



Herbicides and Pollinators

Herbicides are important tools used by transportation agencies to control noxious and invasive weeds or encroaching woody vegetation that impact driver safety, roadside stability, or neighboring land. Noxious and invasive weeds also impact pollinators, significantly degrading habitat by displacing native plants that provide pollinators with food and shelter. Some herbicide uses can have non-target effects that weaken or remove native plants and reduce the quality of roadside habitat for pollinators. Here are some recommended herbicide practices to reduce adverse effects to pollinators and other wildlife.

Management practices that benefit pollinators broadly include:

Train staff and contractors to recognize native plants as well as noxious and invasive weeds to reduce unintended damage to nontarget plants.

Conducting training in weed identification, as well as using plant identification reference materials to recognize noxious and invasive weeds, will help distinguish such species from similar nontarget species.

Use targeted herbicide applications on undesirable plants to avoid harming nontarget species (e.g., spot treatment applications with a backpack sprayer, targeted applications to cut stems, etc.).

To avoid weakening or affecting flowering and seed set among desirable species, weeds can be targeted using spot treatment applications made with a backpack sprayer, weed wiper, or similarly appropriate technology. Using highly targeted applications on cut stems, on stumps, or under bark can also reduce unnecessary effects on desirable plants. Use broadcast treatments or pellet dispersal only for dense infestations of weeds, the safety zone, and guardrail treatments.

Apply herbicides during plant life stages when weeds are most vulnerable (e.g., before blooming or before going to seed).

Applications can be timed to be most effective, based on the herbicide's mode of action and the application technique. For example, when using a systemic herbicide (i.e., absorbed by the plant and transported throughout the plant by the vascular system), perennial weeds can be treated in late summer and fall, when, as they begin to move sugars down to their roots, the herbicide is translocated to where it is most effective at controlling the plant.

Applications of herbicides when the weed is most vulnerable are the most successful applications. For many weeds, this is the seedling or rosette stage.

Use selective herbicides whenever possible to reduce damage to nontarget plants.

It is important to use products and application rates that are effective in controlling target weed species, with minimal effects on nontarget species. Whenever possible, the use of selective herbicides—those formulated to control specific weeds or groups of weeds—can reduce damage to nontarget plants. Nonselective herbicides—those that are broad-spectrum products and kill or damage all plants—can also be used selectively to reduce effects on nontarget plants. For example, nonselective herbicides can be used selectively by applying them on weeds when desirable native plants are dormant and using directed or targeted applications (e.g., spot spraying). Herbicide labels include information about selectivity and persistence.

Avoid herbicide sprays when weather conditions increase drift (e.g., avoid wind speeds above 15 mph, and avoid applications during a temperature inversion).

It is best to avoid applications when wind speeds are greater than 15 mph and during a temperature inversion (i.e., when warmer air above traps cooler air near the ground). During inversions, herbicides and other pesticides can linger in the air and travel long distances off-site with air movement. Reducing the off-site movement of herbicides and using nonselective broadcast applications can help avoid damage to the nontarget plants that provide pollinators with food or shelter.

Choose and calibrate equipment with drift management in mind (e.g., calibrate equipment regularly, choose spray nozzles that reduce drift, and on boom sprayers, use the lowest effective pressure and largest droplet size possible).

The off-site movement of herbicides can be reduced by selecting appropriate spray equipment, periodically calibrating equipment, and adhering to instructions on the pesticide label. Nozzles that produce larger droplets are less likely to cause herbicides to drift off target. Equipment that is calibrated regularly limits over and under applications.

Avoid broadcast applications of systemic herbicides and persistent herbicides with long residual periods to reduce the exposure to butterfly and moth caterpillars, which can be exposed by consuming contaminated vegetation.

Butterfly and moth caterpillars consume host plant vegetation over days to weeks; residues in host plant vegetation could account for the bulk of exposure over the life cycle of these species. Larval butterflies and moths could be chronically exposed to systemic herbicides that are taken up by host plants or the residues of persistent herbicides, which take weeks to dissipate in the environment and have detrimental sublethal effects. Sublethal effects, such as reduced body size or wing size, can reduce survival, and can be regulated under the Endangered Species Act to the extent that they cause "harm." Additionally, inert ingredients like surfactants can sometimes be more toxic to pollinators than the active ingredient alone, making it important to target use whenever possible.

Whenever possible, prevent conditions that would allow incompatible vegetation or noxious and invasive species to establish or reestablish.

Control woody plants that resprout or sucker to stop regrowth and encourage desirable early successional vegetation. Monitor vegetation regularly to stay on top of emerging non-compatible vegetation issues. Track weed outbreaks and herbicide usage over time to evaluate the effectiveness of herbicide treatments and inform future management decisions.

If necessary (e.g., if the seed bank is depleted of desirable species), replant areas that have been treated with herbicides to remove dense infestations of undesirable vegetation with desirable, competitive low-growing plant species to reduce the need to re-treat the area.

Revegetation with appropriate native plants can support pollinators while also helping to reduce weed pressure and need. Revegetation will also provide food for pollinators that may have been using noxious weeds or other undesirable plants (see Chapter 7 of the NCHRP guidebooks for more).

Avoid the use of pre-emergent herbicides on areas where the seed bank might contain desirable native plant species.

Work with the seed bank, choose methods of weed suppression other than pre-emergents in areas with desirable plant species. Native plants are beneficial to pollinators and other wildlife.

Adjusting Herbicides to Support Imperiled Pollinators

Recommended practices for imperiled pollinators include reducing off-target herbicide exposure when working in their habitat. Employ a variety of vegetation management techniques, including cultural and mechanical control. When herbicides are used, avoid direct application to host plants or plants in bloom; make applications when caterpillars are not present whenever possible. Consideration of the life history of target imperiled pollinator species will help determine the conservation practices that are most relevant.

Practices for imperiled pollinator species include:

Train the staff and contractors to recognize and avoid herbicide applications to key host plants for target imperiled butterflies and moths or key nectar plants for bumble bees.

Recognition of the plants that are important to imperiled pollinators by the maintenance staff is a strategy that can help reduce applications to nontarget plants.

Avoid use of products that have toxicity to imperiled species during breeding seasons.

Time the use of fluazifop-p-butyl and sethoxydim, which may have sublethal effects on some imperiled butterflies, after caterpillar activity. Sublethal effects, such as reduced body size or wing size, can reduce survival, and can be regulated under the Endangered Species Act to the extent that they cause harm. Additionally, inert ingredients like surfactants can sometimes be more toxic to pollinators than the active ingredient alone, making it important to limit use when exposure to imperiled species is likely, whenever possible.

If treatment cannot be scheduled outside the window when pollinators are present, consider a mechanical control strategy when feasible if in an area where herbicide use might affect imperiled species.

Avoid direct applications to or near host plants of imperiled species or sources of pollen and nectar.



Applying Herbicide treatment to roadside. (Photo: Lisa Kuder, Maryland DOT.)

For more detail, please see:
Pollinator Habitat Conservation Along Roadways, Volumes 1-16. National Academies of Sciences, Engineering, and Medicine. Washington, DC: The National Academies Press.

Project materials available here: <https://www.trb.org/NCHRP/NCHRPWOD362.aspx>

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