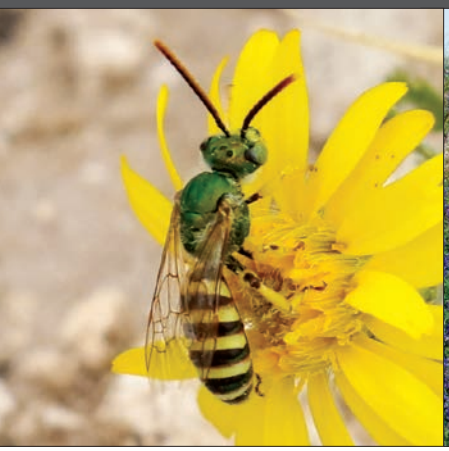
POLLINATORS AND CLIMATE CHANGE

Climate-Smart Right-of-Way Habitat



LEFT: Roadsides can provide important habitat for pollinators and other beneficial insects. MIDDLE: Adding pollinator habitat along roadsides and other rights-of-way increases habitat connectivity, an important step for increasing climate resilience of pollinators. RIGHT: Climate change will have a variety of effects on pollinators and the pollination services they provide.

California Pollinators and Climate Change

Insect pollinators, including bees, butterflies, moths, flies, beetles, and wasps, provide the vital service of pollination in croplands, urban areas, and natural areas. Bees are especially important pollinators, and California is home to more than 1,600 bee species. To provide pollination, pollinators need habitat that includes flowering plants and shelter. Roadsides and other rights-of-way can provide valuable habitat for these pollinators that are important to our economy and environment.

Unfortunately, pollinators are in decline, and these declines are likely driven by pesticides (including insecticides, fungicides, and herbicides), habitat loss, disease, and climate change.

In California, climate change is expected to lead to increased temperatures and longer, more frequent heat waves. Droughts will become more frequent and last longer. All of these factors may influence pollinators and the ecosystems that rely on them. For example, climate change may cause pollinators to shift their distributions or their timing of emergence. Climate change may also influence pollinators by affecting plant communities: changes in the abundance and diversity of flowering plants, as well as drought-related reductions in floral resources, can affect pollinators that rely on these plants for food. Finally, climate change can interact with other stressors, such as habitat loss or pesticides, to amplify negative effects on pollinators.

Building Climate Resilience for Pollinators

Several actions can improve pollinator resilience to climate change: restore and enhance pollinator habitat, increase habitat connectedness, and reduce other stressors. Protecting and expanding habitat is critically important; as the size of habitat increases, it supports larger populations and a greater diversity of species. Larger populations are better able to survive bad years and extreme weather events expected with climate change.

Habitat connectivity allows for several benefits to pollinator populations: larger populations, increased gene flow (enabling species to adapt to new conditions), and mobility for species to track favorable climates. Installing habitat corridors between habitat patches can help achieve this connectivity. Research suggests that linear corridors, such as those along roadsides or utility corridors, may be especially important in facilitating pollinator movement across landscapes. With a network of potential habitat crisscrossing the landscape, roadsides and other rights-of-way present an ideal opportunity to increase habitat connectivity for California pollinators.

Climate-Smart Pollinator Habitat along Roadsides and Other Rights-of-Way

Incorporating the provided suggestions can make habitat corridors more beneficial to pollinators and more climate resilient.

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Managing habitat

- Inventory and identify existing native flowering vegetation remnants along roadsides and other rights-of-way.
- Maintain wildflower diversity through invasive species removal or carefully timed mowing.
- Minimize mowing to once per year or less to avoid degrading important habitat. Along roadsides, reduced mowing can occur beyond the safety zone. If possible, avoid mowing sensitive pollinator habitat during spring and summer, when pollinators are active (for monarchs, avoid mowing from mid-March through October). Areas that provide little or no pollinator habitat could be mowed during spring and summer to keep to mowing schedules.
- Evaluate a range of management techniques (e.g., chemical, physical, or mechanical) to select the least harmful, most effective, and most feasible weed-management method.
- Reduce the effect of herbicides on pollinator habitat by using selective herbicides, and by applying herbicides in the most targeted manner possible and when weeds are most vulnerable.
- Whenever possible, prevent conditions that would allow the establishment or reestablishment of incompatible vegetation or invasive species. For example, wash equipment prior to accessing a new site to avoid transferring weed seeds among sites.
- To reduce drift, avoid applying pesticides when wind speeds are above 15 mph and during temperature inversions.

Restoring habitat

- Incorporate drought-tolerant native plants into habitat. This will help ensure that floral resources are available to pollinators, even during dry periods, as drought in California is expected to become more frequent and severe. Native plants provide important food resources for specialist bees and butterflies that have narrow resource requirements. Native plants tend to attract more species of insects than ornamentals and introduced plant species, and they support more birds and other wildlife.
- Use a variety of flowering plant species, and aim to have at least three species flowering at all times from spring through fall. Habitat with many types of plants also provides small spaces, or microhabitats, that vary in temperature and amount of cover and provide important refuge during heat waves or other extreme weather events.
- Provide nest sites for native bees. Areas of bare soil will provide nesting habitat for ground-nesting bees, and pithy-stemmed plants such as goldenrod (*Solidago* spp.) or primrose (*Oenothera* spp.) will provide nesting habitat for cavity-nesting bees. Native bunch grasses also provide nest sites for many bees, including some species of bumble bees. Appendices E and F of Xerces' *Bee Better Certified Production Standards*, available at beebettercertified.org, contain lists of plants used by cavity-nesting bees.

Improving pollinator habitat along roadsides and rights-of-way has many benefits beyond providing habitat for these important insects. First, carbon sequestration tends to be higher in restored areas and areas with high plant diversity compared to degraded areas with low plant diversity. Thus, creating and restoring pollinator habitat in these areas can also help to mitigate climate change. Second, pollinator habitat improves soil stabilization and leads to better infiltration of water, reducing runoff. Third, pollinator habitat also provides habitat for beneficial insects like predators and parasitoids that contribute to crop-pest control in neighboring farmland. Finally, pollinator habitat is attractive and provides a way to showcase California's local wildflower diversity.

Pollinator habitat along roadsides and rights-of-way can improve climate resilience of California pollinators by greatly increasing pollinator habitat connectivity. Please contact us at centralvalleypollinators@xerces.org if you are interested in collaborating with Xerces to create pollinator habitat or would like more information.

Additional Resources

Xerces Society, *Bee Better Certified Production Standards*: https://beebettercertified.org/docs

Xerces Society, *Literature Review: Pollinator Habitat Enhancement and Best Management Practices in Highway Rights-of-Way:* https://xerces.org/pollinator-conservation/roadsides

Xerces Society, *Pollinators and Roadsides: Best Management Practices for Managers and Decision Makers:* https://xerces.org/pollinator-conservation/roadsides

Xerces Society, *Roadside Best Management Practices that Benefit Pollinators: Handbook for Supporting Pollinators through Roadside Maintenance and Landscape Design:* https://xerces.org/pollinator-conservation/roadsides

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