What are Neonic Pesticides and How Do They Affect Birds, Bees, Water, and Human Health

Neonicotinoids or "neonics" are neurotoxic pesticides linked to massive bee and insect losses around the globe and, increasingly, to vast water and soil contamination, ecosystem-wide harms, and human health concerns. Cornell University research reveals that the neonic uses that pose the greatest threats to bees are also those that provide little-to-no benefits to users or are easily replaceable with safer alternatives. Several states have passed laws prohibiting these wasteful uses on residential and commercial landscapes such as lawns and golf courses.

Neonics Are Toxic, Persistent, and Everywhere – As the world's most widely used insecticides, neonics have made U.S. agriculture 48-times more harmful to insects since their introductioninthemid-1990s.[1] Neonics permeate plants—turning their nectar, pollen, and fruit toxic. They can be applied to a plant's roots or as a coating on a crop seed, which the entire plant then absorbs as it grows. Neonics also persist in soil, where they are easily carried long distances by rain or irrigation water. Today, neonics broadly contaminate water, soil, and plants, concentrating in areas of year-after-year use.[2]

Neonics Kill Bees –A robust body of scientific evidence links neonic use to massive bee population losses, including two worldwide academic assessments, Cornell University research, and even a major pesticide-industry-funded field study.[3] In CT, for example, beekeepers lost 65.7% of their colonies in 2021, the third steepest losses in country[4]—suggesting possible similar catastrophic losses for CT's 337 native bee species. These losses threaten ecosystems and the 24 billion dollars worth of pollination pollinators provide to crops like apples, squash, tomatoes, blueberries, strawberries, cherries, and pears annually in the US.

Neonics Kill Birds – Research links neonics to large declines in U.S. bird species[5]—contributing to the 30% decline in North American birds seen in the last 50 years. Eating just one neonic-treated seed is enough to kill some songbirds, and even at low doses, neonics can harm birds' immune systems, fertility, and navigation, and cause rapid weight loss—reducing birds' chances of surviving in the wild. As neonics kill insect populations, birds also starve. In Europe, for example, declining bird populations were linked to very low levels of neonics in water.

Neonics Harm Majority of Endangered Species –EPA recently released Endangered Species Act evaluations for the neonic chemicals imidacloprid, clothianidin, and thiamethoxam which found its approvals of pesticides containing the chemicals were likely to adversely affect between ~70% to 80% of all listed species, depending on the chemical.

Neonics Contaminate Water and Debilitate Ecosystems, Harming Fish, Deer, and Other Wildlife – Neonics frequently show up in state water testing—including, for example, ~30% of Long Island groundwater samples— indicating a "very high probability" that the pesticides are causing "ecosystem-wide damage".[6] Neonics hollow out ecosystems by eradicating aquatic insect populations that birds, fish, amphibians, and other animals depend on for food. Neonic water contamination has been linked to harm to bats and birth defects in white-tailed deer.[7]

Neonics May Harm Human Health – Monitoring by the U.S. Centers for Disease Control and Prevention shows that half the U.S. population is regularly exposed to neonics—with the highest levels found in children.[8] This is particularly concerning given human and animal research linking neonics to potential neurological, developmental, and reproductive harms, including malformations of the developing heart and brain.[9] While modern filtration systems remove neonics, standard chlorination treatment doesn't, meaning homes that get water from groundwater, older treatment systems, or unfiltered supplies are at higher risk of finding neonics in their tap. Neonic residues also commonly contaminate produce and baby food, and because neonics permeate foods, they cannot be washed off.

(This page was adapted from an NRDC report for New York State)

Alternatives for the Most Widely Used Neonicotinoids

Based on data from states that keep digital records of pesticide use, we see that the heaviest use of these pesticides is imidacloprid to kill grubs in turf grass. In New Jersey 90% of the neonics used fell into this category before such use was banned.

CHEMICAL SUBSTITUTES: Several products are available for use as substitutes for imidacloprid. According to a comprehensive review of neonicotinoids entitled *Neonicotinoidal Insecticides in New York State*, Cornell, 2020, "Acelypryn and Ference, based on chlorantraniliprole and cyantraniliprole respectively, are effective non-neonicotinoid alternatives."

BIOLOGICAL SUBSTITUTES:

1) Nematodes are microscopic worms that are effective against all types of grubs. The strain *Heterohabdis ssp* is the most effective strain. In fact, the Cornell Report as referenced above says "Nematodes are the most reliable non-chemical treatment for white grubs in New York turfgrass."
2) *Milky spore* is a Japanese beetle grub killing bacterium best applied in late summer. (Less effective in cold climates.)
3) A parasitic wasp called *Spring Tiphia* can be very effective at control of Japanese beetles as reported by the University of Connecticut.
4) A bio-insecticide, Grub-Gone, employs *Btg (Bacillis thuringiesnsis gallerias*) has been available since 2018.

1 Michael DiBartolomeis et al., An Assessment of Acute Insecticide Toxicity Loading (AITL) of Chemical Pesticides Used on Agricultural Land in the United States, PLoS One (Aug. 6, 2019), https://bit.ly/2Yr4Xc7.
2 See Pierre Mineau, Impacts of Neonics in New York Water (2019), https://on.nrdc.org/2lXsO0O [hereinafter "Mineau 2019"].
3 See Lennard Pisa et al., An Update of the Worldwide Integrated Assessment (WIA) on Systemic Insecticides, Envtl. Sci. Pollution Research Int'l (Nov. 9, 2017), https://bit.ly/2HqqHwB; Thomas Wood & Dave Goulson, The Environmental Risks of Neonicotinoid Pesticides, Envtl. Sci. Pollution Research Int'l (Jun. 7, 2017), https://bit.ly/2Hpn8T5; McArt et al. 2017, High Pesticide Risk to Honey Bees Despite Low Focal Crop Pollen Collection During Pollination of a Mass Blooming Crop, Scientific Reports (Apr. 19, 2017), https://go.nature.com/2Ir0o9Y; Daniel Cressey, Largest-ever Study of Controversial Pesticides Finds Harm to Bees, Nature (Jun. 29, 2017), https://go.nature.com/2sgJjDk.
4 See Bee Informed Partnership, Colony Loss Map, https://bit.ly/2HpheoW, and select "Annual" under the "Season" menu.
5 Science News, Decline in US Bird Diversity Related to Neonicotinoids, Study Shows, (Aug. 14, 2020), https://bit.ly/3nHu427.
6 Mineau 2019.
7 See Pierre Mineau & Carolyn Callaghan, Neonicotinoid Insecticides and Bats, Canadian Wildlife Federation (2018), https://bit.ly/2kSfs5K; Jim Daley, As Pesticide Turns Up in More Places, Safety Concerns Mount, Scientific American (Apr. 30, 2019), https://bit.ly/2oft0dv.
8 M. Ospina et al., Exposure to Neonicotinoid Insecticides in the U.S. General Population, Envtl. Res. (Jun. 24, 2019) https://bit.ly/2q11yRf.
9 A. Cimino etal.,EffectsofNeonicotinoidPesticideExposureonHumanHealth:ASystematicReview,125Envtl.HealthPersp.155-62(2017), https://bit.ly/2NVA1LR.