

PESTICIDES & SOIL HEALTH

A growing body of research shows that pesticides widely used in American agriculture pose a grave threat to organisms that are critical to healthy soil, biodiversity, and soil carbon sequestration to fight climate change. Soils are one of the most complex and biodiverse ecosystems on earth, containing nearly a quarter of the planet's species. Soil health is critical to many ecosystem functions, including our ability to feed ourselves and future generations.

KEY SCIENTIFIC FINDINGS

In the most comprehensive review of the impact of pesticides on soil organisms,¹ we found that:

- In 70.5% of cases studied, pesticides kill or harm soil invertebrates including earthworms, ants, beetles and ground nesting bees.*
- Negative effects are found across all studied pesticide classes, showing that as a set of chemical poisons, pesticides pose a clear hazard to soil life and are incompatible with healthy soil ecosystems.*
- Parallel research finds that pesticides harm critical soil microorganisms like bacteria and fungi.²

*The review looked at 394 studies encompassing 275 unique species or types of soil organisms and 284 different pesticide active ingredients or unique mixtures. "Pesticide" refers to insecticides, herbicides and fungicides.

BACKGROUND

Pesticides are a major driver of insect declines

Many soil insects, like ground beetles and ground-nesting bees, have declined significantly in recent decades.^{4,5,6} Overuse of pesticides has been identified as the highest impact practice driving the loss of soil biodiversity in the last 10 years.⁷

Agricultural soils are increasingly exposed to pesticides

Over 1 billion pounds of pesticides are used in the U.S. every year. Soil organisms are facing increasing exposure, largely due to use of pesticide-coated seeds. As little as 0.1% of an applied pesticide may reach its target species while the rest contaminates soil, air, and water.⁸ Pesticides can also linger in the soil for years or decades, continuing to harm soil health. Soil organisms are often exposed to mixtures of pesticide residues in the soil because farmers often use multiple pesticides at a time and over the course of a season.⁹ As an example, apples may be treated with an average of 51 different pesticides in 6 to 17 applications per year.¹⁰ The continuous use of pesticides does not give soil communities time to recover.

SOLUTIONS

Ecological farming methods decrease the need for pesticides

Science-based ecological farming methods like cover cropping, composting, and rotating crops contribute to building healthy soils. These farming methods can strengthen plants' defenses against pests and fungi while also disrupting pest cycles and fostering biodiversity, reducing the need for pesticides to manage pests.

Regenerative agriculture depends on reducing use of toxic pesticides

Research supports the conclusion that reducing the use of agricultural pesticides is a critical intervention for maximizing the capacity of soils to serve as a carbon sink. Carbon conversion and sequestration depend on healthy, living soil ecosystems.^{11,12}

Organic agriculture prohibits synthetic pesticide use and is a climate solution

Organic farmers are prohibited from using over 900 pesticides otherwise allowed in agriculture. Research shows organic soils can sequester up to 25 percent more carbon than soil on conventional farms.¹³ Organic soils also increase farmers' resilience to droughts and floods by conserving water during dry periods and absorbing water quickly during extreme weather events.

POLICY RECOMMENDATIONS

Recommendations for the U.S. Environmental Protection Agency

Currently, the EPA gravely underestimates risk to soil organisms by using a species that spends its entire life above ground as a proxy for all soil invertebrates, the European honey bee (*Apis mellifera*) (40 C.F.R. §158.630; 2020). The EPA's Pesticide Assessment Guidelines, codified at 40 C.F.R. 152 and 158, which set forth the data requirements and protocols to register a pesticide, should be amended to require a soil health analysis and incorporate additional data requirements necessary to estimate risk to soil health. Testing should be required for sublethal effects to earthworms, springtails, mites, an isopod species, as well as effects on mycorrhizal fungi and nitrogen transformation as a readout of soil microbial activity. The EPA should develop Soil Health Guidelines to provide guidance on how the agency can comply with its amended regulations.

Recommendations for Congress

Congress should pass the Saving America's Pollinators Act and the Protect America's Children from Toxic Pesticides Act to ensure proper review of pesticides before they are approved. These bills will also ban key pesticides that harm pollinators and ecosystems. Congress should also significantly bolster funding for organic programs and research and USDA Conservation programs and retool them to better address climate change.

SOURCES

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