



Pollinator Friendly Weed Management

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The Xerces Society for Invertebrate Conservation

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Building Spaces for Pollinators to Thrive

Food, Shelter, Protection



Photo: Elaine with Grey Cats (Flickr CC 2.0)

Herbicide toxicity to pollinators

What do we know? Limited research

- Standard acute toxicity testing for honey bees
- Little research on other effects
- Most other research on glyphosate



: Tanner Smida (Wikimedia CC 2.0), J.N. Eskra (Wikimedia CC 4.0)

Herbicide toxicity: What do we know?

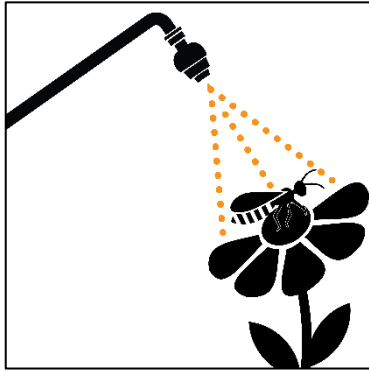
Sublethal effects

- Poor navigation
- Changes in gut microbiome
- Impacts on brood development (smaller size, delayed molting, lower survival of newly emerged adult bees)

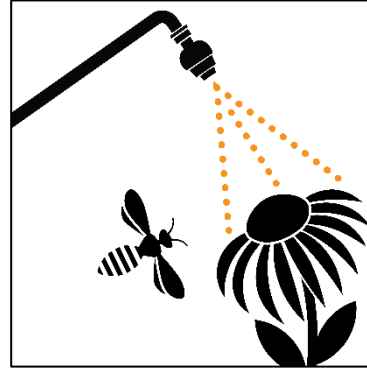


Photo: USDA/Lance Cheung

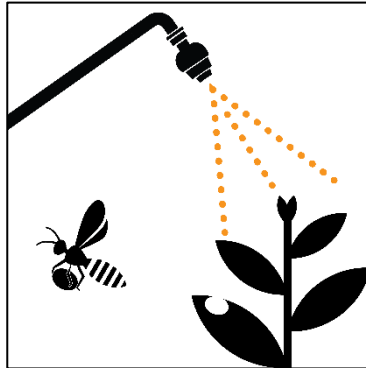
How Are Pollinators Exposed to Pesticides?



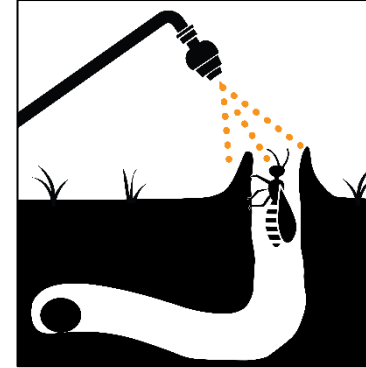
Direct Contact



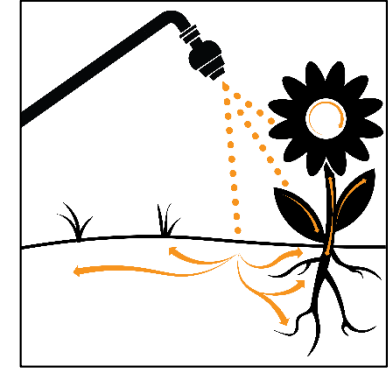
Indirect Contact



Contaminated
Nest Materials



Contaminated
Nest Sites



Systemic

Graphic: Xerces Society/Sara Morris

Which Application Method is More Targeted?



Photos: (L) Montana NPS (R) BLM Idaho

Best Management Practices

- Use an integrated vegetation management plan with least-harmful methods
- Monitoring and early intervention are key
- Set treatment thresholds



Photo: Jillian (Flickr)

Integrating multiple control strategies

Mechanical, cultural, biological

- Prevent movement and new infestations
- Establish desirable/competitive plants
- Pulling, digging, mowing, tilling, grazing
- Biological control (with caution)



Photo: USBLM Arcata

Where Herbicides Are Used, Mitigate Risk

- Select less toxic options (Bee Precaution tool)
- Treat only the area needed
- Avoid applying to flowering plants and limit direct exposure to pollinators
- Target applications at the most effective time



Photo: Justin Meissen

Case Studies

Invasive/Noxious Weeds of San Benito County



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Considerations

- Bloom time
- Attractiveness to pollinators
- Dispersal mechanisms
- Seed viability
- Palatability/toxicity to livestock
- Timing of management
- Key containment areas
- If pollinator forage is removed, how will it be replaced

Yellow Starthistle

Centaurea solstitialis

- Plant family: Asteraceae
- Identifying features: straight spines on tips of phyllaries/bracts, gray-green vegetation, and yellow thistle-like flower
- Found in thickets and has taken over millions of acres in CA
- Roads, cow trails, feeding spots (if haying), loafing areas
- Seeds are highly mobile
- Up to 30,000 seeds per square meter
- Seeds can remain viable for more than 3 years
- Biological, mechanical, cultural controls before resorting to chemical control
- Management before bloom but after bolt

Photo: Peggy Greb, Public domain, via Wikimedia Commons



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Cardoon/Artichoke Thistle

Cynara cardunculus

- Plant Family: Asteraceae
- Identifying features: very large thistle like plant with large purple flowers
- Found as a single plant and small-large clusters of plants
- Seeds are highly mobile each plant can produce in excess of 1,600 seeds
- Biological, mechanical, cultural controls before resorting to chemical control
- When using herbicides, if infestation is small and plants are blooming, clip flowers off before any chemical use
- Ideally treat before bloom and at seedling stage

Poison Hemlock

Conium maculatum

- Plant family: Apiaceae (Carrot family)
- Identifying features: white umbellate flowers and purple spots all along stalk
- Found in thickets in wetland and riparian areas or roadside ditches
- One plant may produce **up to 30,000 seeds** that remain viable for 3 to 6 years
- Reproduces solely via seeds
- Highly toxic to humans and animals can cause contact dermatitis in sensitive individuals
- Biological, mechanical, cultural controls before resorting to chemical control
- Can hand remove or mow for smaller infestations. If applying herbicides do so before bloom or at times when pollinators are less active



Photo: Professor108, CC BY-SA 4.0 <<https://creativecommons.org/licenses/by-sa/4.0/>>, via Wikimedia Commons

Fennel

Foeniculum vulgare

- Plant family: Apiaceae (Carrot family)
- Identifying features: yellow umbellate flowers and very aromatic
- Found in thickets in open and disturbed areas, slopes, grasslands, wetland and riparian areas or roadside ditches, particularly in coastal areas
- One plant may produce thousands of seeds
- Reproduces via seeds and root or crown fragments as well
- Palatable to livestock and increased dispersal
- Biological, mechanical, cultural controls before resorting to chemical control
- Can hand remove, cut, disk, or mow for smaller infestations. If applying herbicides do so before bloom or at times when pollinators are less active. Grazing makes infestations worse. Burning is not effective unless followed by herbicide application.

Xerces Resources

CREATING AND MAINTAINING HEALTHY POLLINATOR HABITAT

Guidance to Protect Habitat from Pesticide Contamination

How Neonicotinoids Can Kill Bees

The Science Behind the Role These Insecticides Play in Harming Bees

PROTECTING POLLINATORS FROM PESTICIDES

Fungicide Impacts on Pollinators

2nd Edition; Revised & Expanded

Mace Vaughan, David Biddinger, Matthew Shepherd, Ryan Black, Eric Lee-Mader, and Criste Mazzacano

Organic Pesticides

MINIMIZING RISKS TO POLLINATORS AND BENEFICIAL INSECTS



Significant

icides to control plant pathogens. While insecticides have long been assumed to be relatively harmless, a growing body of research suggests that some fungicides can have insecticidal properties and can kill bees on contact. Effects—including changes in development, behavior, immune system function, and reproduction—reducing long-term survival and population size.

ated pollen and nectar) can experience a variety of sublethal effects. For example, dietary exposure to chlorothalonil (e.g., Bravo, Bravo X) can decrease the number of offspring produced by bumble bees. A mixture of pyraclostrobin and boscalid (e.g., Pristine) commonly used in agriculture can reduce bee forager survival and queen production, increase virus infection, and reduce the survival of solitary bees (Fisher et al. 2017; DeGrandi-Hoffman et al. 2017).

Pesticides

es synergistically increasing toxicity to bees. Demethylation of fungicides (e.g., fenbuconazole [Enable, Indar]; propiconazole [Banner, Banner X]) can increase their toxicity to bees by blocking the enzyme pathway bees use to detoxify pesticides. Fungicides also exhibit synergism with insecticides. For example, the toxicity of clothianidin (e.g., Belay, Clutch, Poncho) and imidacloprid (e.g., Dursban, Gaucho, Meridian, Provado, Ultara) to bees is significantly increased when combined with fungicides (Fisher et al. 2017).

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Highly contaminated nectar and pollen in urban and agricultural settings can harm bee health and reproduction. (Left to right: Mining bee (*Andrena* sp.) on wild bergamot (*Monarda fistulosa*).



For growers, habitat from information obtain clean pesticide use. Considering that habitat at s, as well as (S. Pececka upke 2016). termination rural fields as well as igh not all ites is from 2016; Long

With growing interest in installing pollinator habitat, it is very important to manage the habitat and surrounding areas to reduce pesticide contamination. This can be achieved by instituting a combination of measures such as incorporating non-chemical options into pest management plans, eliminating prophylactic and other pesticide uses, and instituting risk mitigation efforts that limit movement of pesticides into habitat. If pesticide risks cannot be managed, habitat should not be installed.

Priority Pesticide Concerns for Pollinators

While a wide range of pesticides could pose risk to pollinators, priority pesticide concerns include:

- ➔ **Insecticides.** In general, insecticides are more acutely toxic to insect pollinators than other pesticides. Insect-



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Questions?



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Photo: *Bomus fervidus* /Karen Keating-Stuart