Recent Science on Neonicotinoid Insecticides

A recent outpouring of scientific research identifies the use of neonicotinoid insecticides or "neonics" as a leading cause of massive losses of bees and other pollinators. New science also links neonics with harms to other wildlife—like fish, birds, deer, bats and aquatic insects—sometimes dubbed a "second Silent Spring"—and raises concerns about neonic water contamination and potential human health impacts. The most recent relevant research is summarized below:

Neonic Impacts on Bees and Other Pollinators:

- *Main et al.* (Oct. 2019) — Neonics detected in soils adjacent to fields with historic neonic use as well as those without; higher neonic soil concentrations were correlated with lower native bee species richness. http://bit.ly/2OhMB6W.
- *Chan et al.* (Aug. 2019) — Finding neonic residues in soil from *cucurbita* and field crops "pose a high risk" to the female hoary squash bee, also concluding risks are likely to be applicable to other species of ground-nesting bees in agricultural soils. https://go.nature.com/2Ry2loa (and discussed at https://bit.ly/2LCMwJi).
- *DiBartolomeis et al.* (Aug. 2019) — Finding U.S. agriculture is now 48-times more harmful to insects than thirty years ago, primarily due to neonics. Neonics accounted for 92% of total acute oral insect-toxicity load from 1992 to 2014. http://bit.ly/2ZEmCtu.
- *Sanchez-Bayo et al.* (Apr. 2019) — Finding 40% of insect species are at risk of extinction. Steepest butterfly declines found in places with large areas of neonic-treated farmland. http://bit.ly/2LfRrPs.
- *Morfin et al.* (Apr. 2019) — Field-realistic (i.e., "real-world") neonic exposures reduced honeybee ability to fight off parasitic varroa mites. http://bit.ly/2Oh7lf1.
- *Kenna et al.* (Apr. 2019) — Neonic-exposed bumble bees only capable of flying a third of the distance as unexposed bees. http://bit.ly/2KSaiAE.
- *MacPhail et al.* (June 2019) — American bumble bee—with main range in area of heavy neonic use—at risk of extinction in Canada. http://bit.ly/2OMuWU1.
- *Basley and Goulson* (Apr. 2018) — Plants located next to neonic-treated wheat crop found to be contaminated with neonics; concentrations were comparable to and sometimes higher than those in treated crops and stayed at these levels for up to 21 months after sowing. https://bit.ly/2LCTRbO.
- *Pisa et al.* (Nov. 2017) — Worldwide literature review summarizing studies confirming neonic impacts on bees and other pollinators. Review also warns of neonics' "potential to greatly decrease populations" of terrestrial and aquatic arthropods and highlights impacts on fish, reptiles, birds, frogs, and mammals. http://bit.ly/2OW4G9R.
- *McArt et al.* (2017) — Finding neonic thiamethoxam posed the greatest oral exposure risk to honey bees in apple orchards and was detected in beebread at multiple orchard sites where thiamethoxam was not sprayed. https://go.nature.com/2LO2ksS.
- *Woodcock et al.* (June 2017) — Largest bee field study to date finding population-level declines in honey bees and wild bees linked with neonic-treated agriculture. http://bit.ly/2Dezjl9.

Harms to Fish, Birds, Deer, and Other Wildlife:

- *Eng et al.* (Sept. 2019) — Neonics caused rapid decrease in food consumption, mass, and body fat in songbirds, reducing chances of migratory survival and reproduction. http://bit.ly/2XSIp0E.
- *Yamamuro et al.* (Nov. 2019) — Sudden collapse of Japanese smelt and eel fisheries linked to the introduction of neonic use in nearby rice fields; neonic introduction correlated with rapid and substantial loss of zooplankton, the fish's primary food source. http://bit.ly/2OKhf7L.
- *Berheim et al.* (Jan. 2019) — White tailed deer exposed to the neonic imidacloprid demonstrated hypothyroidism and lethargy, decreased body and organ weight, decreased jawbone length, and higher mortality rates for fawns. Surprisingly, imidacloprid found in spleens of control group deer, demonstrating ubiquity of neonics in the environment. https://go.nature.com/2sgOOHb.
- *Rogers et al.* (Jan. 2019) — Case study of 26 American goldfinches found dead following the drench application of the neonic imidacloprid in California; attributes likely cause of death to ingestion of fallen elm seeds contaminated during the drench application. https://bit.ly/38kTtbz.
- *Mineau and Callaghan* (2018) — Finding evidence that bats are harmed by neonic use through neurological impairment and reduced insect prey populations. http://bit.ly/2KTfLY1.

Food and Water Contamination and Human Health:

- *Ospina et al.* (Sept. 2019) — Finding half of the American population had traces of neonics in their urine, indicating recent exposure. Concentrations were highest in children. http://bit.ly/2OP7R34.
- *Mineau* (Sept. 2019) — Analysis of state and federal water testing data finding neonics "frequently" in New York surface waters and roughly a third of Long Island ground water samples, indicating a "very high" probability of "ecosystem-wide" damage. https://on.nrdc.org/2QTkTi7.
- *Klarich et al.* (USGS, April 2017, Jan. 2019) — Companion studies finding neonics "ubiquitously" in University of Iowa drinking water, as well as neonic breakdown products up to 300 times more toxic to mammals than parent chemicals. Studies also found traditional water treatments generally fail to remove neonics and their metabolites and may create new, and potentially more toxic, "chlorinated disinfection byproducts." https://bit.ly/2Ntsv8J; http://bit.ly/35zlSIS.
- *Craddock et al.* (Jan. 2019) — Low levels of neonics found in baby food and commonly-consumed fruits and vegetables, including cherries, apples, pears, strawberries, cauliflower, celery, grapes, leafy greens, and potatoes. Neonics also detected in some organic produce. http://bit.ly/37Cje6V.
- *Cimino et al.* (Feb. 2017) — Review of research linking neonic exposure and adverse developmental outcomes or neurological effects. Concludes more human health research on neonics needed given initial findings and widespread neonic use. https://bit.ly/2P4J0cx.
- *Secord & Patnode* (U.S. Fish and Wildlife, Nov. 2018) — Federal government pilot study finding neonics in New York water "in excess of toxicity and regulatory thresholds" and that neonics "may bioaccumulate in aquatic organisms." https://bit.ly/2tci174.
- *Hladik and Kolpin* (Aug. 2015) — USGS researchers find at least one neonic in 53% of samples from a nationwide survey of surface waters. http://bit.ly/2OgEqrk.

Neonic Inefficacy and Alternatives:

- *Mourtzinis et al.* (Sept. 2019) — Neonic seed treatments in soybean provide negligible benefits to farmers. https://go.nature.com/2KVXUQa.
- *Jactel et al.* (Aug. 2019) — French government study finding that 96% of neonic uses are replaceable, with 78% replaceable by non-chemical pest control methods. http://bit.ly/2OKie7X.
- *Krupke et al.* (May 2017) — Documenting "no benefit of the insecticidal [neonic] seed treatments for [corn] crop yield during the study." Modeling also showed 94% of honey bee foragers in Indiana are exposed to neonic during planting of treated corn seeds. http://bit.ly/2rmvkjU.