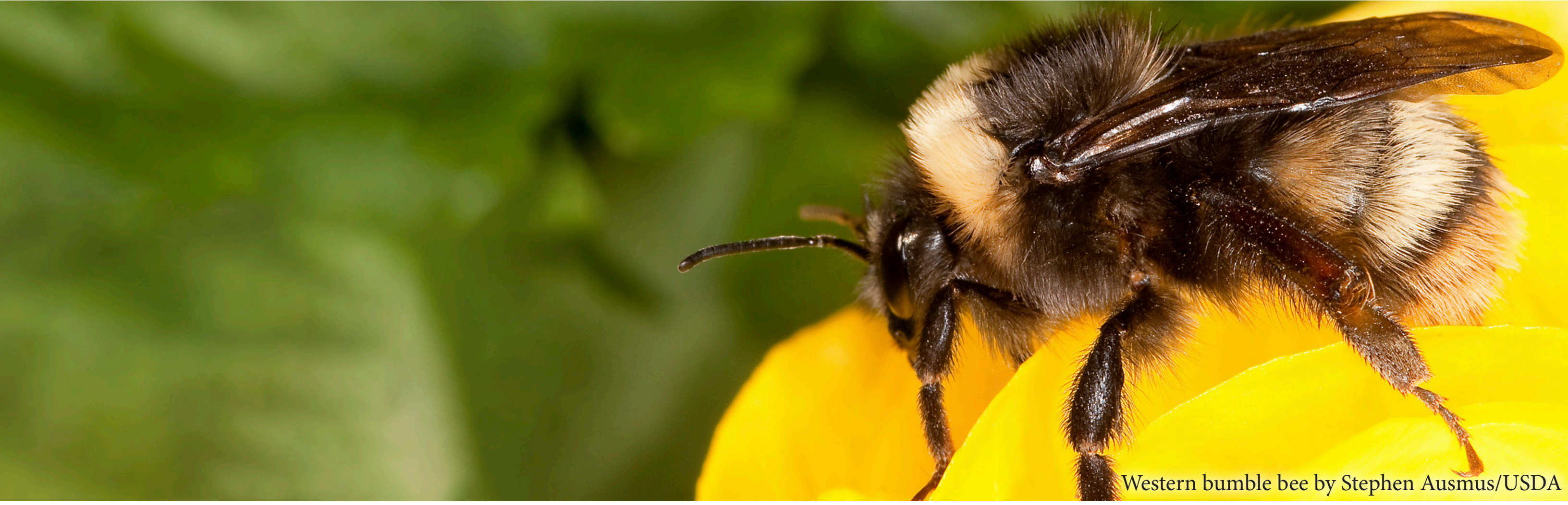

Western bumble bee by Stephen Ausmus/USDA

By Tara Cornelisse, Nathan Donley, Lori Ann Burd
Center for Biological Diversity | August 2019

THE FACTS ON SULFOXAFLOR

WHAT IS SULFOXAFLOR?

Sulfoxaflor is a systemic insecticide that is "very highly toxic" to bees.[1] It functions identically to the neonicotinoid pesticides that are a leading cause of the large scale pollinator decline of the last decade,[2] despite the manufacturer's attempt to claim it is distinct.[3]

Sulfoxaflor can cause harm long after it is initially sprayed. It breaks down quickly in soil but is highly persistent in water, with a half-life of 37 days to more than a year.[4] The primary breakdown product of sulfoxaflor has a half-life of up to 2½ years in soil and up to 14 years in aquatic environments.[5] Because it is a systemic pesticide, animals feeding on any part of a plant treated with this insecticide will be exposed to the poison.[6] It takes about 8-12 days for 90 percent of the pesticide to dissipate from pollen and nectar, respectively.[7]

REGULATORY HISTORY

In 2013 the Environmental Protection Agency approved sulfoxaflor for use on a wide range of crops, including many that are attractive to bees and other pollinators.[8] The Ninth Circuit Court of Appeals revoked the EPA's approval in 2015 due to the lack of scientific support that the pesticide could safely be used on crops where pollinators would be exposed.[9] In 2016 the EPA re-approved sulfoxaflor for use on crops that don't attract bees,[10] and continued to grant "emergency exemptions" for its use on bee-attractive crops spanning millions of acres in over a dozen states.[11,12] In July 2019, the EPA granted new approvals for sulfoxaflor to be used on a massive scale on crops that are highly attractive to pollinators.[13]

WHERE IS SULFOXAFLOR USED?

The July 2019 approval now means that sulfoxaflor can be used on some of the most widely grown crops in the country, like soybean, alfalfa, cotton, corn and sorghum. Many other fruiting plants and vegetables have been added as well, including oranges, lemons, strawberries, squash and pumpkins. In addition many crops that previously had spray restrictions until after flowers bloomed, like peaches, cherries, almonds and pistachios, are now allowed to be treated with sulfoxaflor pre-bloom,[14] increasing the potential for pollinator exposure to the poison. Current approvals now allow the use of sulfoxaflor across more than 200 million acres of farmland in the U.S.[15]

EFFECTS OF SULFOXAFLOR

HONEY BEES

In its July 2019 re-approval of sulfoxaflor the EPA again found that sulfoxaflor was "very highly toxic" to honey bees at all life stages when exposed on a short-term basis.[16] When individual honey bees were

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chronically fed small amounts of sulfoxaflor, their larvae had reduced emergence and survival and adults ate 23 percent less food.[17] By their own calculations, the rates EPA approved will put individual adult and larval honey bees at a risk that is up to 540 times greater than the EPA's own baseline level of acceptable harm.[18]

At the colony level, new studies put forth by the EPA as justification for the widespread approval of this bee-toxic pesticide found adult forager mortality to be three to 20 times and larvae and pupae mortality seven to 580 times higher in colonies exposed to and fed sulfoxaflor compared to colonies fed uncontaminated food.[19,20] The colony studies also found that bees fed sulfoxaflor had significantly decreased food consumption and overall activity, inability to conduct normal movements, and sustained reduction in total brood and in pollen and honey stores.[21] Incredibly, the EPA nonetheless concluded that the new studies indicate sulfoxaflor does not result in impacts at the colony-level,[22] a conclusion not supported by the studies. The EPA also waived the legal requirement for DowDupont, the maker of sulfoxaflor, to conduct a full field study on the impacts to honey bees.[23]

BUMBLE BEES AND OTHER NATIVE BEES

The EPA's risk assessment strategy involves using a surrogate species to estimate harm to other species by assuming the same or less harm is experienced by all species in the same group. The most egregious example of this is with terrestrial invertebrates. The agency uses the European honey bee as the surrogate for more than tens of thousands of terrestrial insects in the U.S. This means that a toxic dose to honey bees is assumed to be identical to all other insects. These other insects, including the over 4,000 native bees in the U.S.,[24] differ from honey bees in countless ways, including the timing of emergence, life span, degree of sociality, sensitivity to poisons and foraging and nesting behavior. This is true even when honey bees are compared to bumble bees, members of the same bee family that share the very rare social traits of having a sole reproductive queen with workers that care for young. The life histories and behavioral differences between honey bees, native bees and other insects can result in very different sensitivities to pesticides.

The EPA's findings of harm with respect to honey bees, no matter how alarming, are likely underestimating harm to many other native bees. The vast majority of solitary bees nest in the ground and would be exposed to sulfoxaflor residues in the soil, a risk the EPA did not consider when evaluating its harms. Further, native bees consume a higher pollen-to-nectar ratio than honey bees. For instance, bumble bee larvae consume up to 130 times more pollen than honey bee larvae – even more if they are future queens.[25] By this fact alone, sulfoxaflor, which can be more concentrated in pollen[26] is likely to have a greater effect on bumble bees than honey bees. Native bees also have smaller foraging ranges. Even large bumble bees will typically forage only within about a mile of their nests and are active for longer periods of time.[27] As a result, label timing restrictions that apply to honey bees do not necessarily protect other bees. A good example of that is the recommendation that sulfoxaflor not be applied until two hours before sunset[28] -- a time when some native bees may be active.

In assessing impacts to non-honey bees, the EPA did analyze one industry-funded study on the buff-tailed bumble bee. Bumble bees are larger than honey bees, so they were less sensitive than honey bees to sulfoxaflor when they came into

Leafcutter bee by Judy Gallagher/Flickr

physical contact with the poison. However, when ingested, the amount needed to kill 50 percent of bumble bees was two times lower than the amount needed to kill 50 percent of honey bees.[29] The single independent peer-reviewed study on sulfoxaflor's impacts to bumble bees found that bees fed even low doses of sulfoxaflor produced significantly fewer workers and had a 54 percent reduction in males and future queens – impacts that are directly comparable to other bee-toxic neonicotinoid pesticides.[30] The EPA deemed this peer reviewed study, published in the journal Nature, inappropriate for use in risk assessment, classified it as "invalid" and did not take into account its findings when registering the widespread use of sulfoxaflor.[31] New research showed that acute, short-term exposure to sulfoxaflor did not impact tested learning or memory in honey bees or bumble bees as other neonicotinoids have been shown to do, but chronic exposure and other acute endpoints were not tested.[32]

Native, solitary bees live for a few weeks, on average, during which time each female builds a nest in the soil or in a cavity and continuously collects pollen and nectar that she turns into pollen balls as sustenance for each egg she lays. Thus, the high toxicity of sulfoxaflor to individual honey bees at all life stages in the short-term (seven-10 days) is extremely concerning for native bees. The colony level assessments deemed by the EPA as inconclusive or not showing impact to honey bees have no bearing on native, solitary bees. As such, based on the short-term, individual impacts of sulfoxaflor to honey bees, solitary bees are most likely put at greater risk by this approved widespread use of sulfoxaflor.

Further, the EPA found that honey bees did not die in high numbers when they contacted leaves that had been sprayed with sulfoxaflor. However, there are more than 240 species of leaf cutting bees in North America[33] that use leaves to create nests, causing their brood (egg, larvae, pupae, and the next generation adults) to come into direct contact with sulfoxaflor-treated leaves during development. As such, the low level of risk assumed by the EPA from contact with sulfoxaflor on leaves does not apply to these native bees.

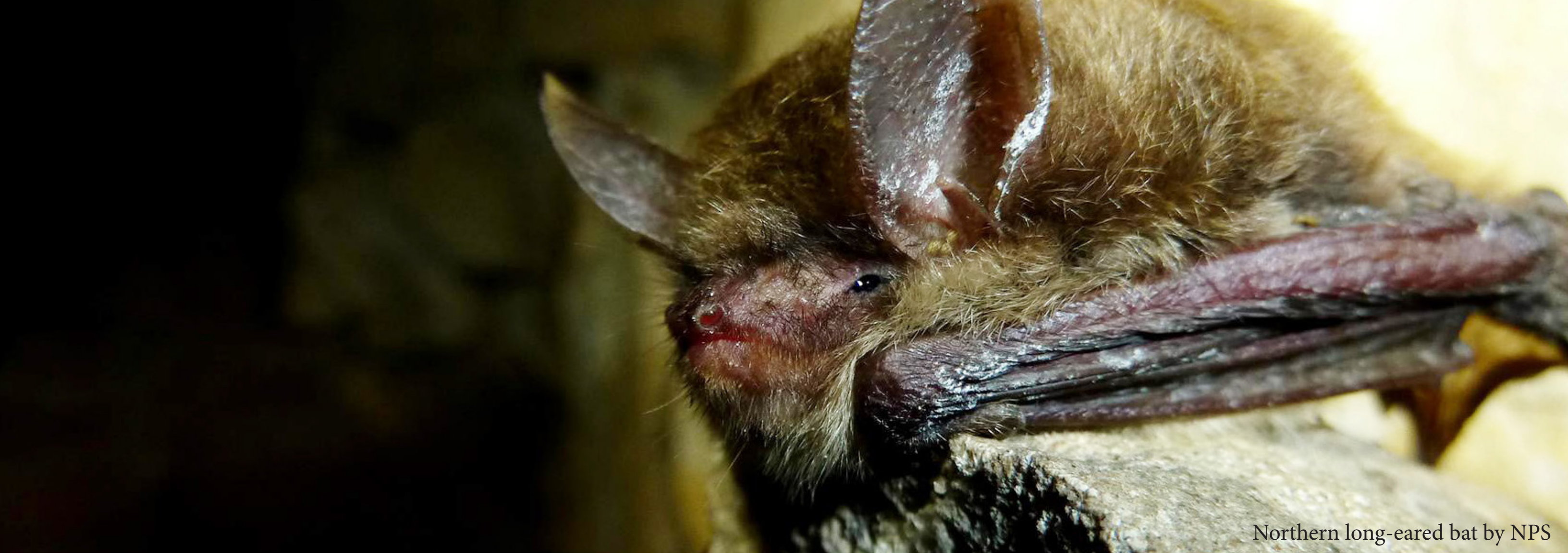
AQUATIC INVERTEBRATES

The EPA considers sulfoxaflor to be "highly toxic" to marine invertebrates.[34] For freshwater invertebrates, long-term exposure to the toxin led to a 40 percent reduction in reproduction[35] and a 23 percent reduction in aquatic fly larvae surviving to adulthood.[36]

Convergent Lady Beetle by Katya Schulz

LADY BEETLES AND OTHER INSECT PREDATORS

Lady beetles are one of the few non-pollinating insects for which the impacts of sulfoxaflor have been tested. Lady beetles provide vital biological control of agricultural pests and without sufficient quality food, they will lay fewer eggs, develop more slowly, and suffer increased mortality. One study showed that sulfoxaflor applied at field-relevant rates significantly reduced the number of lady beetles seven-14 days after treatment compared to controls.[37] In another study, sulfoxaflor treatments consistently reduced numbers of minute pirate bugs, green lacewings, and lady beetles – all aphid predators – compared to untreated controls.[38] Finally, and of great concern considering sulfoxaflor will be used to control aphids, lady beetles that were fed aphids treated with sulfoxaflor at field rates had significantly reduced survivorship and longer larval development (only 20 percent of larvae survived to pupation).[39] Sulfoxaflor also resulted in significantly fewer and smaller female adult lady beetles, reducing their reproductive capacity.


Northern long-eared bat by NPS

MAMMALS

Based on the current approved uses of sulfoxaflor, the EPA found that small mammals – like chipmunks, shrews and bats – can be exposed to enough sulfoxaflor to cause a significant increase in the death of newborn pups.[40] Increased death in newborns was due to involuntary muscle tightening, leading to the constriction of the diaphragm and asphyxiation.[41] Uncontrollable muscle tightening was so severe in newborn pups exposed to sulfoxaflor in utero that the developing bones were bent and contorted enough to produce severe skeletal birth defects at higher doses.[42]

Other effects include liver toxicity (including fatty liver and changes in cholesterol levels) and cancer.[43] Mice fed sulfoxaflor were found to develop liver, testicular and glandular tumors at increased frequencies.[44] The EPA has designated sulfoxaflor as having "Suggestive Evidence of Carcinogenic Potential."[45]

THE WRONG PATH

Sulfoxaflor poses an existential threat to pollinator populations. In addition to approving sulfoxaflor for use on highly pollinator-attractive crops, the EPA's July 2019 approval erased many mitigation measures that were in place to reduce the harm from this pesticide. This includes removing restrictions on crops grown for seed, on mixing sulfoxaflor with other pesticides and on including an in-field buffer when spraying sulfoxaflor from an airplane.[46] Leading pollinator experts have called sulfoximines, of which sulfoxaflor is the first commercially available member, the second-most pressing threat to pollinators in the coming years (followed by corporate control of agriculture at the global scale).[47] The study published in the journal Nature on sulfoxaflor exposure found that even at low doses had severe consequences for bumblebee reproduction.[48] The authors cautioned against the EPA's current trajectory of replacing older neonicotinoids with nearly identical insecticides like sulfoxaflor. Simply replacing one toxic pesticide with another will do nothing to stem the declines in insects we are seeing across the globe. In a widely publicized study, the authors concluded that if we do not take conclusive steps towards a "serious reduction in pesticide usage," we could see the extinction of up to 41 percent of the world's insects within decades.[49]

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[14] 2019 Registration Decision. Pg. 29.

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[17] 2019 EPA ERA. Table 6-2; pg. 28.

[18] 2019 EPA ERA. Table 11-10; pg. 65.

[19] 2019 EPA ERA. Table 11-14; pgs. 72-73.

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