



EcoFARMINGDAILY

from the Editors of Acres U.S.A. Magazine

Pollinators in Peril

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Pollinators have a staunch ally in Graham White. White, a small-scale hobby beekeeper in Scotland, has been an international campaigner on the dangers of neonicotinoid pesticides since 2003. To this endeavor, he brings his background in environmental education and teaching, a fascination with the biodiversity of life and his long-term involvement in environmental issues.

Graham White, a small-scale hobby beekeeper in Scotland, has been an international campaigner on the dangers of neonicotinoid pesticides and their affect on pollinators since 2003.

Born into a family of coal miners and glassmakers in an industrial town near Liverpool, England, White developed his love of nature exploring remnant woodlands and abandoned 19th century canals. As a teenager he was introduced to hiking and as a university

student in the late 1960s he became an avid rock climber. He credits his 1976 expedition, hiking the John Muir Trail from Yosemite to Mt. Whitney in California, with changing his life.

When White returned to the UK, he decided to make it his mission to introduce John Muir, his writings and environmental values to the people of Britain. Muir, who founded the Sierra Club in 1892, was from Scotland, but was virtually unknown there. White founded the UK's first Environment Centre in Edinburgh in 1978 and served as founding director for 23 years. In 1994 he proposed the creation of The John Muir Award for environmental excellence as a personal development program for people of all ages. In recent years over 200,000 people have completed this national challenge award.

White is also an accomplished nature photographer, author and editor of environmentally themed books and articles, and radio broadcaster, whose productions include the BBC interview series Deep in Conservation with environmental luminaries such as David Brower, Satish Kumar, Vandana Shiva, Wangari Maathai, Amory Lovins, and Bill Mollison.

Interviewed by Tracy Frisch

ACRES U.S.A. How did you come to be a campaigner for bees?

GRAHAM WHITE. I started keeping bees in 1994, with four hives; within two years I had 10 hives. I harvested about 20 pounds of honey per hive each year, to share with friends and family. I only became a bee campaigner around 2000, when my bees began to die for no apparent reason. The Varroa mite arrived in 1998, but we treated for it, and I didn't lose any colonies. The French have had Varroa mites since 1963 without any impact on honey production. In 2001, I moved to the Scottish Borders, an area where wheat, canola, barley and potatoes are intensively farmed. I soon noticed something odd happening with the bees; my colonies didn't die, but they no longer thrived or made as much honey. They seemed weaker and lacking in vigor. In 1998 Bayer's imidacloprid appeared in the UK. I wasn't living among the wheat fields back then, so I wasn't aware of it. When clothianidin appeared, around 2003, people began to lose bees on a large scale — 50 to 80 percent of hives died each winter. After some online research, I discovered that mass bee deaths had occurred in France since 1994. We were just the next in a line. I began to educate myself and try to alert my fellow beekeepers in the UK.

ACRES U.S.A. What's the scope of your activism?

WHITE. I give talks, write articles for the general public and share research articles with activists around the world. I tried to influence the UK's national beekeeping organizations and nature conservation bodies, but soon found that any discussion of pesticides was taboo for them. They had long been co-opted by the pesticide and farming lobbies. We discovered that between 2000 and 2010, the British Beekeepers Association had secretly been taking \$40,000 a year from Bayer, Aventis and BASF to endorse their insecticides as "bee friendly." Ever since, the BBKA has flatly refused to campaign against pesticides of any kind. It prefers to foster a friendly, working relationship with Bayer. I was eventually banned from the BBKA online forum, as were others, for raising the issue of neonicotinoids and bee deaths. Hundreds resigned in protest. The Scottish Beekeepers Association executive actually vetoed a motion to support the European Union's proposal to ban neonics. I tried to influence our government, regulators and National Bee Lab, but Bayer, Syngenta and CropLife had infiltrated all of these long before I arrived. So my campaigning has mainly been aimed at the national and international scene, and especially America.

ACRES U.S.A. You've been a great resource.

WHITE. I'm a keen photographer and I've shared lots of pictures of affected bees and dead hives. I also give public slide shows and talks. In 2012 I visited America to give a lecture at the University of the Pacific in Stockton, California. Whilst there, I did a PowerPoint on neonics that was webcast to beekeepers across America. I wanted to alert the American beekeeping organizations, but it seems these groups had already been suppressed as well. There is no organized beekeeper resistance to the pesticides lobby, apart from the Pollinator Stewardship Council.

ACRES U.S.A. John Muir seems to have been a big influence on your life. How did you get interested in him?

WHITE. John Muir, the founder of the Sierra Club, was born in Scotland in 1839; but I didn't know that when a friend and I walked the John Muir trail from Yosemite to Mt. Whitney in 1975. It was the first great mountain trip of my life, and it moved me deeply. I had never seen such beauty in a mountain landscape; Donoghue Pass, Mount Ritter and Thousand Island Lake are still engraved on my heart. When I returned to Scotland in 1977, I attended the first-ever UK exhibition on John Muir's life, held at the National Library of Scotland. Very few people in the UK had even heard of John Muir, and his books were impossible to find. That same year saw the birth of the John Muir Trust in Scotland, formed to purchase and conserve wild land for posterity. I soon joined but my primary interest was in environmental education, bringing young people to the wild places, as John Muir had done with Yosemite and the creation of the Sierra Club. Muir was born and lived his first decade here in Scotland, in the fishing port of Dunbar. I wanted to repatriate him as a Scottish environmental hero and use him as a role model in the schools, universities and youth clubs. I spent the next 20 years doing that. I proposed the creation of the John Muir Award for environmental excellence, as a national program under the aegis of the John Muir Trust. It's a free personal development program that everyone from little kids to university professors can do at own their level. Close to 200,000 people have completed it in the UK since 1994 when it was launched. I had created an NGO called the Environment Centre in Edinburgh, which I ran as the founding director from 1978 to 2001. We ended up running environmental education programs for 200 schools in the Lothian Region. We trained teachers in hands-on environmental education, like taking kids to the mountains, the woods, the rivers and beaches. We created the first school gardens with teachers and students, we initiated the first Urban Wildlife Group in Scotland, and we created school ponds, tree nurseries, wildlife gardens and a host of educational programs centered on these resources.

ACRES U.S.A. It sounds like a lot of fun.

WHITE. It was, but it was exhausting. Eventually, because I was a qualified teacher, I became a senior education advisor in the education department. That was the kiss of death for the NGO. Education departments are bureaucracies and their view was that taking children outdoors is disruptive, risky and doesn't help them pass exams. In 1994 I moved to live in Muir's hometown of Dunbar, where I helped bring his Scottish birthplace into public ownership. I was invited to California every five years for the quinquennial Muir conference at UOP. I usually gave a presentation about Muir's Scottish origins and why the values he acquired as a child were so influential in shaping his environmental ethos and passion for conservation. Muir was a truly great writer and saw God manifested in stars, planets, giant redwoods and grizzly bears. He was raised as a fundamentalist Scottish Presbyterian. He could argue his case and hold his ground with anyone, from princes to paupers. He led President Teddy Roosevelt on a winter expedition into Yosemite for four days, alone apart from some rangers. They slept under a pile of a dozen blankets each and awoke covered in snow. In my [most recent] slide presentation at Stockton, I asked the assembled conservationists, "What would John Muir say if he were here today and he knew 20 million bee colonies had been wiped out in America, and the monarch butterflies and farmland birds were dying by the millions?" The question was not well received. Many conservation scholars don't like to confront real issues, here and now. They prefer the comforts of the library and the groves of academe.

ACRES U.S.A. Today honeybees are portrayed as fragile organisms subject to devastating parasites, pests and diseases that beekeepers must control for them to survive. Is that a correct understanding of the honeybee?

WHITE. The pesticide industry created the narrative of ‘fragile bees’ as a cover story for the bees dying in every country where neonics are used. In truth, honeybees are incredibly resilient. Tom Theobald says that in the 1980s he could lose two-thirds of a hive to the pesticide Pennacap [an encapsulated form of parathion]. But if he treated the hive well and took it away from the poisoned crops, it would often recover and even produce a crop of honey. There’s a village called Kirknewton a few miles from here, which boasts a 1,200-year-old Saxon church. A wild bee colony has lived above the porch there for decades, possibly generations. It has endured Varroa mites for 20 years and probably other diseases, but has survived without any human help. So bees are resilient, but they cannot cope with wave after wave of pesticides being thrown at them today. For 65 million years they never found poison in any flower. But since DDT arrived in 1939, they have rarely known any environment without poisons. Today, the entire landscape — rural, urban, domestic, along with crops, soil, water and air — is massively toxic to bees.

ACRES U.S.A. What’s the magnitude of the problem faced by pollinators and beekeepers?

WHITE. Neonics were first used on French sunflowers in 1994 and they lost a million hives in just two years. People went bankrupt. Some lost their homes as well as their businesses. National honey production crashed by 50 percent. It was a national disaster. French beekeepers soon guessed that imidacloprid had killed their bees. It was the only new factor in play. Bayer denied all responsibility and the French government sat on the fence. Then the poison juggernaut rolled on to Germany, Holland, Spain and Italy, where the same scenario of mass bee deaths was repeated and each government put its fingers in its ears. Imidacloprid came to the UK and America around 1998. But the scale of the American disaster eclipses anything seen in Europe. By official USDA figures, 10 million bee colonies died between 2003 and 2015. Many commercial beekeepers say the real losses are at least 20 million colonies. But nobody is counting the loss of bumblebees or Monarch butterflies, because nobody owns those creatures.

ACRES U.S.A. So the correlation is that when neonicotinoids go into widespread use in a country, bees start dying on a broad scale?

WHITE. Exactly. In every country where neonics have been introduced, mass bee deaths have followed. In rare places where they were not used, such as in The Hebrides and Orkney Islands, no mass bee deaths occurred. Bayer applied for imidacloprid’s first license in France around 1992, and it took a couple years to register. But there was no independent testing or risk assessment. The pesticide companies provide their own data, and the bureaucrats decide whether it’s acceptable. The pesticide companies promised regulators that although neonics killed insects, they were much safer than the organophosphates because they were applied as a seed coating. They claimed it was biologically impossible for the poison to appear in the flowers, the nectar or the pollen. On the basis of that big lie, they got their license. When the

sunflowers bloomed in France, in 1994, a million bee colonies died within weeks. One beekeeper placed 500 hives in an untreated chestnut forest — they made tons of honey and thrived. He placed his other 500 hives among the sunflowers, five miles away, and they all died. The only difference was that imidacloprid had been used as a seed coating on sunflowers. When the beekeepers begged the government for help, they assumed regulators would believe them about the new pesticide and the bee deaths. But the government, heavily lobbied by the pesticide companies, said the evidence was equivocal. So the beekeepers commissioned independent research from Professor Bonmatin at Montpellier University. He proved that Bayer had not told the truth. The poison was in the flowers, the nectar, the pollen and the soil and water near the crop fields. Bayer then sued him for 'defaming' their product. The court exonerated Bonmatin and his research and awarded costs against Bayer.

ACRES U.S.A. Neonicotinoids have become the most widely used class of insecticides worldwide. What features make them so popular, and what are their downsides?

WHITE. In 1992 Shell Research synthesized neonicotinoids as a new organochlorine insecticide. Bayer bought the right to manufacture them in 1994. Organophosphates attack the brain and nervous system in humans and mammals as well as insects. Neonicotinoids have little acute toxicity for mammals or humans. The industry rationale was you could use them on food crops, with little or no danger to people or non-target organisms like bees, because they stayed inside the crop and never reached the flowers. But that wasn't true. They render the pollen and nectar deadly to bees. Neonicotinoids seemed like a quantum leap in pesticide technology. Older pesticides, like DDT and Malathion, were like clubbing insects to death with a big rock, whereas neonics fired a laser beam at the insect brain. They cripple insect nervous systems with an infinitesimal dose that most labs cannot even detect. Neonicotinoids are revolutionary in three ways. Firstly, they are hyper-toxic. Clothianidin is 11,000 times more toxic to bees than DDT. Organophosphates killed insects at a dose of a few parts per million (ppm), but neonicotinoids do the same at parts per billion (ppb). But they don't just kill insect pests and bees, they poison many other organisms in the soil and water. One part per billion is one teaspoon in 1,000 metric tons of water, roughly the volume of an Olympic swimming pool. Five to 10 teaspoons of clothianidin in that Olympic pool (5-10 ppb) would disable or kill any bees that drank it. The second revolution is that these poisons are systemic. Applied as a seed coating, they are absorbed in the water taken up by the roots. They render every part of the plant, from roots to flowers, toxic to insects. The third pesticide revolution is that neonics are used prophylactically as a pest insurance policy. They are used on every seed, year after year, even if no pests are ever seen. When a corn seed is coated with neonicotinoids, just 2 percent of the poison is absorbed into the plant. A similar amount blows away as planter-dust. The balance, about 96 percent, diffuses into the soil. Neonics persist in the soil for three to five years. On clay soil, they can last 19 years. They are water-soluble, so they travel along ditches into ponds, streams and rivers, where they poison water invertebrates. Entire landscapes and ecosystems have been affected all over the world. In America neonicotinoids are used on around 200 million acres of crops a year: 100 million acres of corn and another 100 million acres of soy, wheat, potatoes, canola, and so on. They're also used on most fields of wheat, rice, barley, soybeans, maize and potatoes throughout Europe, Brazil, Argentina, Mexico, China

and Australia.

ACRES U.S.A. Hasn't the EU banned the three most popular neonicotinoids as seed treatments?

WHITE. In 2013 Europe banned the three most widely used neonicotinoids —imidacloprid, clothianidin and thiamethoxam — for all 28 countries of the EU. But this is only a partial ban, on crops whose flowers attract bees, like canola, corn and sunflowers. Neonics can still be used on potatoes, cabbage, wheat, barley, rice and a wide range of other crops. The French government banned these three neonics back in 2000. It took 13 years for Europe to ban them, but as far as the EPA is concerned, it is “carry on poisoning America, boys.” There may be no bee-attractive crop near your apiary, but there could be neonic-treated wheat nearby. The pesticide on every wheat seed seeps into the soil, poisoning the surface and groundwater. This polluted water is then taken up by wildflowers on the field margins, as well as the hawthorn hedges, willows and wild clover. The entire landscape becomes contaminated with chemicals 10,000 times more toxic than DDT. With neonics applied annually, the toxic burden increases. This is ecocide — the poisoning of an entire ecosystem.

ACRES U.S.A. The name neonicotinoids implies that they behave like nicotine in the way they disable and kill insects. Do these compounds resemble nicotine?

WHITE. Only superficially. Neonicotinoids are synthetic chloro-nicotyl compounds that are massively more toxic than the nicotine in tobacco. They are organochlorines, just like DDT, dieldrin, aldrin and other pesticides banned in the 1980s. Chlorine is the ultimate poison. It doesn't exist free in Nature and has to be generated in the lab. Nicotine is extremely addictive, but smokers only absorb a tiny fraction of the nicotine in a cigarette. If you soaked a pack of cigarettes in water so the nicotine dissolved and then drank that water, it would kill you. Nicotine excites nerve synapses in the brain. Synapses are tiny chemical switches which turn each nerve cell on and off hundreds of times per second using a chemical called acetylcholine. Smoking kind of revs up the acetylcholine. It gives smokers a buzz, increases alertness and fights off sleep; hence tobacco was given freely to all troops in both world wars. Unlike nicotine, neonicotinoids don't just 'enhance' that neural switch box, they jam it open and send every brain circuit haywire. Bees fed neonics are overwhelmed by a tidal wave of sensory impressions. Bees have complex neurological systems that enable them to fly and navigate. They have a biological GPS that provides them with a mental map of their hive location so they can always fly home from anywhere within a radius of 3 miles. That's a territory of 18,000 acres. When a bee sips neonic-laced nectar from a canola field the poison attacks its brain, and suddenly the GPS and mental map disappear. Its world becomes chaotic. Its flight muscles go into spasm and it loses control of wings, balance and coordination. Imagine if I made you drink a full bottle of whisky and sent you out to drive in Manhattan traffic. You wouldn't survive five minutes. Bees poisoned with a sublethal dose of neonics simply cannot find their way back home. Given a stronger dose, they tremble like a Parkinson's victim and are soon paralyzed. The nervous system is overloaded. At night, they die alone in the field so nobody finds their corpses. Fifty thousand bees just vanish and the beekeeper is left with the mystery of an empty hive, a few young bees and an abandoned queen. When farmers commonly sprayed fields with

organophosphates, you might find 20,000 dead bees in front of your hive. Neonics don't work like that. Dave Hackenberg was the first beekeeper in America to witness the impact of neonicotinoids on his bees. He left 500 hives in a Florida bee yard to pollinate oranges. When he returned two weeks later, the hives were empty with no sign of dead bees. The bees had vanished as if abducted by aliens. In reality, the bees had been poisoned by a strong dose of neonicotinoids in the citrus groves and never found their way home.

ACRES U.S.A. When given a choice, bees prefer sugar water laced with neonicotinoids to uncontaminated sugar water. Why do they choose what will kill them?

WHITE. It's like a smoker hooked on nicotine. They can't taste the neonics, but they enjoy the mild buzz from a low dose.

ACRES U.S.A. What happens when bees are exposed to neonicotinoids?

WHITE. Bayer told the French government that bees could never be exposed to neonicotinoids because the poison could not transfer into pollen or nectar from the treated seed. But French scientists proved that these pesticides *did* occur in the flowers at doses of 3 to 5 ppb. Sometimes, the nectar and pollen were contaminated at levels up to 11 or even 20 ppb. In response to these independent science results, Bayer admitted it had been 'mistaken,' that neonicotinoids did travel through the sap to the flowers. But it claimed this was irrelevant because you would need a dose as high as 5,000 ppb (5ppm) to actually kill a bee. Bayer claimed that bees could feed daily on neonic-contaminated flowers for 100 days, without receiving a lethal dose.

ACRES U.S.A. You're talking about immediate death from acute exposure.

WHITE. Yes. Luc Belzunces is a French scientist who worked at the French National Centre for Agricultural Research (INRA), the equivalent of the USDA's top bee lab. Way back in 1998, Belzunces found he could kill an entire bee colony in just a few days, if he fed them a 4 ppb dose of neonics. Bayer continues to deny this is possible. Belzunces then made a more alarming discovery. If he lowered the dose of neonics, by a factor of 1,000, to just 4 parts per trillion (4 picograms), the hive still died, after 20 or 30 days. He didn't understand why this happened, but he demonstrated it. This time-delayed sublethal effect had never been observed before. At the time there were probably only two labs in the world that could even detect 4 picograms of neonics. Neither was in America.

ACRES U.S.A. That's astounding, given how much smaller that dose is compared to the amount that acutely kills bees.

WHITE. The founding principle of classical toxicology is that *everything* is poisonous if the dose is large enough. If you drink 30 liters of water in 24 hours, you will die. And while a pinch of salt is great on your fish, 4 ounces will kill you. That's the essence of the linear dose response.

ACRES U.S.A. In other words, the dose makes the poison. Regulatory agencies base decisions on that.

WHITE. When a pesticide is considered for registration, they conduct a Risk Assessment for bees using the laboratory-based LD50 (the lethal dose for 50 percent of the test bees). If you expose bees to 10 ppb of imidacloprid and half of them die in 48 hours, that would be the LD50. One-hundredth of that LD50 might then be considered an acceptable risk. Dutch toxicologist Dr. Henk Tennekes has had a long, distinguished career in brain cancer. While he had no special interest in bees, the evidence on neonicotinoids suggested they acted in ways similar to brain carcinogens. He decided to apply the Druckrey-Kupfmuller equation — which had been used in cancer science for 50 years — to neonicotinoids. For potent human carcinogens, like dioxin, scientists found that the classic linear dose response was irrelevant. Any significant exposure to dioxin, or plutonium, no matter how small the dose, causes cancer. That's the dramatic insight from the DK equation. Even a very small, non-lethal dose of neonics, fed to bees over weeks or months, will always kill the colony. The dose may be a thousand times less than the LD50, they will still die. This time-delayed toxicity is what killed 10 million bee colonies in the United States. The amounts of poison involved are so minute that they are almost beyond measurement. Belzunces' work predicts that if you distribute neonicotinoids throughout the environment, on farms and lawns and in parks, gardens and forests, then every insect that lives in that environment is likely to die, or be weakened to the point where it cannot function.

Pollinators & A Growing Threat

ACRES U.S.A. Does it make sense to call neonicotinoids “the new DDT?”

WHITE. Neonics are 10,000 times more toxic than DDT. Perhaps AIDS is a better analogy. When AIDS first appeared in San Francisco, doctors couldn't understand what they were seeing. Hundreds of young men were suddenly dying of hepatitis, tuberculosis, pneumonia, really rare cancers and collapse of the nervous system. Scientists suspected a virus, but it took a long time to identify HIV and determine it was destroying the immune system. Without an immune system, people died from whatever common pathogens were around.

ACRES U.S.A. How is this analogous to neonicotinoids?

WHITE. Neonics weaken the bees' immune system, just as HIV cripples the human immune system. An important discovery was made independently by teams working in France and in America. In 2010, Dr. Cédric Alaux and a French team followed up on Belzunces' work. They fed bees a minute dose of imidacloprid, a thousand times less than the LD50, and exposed them to the fungal pathogen *Nosema*, which is endemic in hives, but normally benign. All the bees exposed to neonics later died of *Nosema*, but none of the control hives, also exposed to the fungus, showed any sign of disease. They had not been fed neonics, so their immune systems could easily cope with *Nosema*. Drs. Jeffrey Pettis and Dennis vanEngelsdorp at the USDA bee lab in Beltsville, Maryland, repeated Cédric Alaux's experiment with identical results. They suspected neonicotinoids had crippled the bees' immune system, triggering a normally harmless pathogen to explode and kill the bees. The De Prisco team in Switzerland later proved this hypothesis. Pettis' experiment revealed something else. He knew that they had fed all the dead colonies imidacloprid, but they could not find any trace of that insecticide in the dead

bees. Neonics are the perfect killer. They destroy the immune system and disappear, leaving other culprits to take the blame for bee deaths — notably: Varroa mites, Deformed Wing Virus and Nosema. This is why most labs had failed to find any trace of neonics in millions of dead bee colonies around the world. Colonies appeared to die from a plethora of diseases, but the real cause of their deaths was neonicotinoids. Without an immune system, bees succumb to whatever comes in the door. The French and American scientists had unmasked the primary killer, neonicotinoids, but this was not politically acceptable so EPA, USDA, CropLife and the White House swept it all under the carpet. If they were to admit the truth, EPA might face a class-action lawsuit for a billion dollars, from beekeepers who have lost millions of hives.

ACRES U.S.A. Didn't Jeff Pettis lose his job as the director of that important lab?

WHITE. Not directly. Pettis hung on for a few years but he was remarkably muted in anything he said about neonics from that point onwards as was vanEngelsdorp. When they had announced their discovery at the global bee conference Apimondia, there were celebrations. Everyone thought they had solved the mystery of the global bee killer. However, within a month, the USDA dispatched Pettis across the Atlantic, to appear before the House of Lords in the UK; a strange and unprecedented action. On Channel 4 TV, Pettis effectively trashed his own lab research, as “not relevant to the situation in the field.” It's all on YouTube. It really was like the incident where Galileo was forced to deny his discovery of Jupiter's orbiting moons because it was unacceptable to the Inquisition.

ACRES U.S.A. In other words, he recanted.

WHITE. Exactly. Ever since, Pettis and vanEngelsdorp have consistently downplayed the significance of neonicotinoids. If he had defended his discovery, Pettis might have gotten the Nobel Prize, but he wouldn't be working for any branch of the U.S. government. The pesticide lobby would see to that. His bosses at USDA could have made his life very difficult, as they did for Dr. Jonathan Lundgren, who was censored and forced out of the USDA for telling the truth about neonics. vanEngelsdorp now seems to serve as a serial ‘pesticide apologist. He was given an assistant professorship at the University of Maryland and a \$5 million grant to run the Bee Informed Project. In all subsequent public appearances, he stays firmly on message: “There are many factors in bee deaths. It would be wrong to just focus on neonicotinoids. It's all very complex and mysterious. We must plant more flowers. It's Varroa, Varroa, Varroa!”

ACRES U.S.A. Today beekeepers, cooperative extension, the pesticide manufacturers and almost everyone else insist that the loss of honeybee colonies and the difficulty in maintaining them are due to a complex of factors. They lack sufficient forage so they're starving. They have diseases and parasites. Amateur beekeepers manage their colonies poorly. Breeding and genetics must be improved. Where does that narrative come from?

WHITE. This PR fiction was dreamed up to divert attention from the hard science. Varroa mites are the number one scapegoat. They transmit viruses when they bite the bees, especially developing larvae. But Varroa was already in France for 30 years, from 1963 to 1994 without any mention of mass colony deaths in the French literature. But as soon as imidacloprid was

introduced in 1994, tens of thousands of colonies were reported dead within weeks. Varroa does not kill hives in a few weeks, nor does it leave empty hives and vanished bees. Professor Klaus-Werner Wenzel, a German biologist, points out that Varroa does not attack other species of bees, such as bumblebees, Mason bees or solitary bees. But many of the 4,000 species of native wild bees in the United States are disappearing much faster than honeybees.

ACRES U.S.A. Why are native bees even more vulnerable to neonics than the honeybee?

WHITE. A honeybee colony has 50,000 workers, and even if a queen gets sick or dies, they can make new queens in just three weeks. Bumblebees live in tiny colonies of maybe 100 bees and one queen. If the queen dies, that's the end of the colony. Most other American native bee species live alone, usually in burrows. They lack any recuperative capacity and hardly anyone is monitoring them.

ACRES U.S.A. Did you say that the only reason we know about the dangers of neonicotinoids is because honeybees are property?

WHITE. Yes, honeybees are valuable property, so beekeepers monitor them and keep records and commercial beekeepers have to account for their income to the tax authorities. Bret Adee, owner of the largest beekeeping operation in America, allegedly lost 36,000 colonies in one year. How can anyone survive such a disaster? In 2013 Jeff Anderson, a commercial beekeeper from Minnesota, took 3,000 colonies to California to pollinate almonds. He divided them up, 500 hives per bee yard and held them, waiting for the almond bloom. Just a week later, when he checked them, 2,000 colonies were dead. He found empty hives with no bees. They had been poisoned by corn pollen from Minnesota. Those colonies were worth around \$200 each, plus another \$200 for the lost pollination contract. That's a loss of \$800,000. Many commercial beekeepers are barely keeping their heads above water.

ACRES U.S.A. What else is known about how neonicotinoids make bees more susceptible to parasites and pathogens?

WHITE. The Di Prisco team discovered the mechanism which triggered the immune system deficiency Pettis had described. Deformed Wing Virus (DWV) is present in all bee colonies, but is normally dormant and benign, like the cold-sore virus in humans. However, when De Prisco fed colonies a tiny, field-relevant dose of neonicotinoids, thousands of bees would later be born with shriveled wings and the colony died. The scientists found that, in test-colonies fed neonicotinoids the Deformed Wing Virus replicated 1,000 times faster than when neonics were not fed.

ACRES U.S.A. How do they explain that?

WHITE. Many studies conclude that neonics damage the bees' immune system. Once the immune system collapses, viruses reproduce exponentially and overwhelm the colony. This supports Dr. Henk Tennekes' assertion that no safe dose exists. Any prolonged exposure to sublethal doses of neonics inevitably leads to death of the colony. That is what we are seeing.

ACRES U.S.A. How many different crops are neonicotinoids registered for use on?

WHITE. Hundreds of crops are treated with neonics, everything from corn, wheat and soy to apples and almonds.

ACRES U.S.A. And they're also used on pets and livestock and injected into trees, which they're touted as protecting from insects for a year or more.

WHITE. I suspect the sales guys are in an office somewhere right now, trying to identify any market segment they that they haven't already saturated with neonics. I was asked to give a lecture on John Muir for the conference at the University of Pacific in Stockton. The campus is dotted with trees: 150-foot Sequoias, acacias, cherry and tulip trees. Over several days, I saw few birds on campus, except crows. I saw no bees, beetles or butterflies. It was like a biological desert, yet outside the campus, birdsong was deafening. It turned out the landscape department had injected the trees and shrubs with neonicotinoids, year after year, and liberally sprayed Roundup and broadleaf herbicides to kill any weeds. When raising chicks, birds must have insects for animal protein. Our sparrow population crashed dramatically in the last 30 years. London has lost 71 percent of our most common bird. The decline is similar for sparrows, starlings and swallows in every European country. Sparrows need aphids and spiders, to feed to their young in the first weeks. A baby sparrow may consume hundreds of aphids each day. A study by Dr. Kate Vincent found that 'aphid abundance' was the key predictor of whether chicks would survive. But that neonicotinoids are used almost universally, insect populations have crashed dramatically in most farming areas and cities. No insects equals no baby birds!

ACRES U.S.A. Here, one of the big campaigns on neonicotinoids tries to stop big-box stores and hardware chains from selling bedding plants and vegetable starts and shrubs and trees treated with neonicotinoids. People unknowingly are bringing them into their homes and yards.

WHITE. Holland has the world's largest bulb-growing industry for tulips, crocus, iris and daffodils. A Dutch bulb grower, a young man called Jeroen Koemans left Holland because he couldn't stand the blanket use of pesticides. He said tulip growers were dunking bulbs in buckets of neonicotinoid powder and fungicides. Jeroen and his American wife set up the first organic tulip bulb supply company in the United States. Every year people across Europe and America buy hundreds of millions of Dutch tulip bulbs. In the autumn we plant them in our gardens unaware of their toxic load. Bumblebee queens are the first bees to emerge from hibernation in the spring. They're full of fertilized eggs to start new colonies. They fly to the nearest crocus or tulip to feed on nectar and fresh pollen. If it contains neonicotinoids, they die and the future colony dies with them. Almost all of the flats of plants that we buy in UK garden centers come from Holland. Almost every seed is coated with neonicotinoids. Then the seedlings are transplanted into potting soil with neonicotinoid granules. At 6 inches high, they're sprayed with more neonicotinoids. In the garden center, they look perfect, but they're deadly. The wildlife-loving gardener plants them and wonders why her garden has no bees, butterflies or birds. That's been happening for two decades. They even add neonics to compost. In the UK we had a high-end compost brand called Levington. Nobody knew that Scotts of Ohio had acquired the brand. When I bought a bag for my garden, I noticed tiny lettering on the side of

the bag that said, 'now with added plant protection.' It took me ages to discover that this meant it contained imidacloprid. When this was finally revealed, there was uproar in the UK. Scotts quietly withdrew it, but people had been poisoning their gardens for years.

ACRES U.S.A. We've been talking about contaminated flowers. A key recommendation for conserving pollinators is to plant wildflowers and other bee and butterfly forage, especially in impoverished landscapes like mono-crop agriculture. Is that a good idea?

WHITE. While planting flowers is generally a good thing, this is really part of the Distraction Strategy. When Bayer got going with this in Europe, they had several strategies for avoiding responsibility when bees started to die. Firstly, they simply denied everything. The second strategy was distraction narratives. The bees are dying from: mobile phones, or climate change, or rare viruses, or a lack of wildflowers. They've had teams of public relations experts working on this for years. In 2014, I gave a webcast for beekeepers, the American Beekeepers Federation and the American Honey Producers' Association. These two beekeeper networks then invited me as keynote speaker to their 2015 conferences in southern California. My proposed title was "A Poisonous Conspiracy: Why American Beekeepers Need to Wake Up." Then news came that the White House convened a Pollinator Task Force, chaired by the Keystone Policy Center. It seems to be a powerful right-wing think tank that has smoothed the political path for oil pipelines and nuclear power issues.

ACRES U.S.A. An old friend of mine who worked in the environmental movement told me about Keystone a couple decades ago. It specializes in getting consensus between groups with opposing interests.

WHITE. We didn't know any of this. The meeting had been convened by the White House and carried enormous prestige, but it was structured and chaired by the Keystone Center. The strategists from Monsanto, Bayer, Syngenta, BASF, Dow and CropLife sat on one side of the table, while the American Beekeepers Federation and the American Honey Producers' Association were on the other. By the time we heard about the meeting, they had already issued a final agenda that the beekeeper leaders had agreed to. It said something like: The bees are dying, but it's very complex and nobody knows why. We're going to plant more wildflowers. We're going to educate children about bees. We're going to give away free flower seeds to school. Pesticides were only mentioned in a footnote and the only action promised was better messaging on pesticide labels. The beekeepers leaders have sold their entire industry down the river. Terry Oxford, a San Francisco urban beekeeper, circulated an email which asked, "Why would America's beekeeping leaders sit around a White House table with lawyers and strategists for billion dollar pesticide corporations, and not realize they would get taken for a ride? Why would they sign off on an agenda that did not even mention the role of pesticides in mass bee deaths?" I forwarded this with my comments, to the neonics list. Within a couple of days I received emails from both American beekeeper organizations 'disinviting' me as their keynote speaker at their respective conferences. I seem to have become, in Orwellian terms, an 'un-person' for daring to raise the issue of neonics and bee deaths. That was when I realized how deep the pesticide lobby's control goes. The National Association of State Departments of Agriculture appointed Barbara Glenn, a former vice-president of CropLife

America, the pesticide industry's lobby group, to be its CEO. Glenn asked each state department of agriculture to devise a Pollinator Protection Plan, with relevant stakeholders. The White House Task Force agenda was passed to every state, with a strict embargo of any mention of the role of pesticides.

ACRES U.S.A. With a few exceptions, I don't really see much activity from the large environmental organizations in the United States.

WHITE. Well, [Friends of the Earth](#) and [Center for Food Safety](#) have led the way, but even for them, this is only one issue in a very demanding agenda. The beekeepers have surrendered the field to Bayer, Syngenta and Monsanto without even a token fight.

ACRES U.S.A. There have been pockets of resistance among beekeeper groups, in Massachusetts, for example.

WHITE. And there are isolated members of the beekeeper resistance like Tom Theobald, Jeff Anderson, Steve Ellis, Dave Hackenberg, Terry Oxford and Susan Kegley. For beekeepers, whose very survival is at stake, the real tragedy is that their leaders are not fighting back.

ACRES U.S.A. In October 2014 you and Colorado beekeeper Tom Theobald sent an open letter to American beekeepers. Who received it and what did it say?

WHITE. We sent it to everybody we could think of — all the presidents and board members of the ABF, AHPA and the Pollinator Stewardship Council, every bee magazines and as many state beekeeper organizations as we could think of. The message described the White House Pollinator Task Force and asked why the beekeeper leaders had let corporate lobbyists hijack and dictate the entire agenda. Why had they agreed to issue a statement that avoided any mention of the role of neonicotinoids? We also asked why they weren't fighting back against CropLife, Bayer and Monsanto. We didn't get a single response. They're on the ground, being kicked in the guts, and they're praying for it to just stop. They're saying, 'please stop hurting us. Find other pesticide option that doesn't kill our bees and our businesses.' They don't realize they are dealing with the corporate descendants of the chemists who invented Zyklon B gas for the Nazis (it was originally an insecticide). You cannot ask the pesticide giants for mercy. There are only two options: Fight or surrender; resist or be exterminated.

ACRES U.S.A. Many beekeepers seem to be genuinely confused. They believe the researchers who say that it's this, that or the other thing. They're confounded because, as you say, neonicotinoids don't leave a fingerprint, and they're taken in by what you call corrupt science.

WHITE. Well, they have been on the receiving end of a highly coordinated, professional PR campaign for over 20 years. The pesticide companies and CropLife have spent millions of dollars to confuse, distract and bamboozle the beekeepers; and it is working.

ACRES U.S.A. I've even heard the argument that hobby beekeepers that don't know how to control the pests and diseases are causing this scourge of the countryside. They've pitted the

new beekeepers against the commercial beekeepers against the hobbyists. The squabbling is alarming.

WHITE. This is another pesticide lobby narrative, that the victims are responsible for the crime. This has all been carefully planned. They've gained control of the White House, NASDA, every state agriculture department and even the extension colleges, whose biggest business seems to be training farmers to spray pesticides. The same colleges which train pesticide applicators also run the beekeeping courses. So the poison companies control the entire arena, from, training, education and beekeeping practice to Congress, the White House, media and public discourse. In 2013 Terry Oxford invited me to the Marin County Beekeepers meeting. Eric Mussen, who was about to retire after 40 years as California's beekeeping advisor, was giving a talk about Varroa mites and diseases. People asked a few questions about Varroa. Then I said, "I've noticed you have avoided any mention of neonicotinoid pesticides, which almost all the world's independent scientists say are the major cause of mass bee deaths." Mussen looked very uncomfortable and gave a dismissive answer. Later, in private, he upbraided me for my naivety. California could not exist without the pesticides. He said, 'You don't know what's going on. Randy and me — that's Randy Oliver — we're right there in with EPA at UC Davis bee lab, with Bayer and Syngenta, working on cutting-edge technology, new RNA pesticides and strategies.' You couldn't make this stuff up. It's not just EPA and USDA that have been subject to regulatory capture. Even the state beekeeping advisors have been co-opted by the pesticide lobby. Mussen displayed no recognition that his stance was ethically appalling or that his complicity with the pesticide companies' agenda was the ultimate betrayal of the beekeepers he advised for 40 years.

ACRES U.S.A. One of the struggles in Massachusetts was against the state department of agriculture, which wanted to prevent the beekeepers from running their own courses.

WHITE. Michele Colopy [the executive director of the [Pollinator Stewardship Council](#)] wrote in detail about what happened in Ohio when she and other members of a small committee of stakeholders tried to craft a state pollinator plan. They did a lot of groundwork and were about to publicize stakeholder meetings when the Ohio Department of Agriculture bluntly told them that this was their bally-wick.

ACRES U.S.A. They don't want to hear from the beekeepers.

WHITE. That's right. I'm afraid that America has the greatest concentration of corporate pesticide power on the planet; they have infiltrated every branch and agency of the government.

ACRES U.S.A. What is known about honeybee's pesticide exposures other than neonicotinoids?

WHITE. Maryann Frazier at Penn State University analyzed the pollen brought in by individual bees. On average, a single load of pollen from each bee contained five different pesticides. In 108 pollen samples, 46 different pesticides including six of their metabolites were identified. Up to 17 different pesticides were found a single pollen sample. The bees don't stand a chance.

Their pollen and nectar stores are contaminated with a pesticide cocktail of organophosphates, herbicides, fungicides and insect growth regulators. Neonicotinoids were rarely detected; they were probably present but below the level detectable by labs at that time. This is why the bee colonies die in winter and summer. Bees always choose fresh pollen when it's available. They use their stored pollen as an emergency ration when times are lean. The bees mix together pesticide-contaminated pollen and honey to form beebread, and that's what they live on for six months of winter. So for months on end the winter bees are poisoned by feeding on stored pollen contaminated by neonics. Humans have a liver to detoxify poisons, but bees do not. Evolution had to choose between giving bees a strong immune system, which would be energetically costly, or opting for a short lifespan and a huge capacity for reproduction. Individual bees have a weak immune system but the colony has a strong social immune system. The bees groom each other 24/7, removing dust, bacteria and spores from each other's bodies. The colony can lose 20,000 bees and replace them within one month.

ACRES U.S.A. Beekeepers have been asking for research on the synergistic effects of different pesticides.

WHITE. Maryann Frazier found out that imidacloprid's toxicity increases by a factor of 100 when combined with a single fungicide. Add an herbicide to the neonic and fungicide and the toxicity increases by a factor of 1,000. Remember that Frazier found an average of 46 different pesticides in her study hives. This finding points to the inadequacy of so-called Pesticide Risk Assessment. Before EPA registers any pesticide, it is supposed to assess the risks. But the poison manufacturer provides the only data that EPA uses to evaluate it. If you're a company which has spent \$50 million developing a new pesticide, why would you reveal data that proves your pesticide kills bees? There are no gamekeepers here, only poachers. The truth is America doesn't really have a pesticide regulation system. It has the carefully crafted, necessary illusion, that some agency is protecting the health and environment of the American people. In truth, EPA rubber-stamps virtually every pesticide that comes before it. Pesticide science is utterly corrupt, the equivalent of tobacco science in the 1970s.

ACRES U.S.A. How specifically does this regulatory failure relate to neonicotinoids?

WHITE. EPA has a track record of licensing pesticides, even when its own scientists say they should not be licensed. This happened with clothianidin. The agency even changed the definition of pesticide, so that a seed coated with neonics is officially "not a pesticide." Instead it is defined as a "treated object" and doesn't appear in the pesticide statistics. Not one of the trillions of neonic-coated seeds, used on 200 million acres of U.S. crops, is classified as a "pesticide-use" by EPA. This obscene loophole speaks volumes about EPA's determination to enable the use of neonics. In 2005 Tom Theobald was contacted by an informant within EPA, who leaked a memo from the agency's science division. They had assessed clothianidin, using the industry's data, and concluded that it should not be licensed because it killed bees, was highly persistent in soil and contaminated groundwater. Tom posted this internal memo online and it went viral. EPA ignored the direct advice of its own scientists to refuse this pesticide a license. Management's response was to give clothianidin a conditional license. Conditional registration means EPA licensed clothianidin with a flimsy rider that the agency would require an

additional bee-life cycle study within a few years. EPA has used that loophole to license dozens of pesticides. Then EPA accepted absurd studies like the Cutler-Dupree study, which didn't prove a thing. Researchers planted four canola fields of about 2 acres each, and put hives in each area. Two fields were treated with clothianidin and two received no pesticide, but the test and control plots were only 300 yards apart. The researchers claimed no difference in the colonies' survival, whether they fed on the neonics or not. But bees gather pollen over a 3-mile radius. The chances of a bee staying in either the control or test plots were nil. Pollen analysis showed that the bees only gathered 5 percent of their pollen from the test plots. Nevertheless, EPA brazenly accepted this ludicrous study and gave clothianidin a full registration. There have been four pesticide cycles: the organochlorines, organophosphates and carbamates, pyrethroids and neonicotinoids. At the beginning of each cycle, the regulators declared each of these pesticides safe, based on data from the manufacturers. After a few years people start to notice that bees, or fish, or eagles are dying, and protests begin. After 20 years, when a real environmental crisis develops, the pesticide company or EPA admits it's dangerous and withdraws it.

ACRES U.S.A. Because there are new ones!

WHITE. Yes, and the process just repeats with the next family of pesticides. The industry is very comfortable with scientific debate because they know few people understand the science. Many universities are happy to give a pesticide a clean bill of health, since they're desperate for corporate funding. The science debate is like a labyrinth. If you agree to debate the science with them, they drag you inside the dark labyrinth. Ten years later, you emerge dazed and confused, buried up to the neck in scientific papers, while all the time the pesticide cash rolls in.

ACRES U.S.A. What a great metaphor! Let's turn to the real-world impacts of neonicotinoids, specifically the research that suggests that their use in agriculture is wiping out insects.

WHITE. The Orbrich Nature Reserve at Krefeld, Germany, is an area of water meadows along a river. In 1989, entomologists set up two Malaise insect traps to sample insect populations in the reserve because they are food for insect-eating birds. They weighed and identified the insects over 24 weeks. The biomass of insects was large and the diversity of species variety was huge. In 2011 Dr. Henk Tennekes came out with his book *The Systemic Pesticides: A Disaster in the Making*, describing the collapse of insect populations poisoned by neonicotinoids. In 2013, alarmed by Tennekes' book, the Krefeld scientists repeated the 1989 experiment. They were shocked to find the average biomass of insects collected each week had fallen to just 200 grams per week, a decline of over 75 percent. In some weeks the biomass was less than 10 percent of what it was in 1989. The diversity of species had also fallen by about 70 percent. This was the klaxon warning of impending ecological collapse. It also explained the decline of bird populations on the reserve. Since 1989, the grey shrike, which depends on beetles and grasshoppers to feed its chicks, has become extinct there. Other insect eaters, like swallows, flycatchers and praying mantises, have suffered a similar decline in the region. If biological collapse is happening on a remote nature reserve in Germany, it is happening everywhere that pesticide-drenched, industrial farming dominates the land.

ACRES U.S.A. You have written about how the queen is often the most vulnerable link in the chain of colony survival.

WHITE. The queen is the mother of all the bees and the center of the entire colony. At the height of the season, from May to July, she lays her bodyweight in eggs every day. It follows that she must eat her bodyweight in food every 24 hours or she will shrink and die. A queen consumes thousands of times more food than worker bees, so logically, she ingests thousands of times more pesticides than they do. If a queen's pheromone levels decline, or she isn't laying the right amount of eggs per minute, or her behavior becomes abnormal in any way, the bees take pre-emptive action and replace her with a new queen. When I kept bees from 1994 to 2000, the work cycle was very simple. Queens under two years old would just carry on laying. If the queen was any older, the bees would usually replace her and make a new queen. Bees instinctively know the colony cannot survive if it goes into winter with an old or failing queen. The queen must die; long live the new queen. It is normal for 20 to 30 percent of bee colonies to make a new queen, usually in May. However, it takes six weeks, from the time the bees kill the old queen to the time a new queen has grown, emerged, mated and started to lay new eggs. During this brood gap, no eggs are laid and no young bees born. Since the original queen would have laid say 1,500 eggs each day during that 42-day period that represents a loss of 60 to 80,000 young bees. If your bees create a new queen in early May, you might still get a honey harvest, but it won't be as big as usual. If your queen dies in late May or in June, the hive might barely make enough honey to survive the winter. For a colony to 'supersede' a queen in the middle of the breeding season, this used to be rare and highly abnormal. Today we see it all the time because of the poisoning of the queen by neonics. I began to experience abnormal queen replacements after 2003, when clothianidin started to be used on canola in this region. My 10 bee colonies would suddenly breed five new queens in May. I would be relieved that at least I have healthy new queens. But when I looked at those colonies six weeks later, those new queens had vanished and there would be five even newer queens. The bees had detected something wrong with the first lot of new queens, so they killed them. If a colony tries to replace queens in July, you'd be lucky if that hive survives the winter.

ACRES U.S.A. Given that most flowering plants require insects for pollination, how might neonics affect them.

WHITE. Insects are the second tier in the pyramid of life. If they are exterminated, everything above them in the pyramid will die as well. Thirty percent of all our food crops are pollinated by bees or other pollinators. Wildflowers, trees and bushes, berry fruit and wild apples also depend on pollinators. Wildlife such as bears and deer can only survive if insects pollinate the plants they feed on. Then there are all the insectivorous birds and mammals. People don't seem to grasp the enormity of this unfolding ecological disaster.

ACRES U.S.A. Are neonicotinoids harming birds directly?

WHITE. Neonics kill birds both directly and indirectly. As early as 1998 French scientists were finding dead partridges with neonic-coated grain in their crops. Just 5 to 10 neonicotinoid-coated wheat seeds will poison a partridge outright. A single neonicotinoid-coated seed can kill

a small songbird the size of a house sparrow. Sublethal doses appear to cause eggshell thinning and cause chicks to die in the egg. The 70 percent crash in farmland bird populations is largely due to their insect food disappearing, but neonics also poison their nervous and immune systems. The American Bird Conservancy reported that grassland bird populations in America have declined nearly 50 percent in 30 years. The trends are remarkably similar in Britain, where on average farmland birds have declined 70 percent. Skylarks are down 80 percent and partridges 96 percent. The immune system connection is still hypothetical. In a 2014 paper Rosemary Mason, a Fellow of the Royal College of Medicine and retired consultant anesthesiologist, theorized that neonicotinoids may be wrecking the immune systems of birds, bats, frogs and even mammals, not just those of bees.

ACRES U.S.A. I was fascinated by the study that looked at the incidence of different bird species and the concentration of neonicotinoids in waterways in the Netherlands. Was there any correlation between the birds sighted in areas with neonicotinoid levels in the water?

WHITE. Basically, the invertebrate population, above and below water, has crashed dramatically. Birds that depend on aquatic invertebrates simply can't find anything to eat. Van Dijk's team in the Netherlands found that wherever the level of neonics in the water reached 20 nanograms per liter, insectivorous bird populations declined on average by 3.5 percent each year. That's 35 percent over a decade. Reed warblers, swallows, yellowhammers, meadow pipits, wagtails — they are melting away like snow in spring. The fish predators, like herons and cormorants, are doing just fine, but insect eaters are vanishing. Some birds like the corn bunting and shore lark have actually become extinct in Holland. They don't eat water invertebrates, but their insect prey, like mayflies, dragonflies, gnats and mosquitoes, spend their early lives under water, where they are poisoned by neonics. The national bird of Holland is the oystercatcher. This dramatic wading bird probes sand and mud with its bright red beak for cockles and rag worms. Flocks of hundreds of thousands of oystercatchers were a common sight in winter. But if the present decline continues, they will be extinct in Holland by 2025. The Netherlands is one of the most intensive users of pesticides in the world, and chemical agriculture sends waves of neonicotinoids down the rivers, wiping out the shellfish and invertebrate life that oystercatchers depend on.

ACRES U.S.A. How do neonicotinoids affect bats?

WHITE. A recent Japanese study found that neonicotinoids damaged the brains of bats, specifically their ability to echo-locate. This sounded a big alarm, because it is the first direct evidence of neonicotinoids affecting a mammal's brain directly. Until 2000 I lived on an ancient estate which had one large wheat field beyond the walls. From 1994, when I moved there, at night the bats would emerge from under the eaves of my house to hunt insects above the crop. After 1998 however, their behavior changed, they no longer flew over the wheat field. Although I did not know it, the field had been treated with neonicotinoids and held few insects for them to eat. Instead, the bats patrolled the edge of the woods, which still held insect prey. So how are bats exposed to neonics? The hypothesis is they would find it easier to catch insects weakened by neonics, which would not fly as well as healthy insects. A single bat may eat 1,000 insects a night, so the intake of neurotoxins may affect its brain or immune system.

ACRES U.S.A. You sent me beautiful photos of frogs when we had almost 2 feet of snow here in upstate New York. What is known about the effect on amphibians?

WHITE. I don't think anyone's done much research. I am surrounded by one of the largest wheat growing areas in Scotland. The spraying is frequent and intense. Bumblebee researcher Dave Goulson's blog documented a single wheat field receiving 22 different pesticides in one season. There are probably miles of water ditches on this farm which drain every field. Most of the year they're filled with rainwater, but in the 16 years I've lived here I've never seen a frog or a toad. Yet, just 5 miles away, among sheep and cow pastures, the ditches swarm with frogs.

ACRES U.S.A. Do we have any idea what neonicotinoids are doing to humans?

WHITE. Japanese scientists have studied the effects of neonicotinoids on humans. They've found evidence of acute poisoning and occupational poisoning among rice farmers and claim health effects from neonicotinoids in the food people eat. They describe people suffering tremors, anxiety and other neurological effects. Dr. Vyvyan Howard, professor of toxicology at Ulster, testified to the Royal Commission on Pollution that a big issue is the effect of pesticides on the unborn child. A very critical period for any pregnancy is the first month, when the neural tube is formed as the blueprint for the spinal cord and nervous system. At this point the human fetus is the same size as a bee. Dr. Howard struggled to convey just how delicate and vulnerable that neural tube structure is. He told the Commission that if as little as one-trillionth of a gram of pesticides contaminated the neural tube in a developing embryo, he could not guarantee that the spinal cord and brain would develop normally. That's a thousandth of a picogram! Dr. Howard stressed that the neural effects might be very subtle, like anxiety, ADHD, or an inability to socialize.

ACRES U.S.A. A review article about neonicotinoids and human health effects that suggested they might cause birth defects.

WHITE. There's no way to prove that without *in vitro* tests in the lab, which, of course, have never been done. Rosemary Mason said, Just imagine if back in 1994 the UK Agriculture Minister had told us that he was about to license a group of neurotoxic insecticides, which would contaminate the entire human food chain. She said she would have predicted an explosion of neurological conditions in young children exposed in-utero. Arguably, that is exactly what we are seeing.

ACRES U.S.A. I'm wondering if you have any criteria for distinguishing between real wins against neonicotinoids and meaningless reforms. For instance, the Province of Ontario has taken action toward the goal of reducing neonicotinoid seed treatments in corn and soybeans by 80 percent. Would you consider that a victory?

WHITE. In America the corporations are facing a tsunami of scientific papers which all point to neonicotinoids as the primary cause of the global declines in bees, pollinators and birds. Europe is likely to opt for a complete ban in May 2017. For 23 years the poison-makers have used denial, diversion and distraction to avoid any regulatory curb on their profits. Now we are

coming to the end of that family of pesticides, they're staging what is called, in military terms, a strategic withdrawal.

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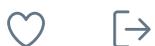


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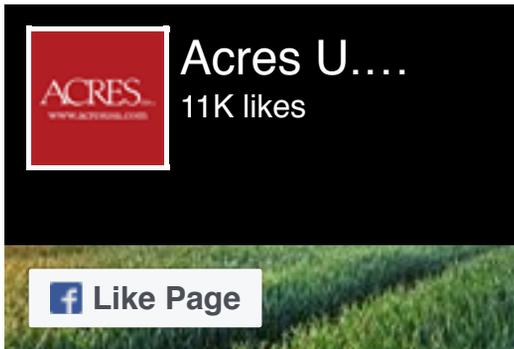


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