may-quadruple-in-mexico-1770459587.html [https://perma.cc/NTR4-6NKR].

cycle.[142] The three countries' goal is for monarch butterfly populations to occupy six hectares of Mexican forest by 2020.[143]

In the monarch butterflies' situation, not only did governmental figures and agencies negotiate possible solutions, but environmental activists were also flexible with their hopes and solutions to this problem. Environmentalists understood that the necessity for prompt action superseded the need for stringent regulation.[144] Instead of focusing on a ban on glyphosate, environmental activists focused on other—more immediate and less stringent—measures to increase monarch butterfly numbers.[145] To this end, environmentalists fought for programs to plant milkweed on roadsides and in-between fields, and subsidies for farmers who set aside herbicide-free patches of land.[146]

B. Takeaways from the European Union and Monarch Butterfly Regulations

Colony Collapse Disorder cannot be attributed to one single cause; it occurs due to an amalgam of stressors, that when combined, have a disastrous effect on bees.[147] The structure of CCD itself gives us the solution to the problem; solely relying on decreasing one stressor will not increase pollinator numbers. Instead of relying on a full ban of all neonicotinoids, the stricter, more controlled use of neonicotinoids combined with other environmental efforts is a better—and more likely—solution to Colony Collapse Disorder.

Solely relying on a neonicotinoid ban is not the best way to increase pollinator numbers. There are other beneficial measures that can be taken, which are more feasible and can happen today,

142. *Id.*

143. *Id.* The working group wants to eventually reach the 19 hectares occupied by monarch butterflies in its population peak during the 1996-97 migration season. *Id.*

144. Homero Aridjis, a Mexican poet who was involved in the proposal letter that was sent to the 2014 Summit, said it best when he explained that "[w]e can't ask farmers to change their habits." Malkin, *supra* note 134.

145. *Id.*; Tim Johnson, *NAFTA Leaders Put Saving Monarch Butterfly on Trade Pact's Agenda*, MCCLATCHY D.C. (Feb. 20, 2014, 3:44 PM), http://www.mcclatchydc.com/news/nation-world/world/latin-america/article24764011.html [https://perma.cc/ER3J-QT7P].

146. Malkin, *supra* note 134.

147. Vaidyanathan, *supra* note 11.

rather than waiting decades for a neonicotinoid ban. Nor is a ban recommendable, as completely banning certain neonicotinoids caused an increased use of other dangerous pesticides in Europe. If there is to be any sort of regulation, "effective regulatory design must openly acknowledge the full complexities of both the 'politics' and 'science' of environmental protection."[148] Due to these complexities, it is unrealistic to expect a complete ban on neonicotinoids in the United States. Neonicotinoids were developed for an important reason—pesticide management—and although neonicotinoids are having unexpected effects on bees, that does not mean neonicotinoids should be completely abandoned. Taking into consideration the power the pesticide industry has over the EPA, a complete ban on neonicotinoids is also unlikely to be politically feasible anytime soon.

Whether a risk/risk trade-off occurs due to a neonicotinoid ban depends on what crop the neonicotinoid was used on.[149] Italy used neonicotinoids for maize, whereas in the U.K. neonicotinoids were used for rapeseed, and the countries had differing outcomes with the neonicotinoid ban. This demonstrates that a solution which would prevent a risk/risk trade-off is to limit the use of neonicotinoids to certain crops that attract bees instead of using neonicotinoids as a general pesticide on all crops. Neonicotinoids should be banned where they are used unnecessarily and where there are alternative, less harmful pesticides available.[150] At the same time, the limited use of neonicotinoids should be allowed on crops that do not generally attract bees, like lettuce.[151] For example, California already prohibits the use of imidacloprid on almonds and limits its application on other crops during bloom periods when bees are most likely to be present.[152] Another example of what can be done is to ban the use of neonicotinoids as seed coating but still allow its use in other situations.[153] Another

148. Donald T. Hornstein, *The Medicare DRGs: Lessons from Federal Pesticide Regulation on the Paradigms and Politics of Environmental Law Reform*, 10 YALE J. ON REG. 369, 369 (1993).

149. *See generally* Samuel J. Rascoff & Richard L Revesz, *The Biases of Risk Tradeoff Analysis: Towards Parity in Environmental and Health-and-Safety Regulation*, 69 U. CHI. L. REV. 1763, 1763 (2002).

150. Colwell, *supra* note 12.

151. *See* Dolan & Mohan, *supra* note 129.

152. Mohan, *supra* note 35.

153. Pistoi, *supra* note 120.

possibility is banning the use of spray neonicotinoids in the seasonal times where bees are most likely to be pollinating.

Although monarch butterflies may not have the same biological requirements as honeybees, the meteoric comeback of monarch populations demonstrates that governmental actions can positively affect pollinator numbers. The way in which government, industry, and environmentalists negotiated their demands and worked together for monarch butterflies can also be applied to honeybees. Initiatives to save monarch butterflies show that creating legal actions with a cooperative mindset will help honeybee initiatives succeed. Working with farmers, the agriculture industry, and focusing efforts and research on why farmers use neonicotinoids to begin with will be more successful than simply forcing regulations onto neonicotinoid users and expecting them to comply.[154]

Before deciding on the extent of an allowed neonicotinoid use, the EPA needs to broaden its investigation of the effects of neonicotinoids beyond honeybee populations to include wild bee species and other pollinators, especially butterflies and bats.[155] The EPA must commit to properly researching and changing neonicotinoid regulations if necessary. When limiting the use of neonicotinoids, the EPA or U.S. government must make sure not to repeat the same research-related mistakes that the European Union committed when enacting its 2013 neonicotinoid ban. This can be accomplished by setting aside funding for continued research. These studies need to record the positive and negative effects of restricted neonicotinoid use both on honeybee populations and the agricultural industry. The responsible entity should also give farmers and other affected parties adequate

> [C]oating seeds with insecticides has many drawbacks and brings no real advantage to farmers. It is like taking a pain-killer in the morning, just in case we are likely to have a headache in the evening. Today, there are many pest indicators available to farmers. They could only use insecticides when there is an impeding danger for crops.

Id.

154. *See generally* Rascoff & Revesz, *supra* note 149.

155. Mohan, *supra* note 35. As the environmental health director of the Center for Biological Diversity explains, "[y]ou can't claim to do a 'pollinator risk assessment' and really only look at one pollinator, the honeybee . . . . That's not only cheating on the purpose of this work but also cheating the native bees, birds, butterflies and other species threatened by [neonicotinoids]." *Id.*

warning of the impending neonicotinoid limitation. This way, farmers, the agricultural industry, and other parties who utilize neonicotinoids will have time to search for and decide on what pesticides or alternative measures will be used in lieu of neonicotinoids. Providing adequate warning will help the U.S. agricultural industry avoid a similar risk/risk trade-off as the one that took place in the U.K. after the E.U. ban was established.

Instead of pressuring one group to increase pollinator numbers alone, a better, long lasting action plan to increase pollinator numbers in the United States can be implemented by involving industry, government, and citizens. U.S. government must do its part by passing stricter measures, while industry should make neonicotinoids less available and support the honeybee industry. Furthermore, citizens have to help scientists with research; there is a dire need for citizen volunteers to help scientists obtain data, especially reporting honeybee trajectories and honeybee deaths.[156] In addition to the need for further research and honeybee conservation efforts, these efforts need to be integrated horizontally across countries and vertically from a local to international scale. The current popular interest in bee conservation needs to be maximized and must not be allowed to peter out.

VI. CONCLUSION

Colony Collapse Disorder does not have a sole cause, as previously expected. New research shows that the global honeybee die-off is due to the accumulation of stress on bees and colonies. This stress is caused by an array of factors, including neonicotinoid use, parasites, poor nutrition, and poor travelling conditions. The combination of these stressors, particularly neonicotinoids, is causing the massive bee colony die-off.

Due to the stress placed on hives by the constant use of neonicotinoids, many farmers and environmental groups are calling for a complete neonicotinoid ban, as was implemented in the European Union. A neonicotinoid ban would be the perfect solution in a dream world, with politicians interested in protecting pollinators, and industries willing to turn away from using other dangerous chemicals. In reality, there is a likelihood that

156. *See* Goulson, *supra* note 112.

establishing a neonicotinoid ban will lead the agricultural industry to turn to other dangerous pesticides, as occurred in the U.K. as a result of the E.U.'s ban. Once the likelihood of a risk/risk trade-off is lessened—for example, due to ample notification time for neonicotinoid users to establish other pesticide protection methods—then a neonicotinoid ban could be considered.

However, even if the possibility of a risk/risk trade-off is completely eliminated, a limitation on neonicotinoid use is more likely to succeed in the U.S. than a ban. The political climate in the U.S. is different than in Europe, and here, pesticide companies have a stronger pull on the federal government. Even if a study demonstrated an indisputable connection between bee deaths and the use of neonicotinoids, due to the current political climate, a ban would still not be established by the federal government. Therefore, due to the likelihood of a risk/risk trade-off and the current political climate, a ban on neonicotinoids is not a probable solution to CCD.

It may not be currently feasible to establish a federal neonicotinoid ban, but that does not mean that there is nothing that can be done to help pollinators. In order to increase pollinator numbers, the decreased use of neonicotinoids via state legislation needs to be combined with other efforts to "de-stress" bees. These efforts need to target the other factors stressing pollinators, including malnutrition and lack of pollen diversity. Such efforts could include incentives for farmers and homeowners to provide ecosystem services—for example, payment for creating bee-friendly gardens, subsidizing organic farming, and establishing "neonicotinoid-free zones." Further research on neonicotinoids and parasitic mites, limiting neonicotinoid use to plants that do not attract pollinators, and providing bees with more diversely flowered areas to pollinate will provide a more successful and probable solution for Colony Collapse Disorder, compared to solely relying on a neonicotinoid ban. Instead of fighting for a ban that will likely take years to establish, farmers, industry, and environmentalists must work together to make these more achievable solutions permanent. If successful, these measures could substantially increase honeybee populations, as they did for monarch butterflies. In turn, this will help stabilize global food production—and ultimately—the sustainability of our generation and the next.