

Ozone pollution threatens plant health and makes it harder for pollinators to find flowers

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A bee pollinates a sunflower. Credit: Evgenios Agathokleous

Over the past decades, rising levels of ozone pollution have been interrupting pollination, impacting the livelihood of both plants and the animals that pollinate them. In a review published September 29 in the journal *Trends in Ecology and Evolution*, researchers explain how an excess of ground-level ozone can damage plant foliage, change plants' flowering patterns, and act as a barrier to pollinators finding blooms.

"There is much noise about the direct effects of agrochemicals on pollinators, a subject of profound societal attention, but it now emerges that ozone is a silent threat to pollinators and thus pollination," says lead author Evgenios Agathokleous, an ecologist at Nanjing University of Information Science & Technology. "These impacts of ozone have long been missed."

Ozone gas can be both friend and foe to the planet. In the stratosphere, 12 kilometers above [sea level](#), ozone forms naturally and helps protect the Earth from harmful sun rays. But below that zone, ozone is a damaging pollutant. Tropospheric-level [ozone gas](#) is created by a photochemical reaction between [volatile organic compounds](#)—emitted by vegetation and commonly found in substances such as paint and aerosols—and oxides of nitrogen, which are released when fossil fuels burn. Tropospheric ozone levels have been rising because a warming climate is creating optimal conditions for its formation.

"Ozone pollution can affect the timing and duration of flowering in such a way that the occurrence of flowering is asynchronous to the activities of pollinators," says Agathokleous. "It can also change the color of flowers, disrupting the visual signals to pollinators. Ozone pollution can also directly react with pollen, decreasing its quality, but also indirectly changing the amount of pollen."

Ozone pollution can also damage plant leaves almost instantly, leaving injury signs of diverse colors and shapes and discoloring leaves. When

damaged, leaves have a hard time photosynthesizing and struggle to provide the plant with the energy it needs to grow. Plants emit their own organic volatile compounds that act as chemical signals facilitating communication from one plant to another and alert pollinators to the presence of a waiting flower. Ozone pollution appears to be disrupting these chemical signatures.

"Changes in the composition of the volatile blends could also have severe implications to pollinators because they might not recognize [host plants](#) and their qualities in the same way they did in the past," says Agathokleous. "Within [plant tissues](#), [ozone pollution](#) could decrease the amount of nutrients that are essential to insects, increase the abundance of chemicals that are harmful to insects ingesting them, and degrade the overall quality of plant tissues."

More information: Ozone pollution disrupts plant-pollinator systems, *Trends in Ecology & Evolution* (2022). [DOI: 10.1016/j.tree.2022.08.004](https://doi.org/10.1016/j.tree.2022.08.004), [www.cell.com/trends/ecology-ev ... 0169-5347\(22\)00199-9](https://www.cell.com/trends/ecology-ev/article/0169-5347(22)00199-9)

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