Toxic Acres

The Increasing Toxicity of U.S. Agriculture for Insects

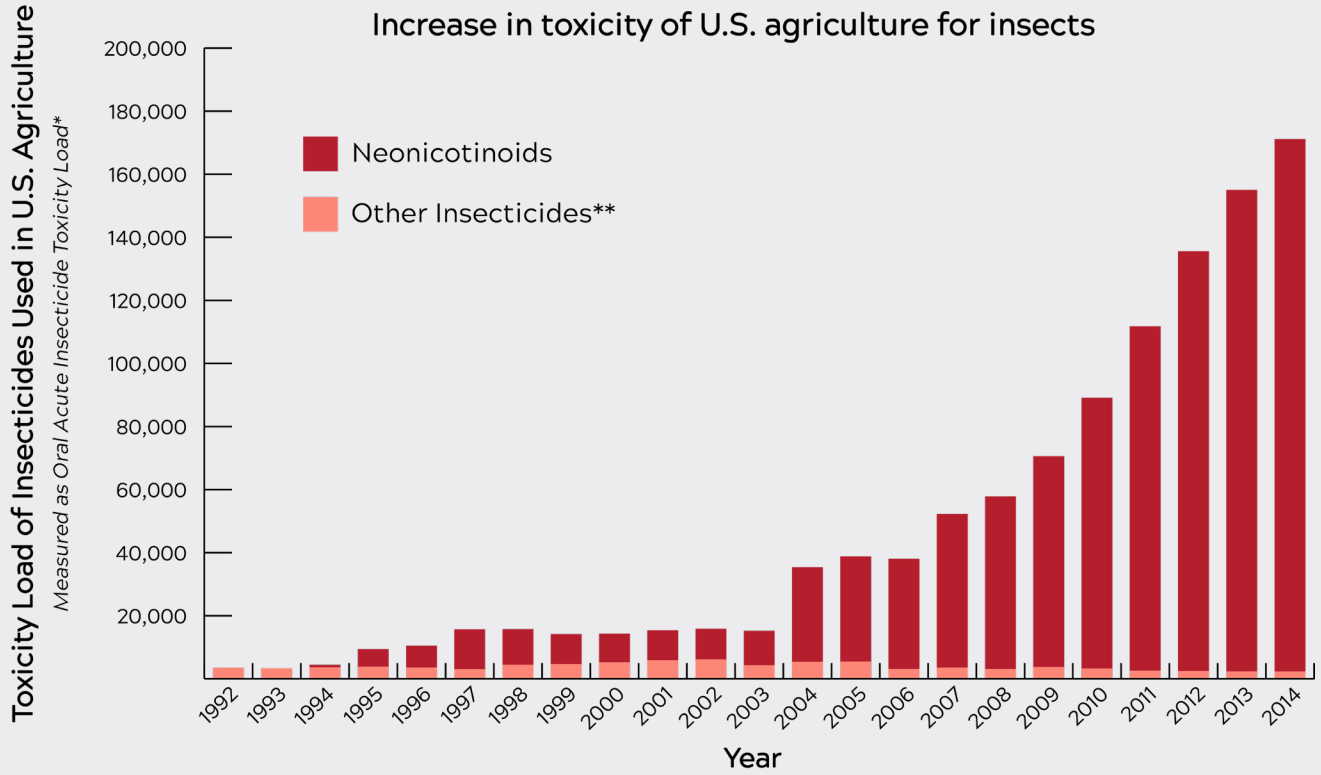
STUDY SUMMARY

Since neonicotinoid insecticides were first introduced in the 1990s, U.S. agriculture has become 48 times more toxic to insect life, according to a new study in the peer-reviewed journal PLOS One. The study is the first to quantify just how deadly neonicotinoids have made our agricultural lands for insect life by providing a way to compare changes in the toxicity of U.S. agriculture year-to-year.

The findings support the need to phase out neonicotinoids and invest in ecological farming methods like organic and regenerative agriculture to protect bees and other beneficial insects that are critical to food security and ecosystem health.

KEY FINDINGS

- U.S. agriculture is 48 times more toxic to insect life than it was two decades ago.
- Neonicotinoids account for 92 percent of the increase in toxicity.
- The persistence of neonicotinoids creates a cumulative toxic burden in the environment that is much higher than that experienced by insects 25 or more years ago. This is because neonicotinoids are considerably more toxic to insects and far more persistent in the environment than other commonly used insecticides. While others break down within hours or days, neonicotinoids can be effective at killing insects for months to years after application.
- The increase in toxicity measured by the study is consistent with the reduction in beneficial insect and insectivorous bird populations observed in recent years.
- Neonicotinoid use on corn and soybeans contributed the most to the increase in toxicity load.
- The three neonicotinoids that contributed most to the toxicity load are imidacloprid and clothianidin — which are manufactured by Bayer-Monsanto — and thiamethoxam, a product of Syngenta-ChemChina.



*For method, see DiBartolomeis and Kegley et al., 2019. An assessment of acute insecticide toxicity loading of chemical pesticides used on agricultural land in the United States, PLOS One.
**pyrethroids, organophosphates, pyrazoles, spinosyn, N-methyl carbamates, others

Based on the study analysis, it is clear that existing regulations for the registration of pesticides in the U.S. are not adequate to prevent the introduction of chemicals that can cause catastrophic harm in the environment. The study presents a new method that could be used by the Environmental Protection Agency to assess future potential risks to biodiversity before introducing new pesticides into the environment.

WHY IT MATTERS

This study comes on the heels of the first meta-analysis of global insect decline, which found that 40 percent of insect species could face extinction in coming decades, leading the authors to warn of "catastrophic ecosystem collapse" if we don't change the way we farm.[1] In addition, a recent global scientific assessment warns that the ecological crisis of biodiversity loss is on par with the climate crisis.[2]

Insects make up the basis of the food webs that sustain life on Earth and play a critical role in the agricultural production of crops that feed us all. Pollinators like bees are responsible for 1 in 3 bites of food we eat. Without them, we would face shortages of some of our most nutritious foods, including nuts, fresh fruits and vegetables, meat, dairy and more.

HOW DID WE GET HERE?

Neonicotinoids are the most widely used insecticides in the world

Neonicotinoids, which were first introduced in the 1990s, are now the most popular insecticides in the U.S. and globally. They are used on more than 140 crops. Neonicotinoids are chemically similar to nicotine and are designed to kill insects by attacking their nerve cells. They are also "systemic," meaning they dissolve in water and are absorbed by plants, making the plant itself—including its nectar, pollen, and fruit—toxic.

The role of neonicotinoid seed coatings

The study found that corn and soybeans are the two crops most responsible for the increase in toxicity. Neonicotinoid use rose dramatically starting in the early 2000s when they began to be used as coatings on soybean and corn seeds.[3] Seed coatings account for the vast majority of total neonicotinoid use in the U.S.[4] Science shows these coatings provide almost no benefit to farmers and come at a high cost to the environment. The Environmental Protection Agency determined that neonic-coated seeds provide "little or no overall benefits to soybean production," yet nearly half of all soybean seeds in the U.S. are treated.[5] Similar analyses have found no economic benefit to farmers from neonic-coated corn, yet up to 100 percent of U.S. corn seeds are treated.[6]

SOLUTIONS

Banning neonicotinoids works to protect pollinators

In 2008, Italy instituted a ban on neonicotinoid use as seed treatments for corn. In an evaluation five years later, researchers found a "clear and dramatic improvement" in the number of bees and colonies in the region.[7] They also found that the ban did not impact farmers' yields.

Organic agriculture protects pollinators and other insects

Organic farms support up to 50 percent more pollinating species and help beneficial insects flourish.[8] Recent studies show that even non-organic farmers could dramatically reduce overall pesticide use while maintaining productivity and profitability, and in some cases, could improve yields and decrease farm costs.[9] Ecological farming methods like crop rotation, cover cropping and protecting beneficial insects reduce farmers' need for pesticides.

Photo: Tractor spraying wheat field. Credit: Shutterstock

Photo: Monarch butterfly perched on flower. Credit: Shutterstock

Policy leadership in Europe

The European Union banned neonicotinoids for field use in 2018 based on their harm to pollinators.[10] More leadership comes from the German state of Bavaria, which passed a law in April 2019 to transition 30 percent of the region's farmland to organic by 2030 in order to protect bees and other beneficial insects.[11]

Scientists call for action

Over 240 scientists from around the world have called for international action to restrict use of neonicotinoids based on their harm to pollinators and other beneficial insects in the journal *Science*.[12]

Policy change in the U.S. is imperative

The U.S. Environmental Protection Agency continues to stall scientific review of neonicotinoids, and although the agency placed a moratorium on new uses in 2015 and canceled the registration of 12 neonicotinoid-based products in 2019, it has not taken action to restrict the vast majority of uses currently on the market.[13] In 2018, the U.S. Fish and Wildlife Service reversed a ban on the use of neonicotinoids in national wildlife refuges.[14]

POLICY RECOMMENDATIONS

Recommendations for Congress

- Pass the Saving America's Pollinators Act [H.R.1337], Rep. Earl Blumenauer (D-OR)
- Pass the Protect Our Refuges Act [H.R. 2854/S.1856], Reps. Nydia Velazquez (D-NY), Martin Heinrich (D-NM)
- Adopt policies that incentivize transition to organic production and increase research into diversified organic and regenerative production methods.

Recommendations for the U.S. Environmental Protection Agency

- Suspend the registrations of neonicotinoids for agricultural as well as cosmetic and other uses, including a moratorium on use of neonicotinoids as seed coatings.
- Incentivize use of least toxic alternatives that are benign for human health and the environment.
- Use a methodology, such as the acute insecticide toxicity loading (AITL) analysis provided in this study, to predict the environmental toxicity burden of newly developed pesticide products on beneficial insects and other non-target species.
- Implement an improved surveillance and use reporting system for pesticide products that have the potential to disrupt ecosystems on agricultural lands and surrounding areas.
- Reinstate tracking the use and distribution of neonicotinoids as seed coatings, which was suspended in 2015.
- Prioritize systemic insecticides like neonicotinoids for Registration Review and ensure inclusion of independent, peer-reviewed research on the acute and chronic effects of systemic insecticides on bees.
- Expedite the development and implementation of valid test guidelines for oral toxicity and sub-lethal effects of pesticides on pollinators and require data from these studies for all currently registered and any new pesticides.
- Develop, implement and require testing methods to determine the relative risk for synergistic and increased toxicity of likely mixtures of pesticide active ingredients registered for use on comparable and overlapping crops.

STUDY

DiBartolomeis M, Kegley S, Mineau P, Radford R, Klein K (2019) An assessment of acute insecticide toxicity loading (AITL) of chemical pesticides used on agricultural land in the United States. PLoS ONE 14(8): e0220029.

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Photo: Closeup of Monarch butterfly. Credit: Shutterstock

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