

# Edge habitats along roads and power lines may be key to conserving rare plants

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Wild lupine, a plant of conservation concern across most of its natural range in eastern North America, grows along a Pennsylvania roadside. Credit: Isabella Petitta

Managing forest edge habitats to maintain a gradient of canopy cover and plant density could be key to conserving some threatened native plant species such as wild lupine, according to Penn State researchers.

Edge habitats created by natural or human-caused disturbances, including corridors along roadways and utility rights-of-way, provide prime opportunities for encouraging the establishment and reproduction of rare native plants, the researchers reported in a [new study](#) published in *Plant Ecology*.

The authors reviewed and synthesized the findings of 33 published studies examining the biology and management of wild [lupine](#) and associated plants and insects. Their case study suggests that [land management](#)—including prescribed burning, mowing and mechanical thinning—can promote the conservation of wild lupine and other forest edge plants.

"Most Eastern ecosystems are managed to maintain dense, forested habitats," said lead author Isabella Petitta, master's degree candidate in Penn State's intercollege ecology graduate program. "The lack of disturbance in these woodlands generates homogenous, closed canopy forests that result in losses of habitat for early successional plants such as wild lupine."

Across almost 60% of its original range in eastern North America, wild lupine is a species of conservation concern that requires management strategies for its protection, the researchers said.

Petitta, a U.S. National Science Foundation Graduate Research Fellow, explained that one of wild lupine's primary habitats is oak savanna, an early successional habitat with a canopy cover of less than 50%. Considered transition areas between prairie and forest, oak savannas provide a mix of canopy cover that allows for diverse plant communities

and microhabitats.

Wild lupine prefers open or partially shaded conditions with a canopy cover of 50% or less. It grows to about 8 to 24 inches tall, and each mature stem produces between 30 and 50 white, light pink, purple or blue flowers. The pollinator-dependent perennial has been deemed an indicator species of quality oak savanna habitat.



A patch of wild lupine grows along a forest edge in a road and utility right-of-way. With the decline of the plant's original habitat, 80% of wild lupine populations in Pennsylvania are located along rights-of-way for human infrastructure, researchers said. Credit: Nash Turley

"But fire suppression, development, demand for timber, conversion to agricultural land and other factors have reduced oak savannas to be among the most endangered habitats in North America," Petitta said, noting that oak savannas cover only about 0.02% of their original land area.

Study co-author Autumn Sabo, assistant professor of biology at Penn State Beaver and Petitta's co-adviser, noted that the loss of oak savanna habitat means that [forest edges](#) that are maintained for infrastructure have become an important habitat for rare plant species.

"In 2017, for example, there were more than 700,000 miles of high-voltage transmission lines and 6.5 million miles of local power distribution lines in the United States," she said. "And in Pennsylvania, about 80% of wild lupine populations are located along road, trail, rail, gas or power line rights-of-way."

Wild lupine habitat generally supports other early successional, prairie and forest edge plants, some of which may benefit from wild lupine's ability to fix atmospheric nitrogen in the soil, the researchers said.

"Wild lupine habitats also support a diverse insect community, and the flowers produce pollen and nectar that attract [insect pollinators](#) and visitors," said study co-author Margarita López-Urbe, associate professor of entomology and Lorenzo L. Langstroth Early Career Professor in the College of Agricultural Sciences.

López-Urbe, who also co-advises Petitta, pointed out that roadsides and power line rights-of-way adjacent to a forest edge are considered pollinator-friendly habitats because they provide diverse floral resources and movement corridors.

"Also, the vegetative parts of wild lupine serve as a host for the larvae of

three butterflies of conservation concern—the endangered Karner blue butterfly, the persius duskywing and the frosted elfin—and one moth, the lupine leafroller," she said. "Declines in wild lupine habitat are directly related to the decline of these species."

The researchers said several environmental conditions are needed to increase wild lupine cover and density, including light intensity levels around 65% of full sunlight, canopy cover that provides intermediate or partial shade, and the minimal presence of leaf litter. Management practices that can achieve these conditions, they suggested, include prescribed fire, herbicide application, mowing and mechanical tree removal.

In addition to habitat management, wild lupine populations can be enhanced through seeding and transplanting, the researchers added. But they recommended that land managers should focus on increasing existing populations before attempting to establish new ones.

The researchers cautioned that although various edge habitat management practices have been shown to have benefits for early successional plants, these methods need to be planned and timed correctly to be effective, and more study is needed to fine-tune recommendations.

"Wild lupine offers an opportunity to study and optimize management of rare plants in early successional edge habitats, including human-made habitats such as power line rights-of-way and roadsides," Petitta said. "Restoring and managing these edge habitats is critical for the conservation of wild lupine and its associated plant and insect communities."

**More information:** Isabella R. Petitta et al, *Biology and management of wild lupine (Lupinus perennis L.): a case study for conserving rare*

plants in edge habitat, *Plant Ecology* (2023). DOI: [10.1007/s11258-023-01371-9](https://doi.org/10.1007/s11258-023-01371-9)

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