

Herbicide Roundup® “Extremely Lethal” to Amphibians in Natural Setting, Relyea Finds

Some species totally eliminated in recent field experiment

The herbicide Roundup® is widely used to eradicate weeds. But a new study by a Pitt researcher finds that the chemical may be eradicating much more than that.

Pitt assistant professor of biological sciences Rick Relyea found that Roundup®, the second-most-commonly applied herbicide in the United States, is “extremely lethal” to amphibians. Relyea’s field experiment is one of the most extensive studies on the effects of pesticides on nontargeted organisms in a natural setting, and the results may provide a key link to global amphibian declines.

In a paper titled “The Impact of Insecticides and Herbicides on the Biodiversity and Productivity of Aquatic Communities,” published April 1 in the journal *Ecological Applications*, Relyea examined how a pond’s entire community



eliminated, and wood frog tadpoles and toad tadpoles were nearly eliminated. One species of frog, spring peepers, was unaffected.

“The most shocking insight coming out of this was that Roundup®, something designed to kill plants, was extremely lethal to amphibians,” said Relyea, who conducted the research at Pitt’s Pymatuning Laboratory of Ecology. “We added Roundup®, and the next day we looked in the tanks and there were dead tadpoles all over the bottom.”

Relyea initially conducted the experiment to see whether the Roundup® would have an indirect effect on the frogs by killing their food source, the algae. However, he found that Roundup®, although an herbicide, actually increased the amount of algae in the pond because it killed most of the frogs.

(25 species, including crustaceans, insects, snails, and tadpoles) responded to the addition of the manufacturers’ recommended doses of two insecticides—Sevin® (carbaryl) and malathion—and two herbicides—Roundup® (glyphosate) and 2,4-D.

Relyea found that Roundup® caused a 70 percent decline in amphibian biodiversity and an 86 percent decline in the total mass of tadpoles. Leopard frog tadpoles and gray tree frog tadpoles were completely

“It’s like killing all the cows in a field and seeing that the field has more grass in it—not because you made the grass grow better, but because you killed everything that eats grass,” he said.

Previous research had found that the lethal ingredient in Roundup® was not the herbicide itself, glyphosate, but rather the surfactant, or detergent, that allows the herbicide to penetrate the waxy surfaces of plants. In Roundup®, that surfactant is a chemical called polyethoxylated tallowamine. Other herbicides have less dangerous surfactants. For example, Relyea’s study found that 2,4-D had no effect on tadpoles.

“We’ve repeated the experiment, so we’re confident that this is, in fact, a repeatable result that we see,” said Relyea. “It’s fair to say that nobody would have guessed Roundup® was going to be so lethal to amphibians.”

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