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The Neonic Problem:

Racing to Gauge a Global Threat to Birds and Bees

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It's muddy, smelly work, counting bugs in the Canadian wetlands, especially after the April snow melt. The surrounding croplands offer a pretty backdrop, but the sulfur and other swamp gases bite the nose while the mosquitoes sting the flesh.

But those inconveniences don't bother Christy Morrissey, an ecotoxicologist at the University of Saskatchewan. She's been leading eager groups of students armed with small glass sample bottles into the swamps for years. "We fall into the ooze a lot, and sometimes we get stuck in it," she says. "But it's fun, and it's worth the effort."

This is work that could affect the health of countless birds and honeybees, as well as the future of the world's most widely used class of insecticides. Known as neonicotinoids—or "neonics" for short—these chemical compounds are now so widespread that it's hard to find an insect control product that does not contain them. Neonics are sprayed on farmlands the world over. They are used to make tick and flea collars for dogs. They are injected into tree trunks. Seeds coated with neonics produce some of the world's most important crops, including a large number of the crops that grow in western Canada, where Morrissey is measuring how the neonics are affecting local food webs. That work is not close to being finished, but what Morrissey has found so far alarms her.

"There's an urgent need to find out more about the threats that neonicotinoids pose to the world around us," she explains. "Clearly, they are not as harmless as previously assumed."

Early Praise

In the early 1990s, the first neonicotinoids approved for use were hailed as safe alternatives to notoriously toxic pesticides such as diazinon and carbofuran. At first, the U.S. Environmental Protection Agency (EPA) restricted the use of neonics to potatoes, which helped make it look like regulators were proceeding cautiously.

But that sense of caution seemed to vanish in the early 2000s, when the EPA began approving new neonic compounds much more rapidly and for a much wider range of uses. Since that time the agency has helped put nearly 600 new neonicotinoid products onto the market; in some cases, this was done over the objections of the EPA's own scientists. These experts repeatedly voiced concerns about how long it took for neonicotinoids to break down after being applied and about the speed with which they moved from farm fields into wetlands, lakes,

Although this field of canola looks beautiful, it has very likely been treated with the toxic neonicotinoid clothianidin. Former graduate student Kasia Majewski shown in the background. Photo by Anson Main, July 2012

and aquifers. Some warned that neonics could harm birds, bees, and other pollinators.

Morrissey says research teams around the world are now doing work that is deepening those fears. Some have published studies associating neonics with mass die-off of honeybees. Others have established that a single seed of corn treated with the oldest neonic, imidacloprid, is all it takes to kill a songbird. Still other researchers are now testing the hypothesis that exposure to neonics depresses the immune systems of bats, frogs, and other wildlife, making them more susceptible to parasites and diseases.

"It's the kind of work we should have done before allowing neonicotinoids to flood the global market," says ecotoxicologist Pierre Mineau. He has been a leading expert since the 1980s on pesticides' effects on wildlife, first with the Canadian government and now as an independent consultant. Recently, along with ABC and other groups, he asked the EPA to ban the use of neonics as seed treatments and to suspend all registrations pending independent review of the effects on birds, terrestrial and aquatic invertebrates, and other wildlife.

Studying the Studies

Mineau made that request after evaluating nearly 200 studies, including the EPA's internal reviews and industry research obtained by ABC through the Freedom of Information Act. His report—co-written by this correspondent—was published by ABC last March. It charged that the EPA had "greatly underestimated" the threats posed by the neonicotinoids, in part because the risk assessment tools used by the EPA were "scientifically unsound and outdated." The report went on to note that when the EPA tried to evaluate the toxicity of neonics to aquatic invertebrates, it tested a species of freshwater flea that is uniquely insensitive to neonics. And when the agency set out to gauge the risk to bird species, it tested only Mallards and Northern Bobwhites, even though it is known that other birds can be 10 times more sensitive to chemicals like these.

Eastern Meadowlark by Larry Thompson

Butterfly and bee on vetch flower. Photo by Kasia Majewski

The report concluded that the neonicotinoids were lethal to both birds and aquatic insects. Some of the field studies it relied on came from western Canada, where Morrissey and her students are studying what these chemicals can do to food chains.

"Actually, it was Dr. Mineau who first suggested that I study the effects of these compounds," says Morrissey. "Three years ago, when I was setting up my laboratory in Saskatchewan, I asked him what was the hot issue in Canada that I should be studying, and he suggested neonicotinoids. I couldn't pronounce the word but he seemed to have his finger on the pulse of something big."

Since then, Morrissey has been leading teams of field researchers into bodies of water found in the Great Plains of western Canada. The region includes the provinces of Alberta, Saskatchewan, and Manitoba, and it is the nation's breadbasket, containing 80 percent of Canada's farmland. Like farms in the United States, these places are awash in neonicotinoids: The canola crop, which covers 21 million acres of this region, grows almost exclusively from seeds that have been treated with neonics, as do many other crops grown on the plains, including an increasing proportion of the cereal crops.

Not coincidentally, Morrissey and her field teams have spent huge amounts of time in the ponds and wetlands near these farmlands, filling hundreds of laboratory flasks with water samples. Some of those water samples have shown neonic levels high enough to kill aquatic insects. That's the kind of data that helped convince Mineau of the need for a moratorium on neonic registrations.

High Stakes Game of Scientific Catch-up

Morrissey's research teams have been trying to find out more about how these pollutants move from farm fields into water bodies, and about what happens when regular spring

Morrissey's graduate student, Chantel Michelson, sampling macroinvertebrates near a canola field north of Lanigan, Saskatchewan. Photo by Kasia Majewski, July 2012

Tree Swallow research is part of an ongoing neonics study. Photo by Christy Morrissey

storms send major "pulses" of farm water laced with neonics into nearby wetlands. This work was inspired by a Dutch researcher, Henk Tennekes, who studies the damage neonicotinoids do to invertebrate neural synapses. He believes repeated pulses of polluted waters can do cumulative damage. Morrissey is carrying this work further by looking at the effect that major die-offs of aquatic insects have on the birds that eat them.

Every year, she and her students band and monitor hundreds of Tree Swallows in 120 nest boxes, taking weights and measurements and counting insects in the vicinity. Morrissey says that, so far, it appears that the swallows found near water bodies laced with neonics are lighter and less healthy than swallows found elsewhere, but she adds that those results are not yet final.

Canadian toxicologists like Morrissey and Mineau, along with researchers in Europe, the United States, Australia, and Japan, are now trying to determine just how dangerous the neonics are. Basically, these researchers have joined a high-stakes game of scientific catch-up. What they find will clarify our understanding of what the global flood of neonicotinoids is doing to the natural world.

By all accounts, it will be years—at least—before the research is completed and regulatory decisions are finalized. In the meantime, the European Union has imposed a two-year ban on three of the most common neonicotinoids, in response to what has been described as an ongoing threat to the world's food production systems because of impacts to pollinators. In the U.S. Congress, Reps. John Conyers (D-MI) and Earl Blumenthal (D-OR) have introduced the "Save America's Pollinators Act of 2013," which would force the EPA to suspend certain neonicotinoid compounds. A wide range of conservation groups—including ABC—have endorsed this bill.

EPA Re-evaluation

So far, the EPA has chosen to forgo even a temporary ban on neonics, or to endorse the recent call for an independent review of threats posed by these pesticides. Instead the EPA has launched a multi-year review of the neonics. ABC and other groups have asked the EPA to compress the timeline for that review, but so far the agency has expressed unwillingness to do so.

The companies that manufacture most of the world's neonicotinoids—Bayer and Syngenta—continue to insist that these chemical compounds are only harming "target insects" and not honeybees, aquatic invertebrates, or the birds that eat them. They've been harshly critical of the work being done by scientists like Morrissey and Mineau, but the researchers are not fazed. Mineau says he'll keep plodding through all of the neonic studies he can get his hands on. Morrissey says she'll continue wading through the prairie wetlands, counting bugs and studying birds—until she and her colleagues find out just how dangerous these pesticides are.

See ABC's report on neonics at **ABCBirds.org**. Search on "pesticides report."

Cynthia Palmer directs ABC's efforts to address major toxic impacts and pollution threats to birds. She coordinates the National Pesticide Reform Coalition and participates on the EPA Pesticide Program Dialogue Committee.