Study finds microbial-plant interactions affect the microbial response to climate change

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Surface litter samples were collected from the Loma Ridge Global Change Experiment (LRGCE) field site located 5 km north of Irvine, California. Credit: Ecology and Evolutionary Biology Professor Steven Allison

University of California, Irvine, biologists have discovered that plants influence how their bacterial and fungal neighbors react to climate change. This finding contributes crucial new information to a hot topic in environmental science: in what manner will climate change alter the diversity of both plants and microbiomes on the landscape? The paper appears in *Elementa: Sciences of the Anthropocene*.

The research took place at the Loma Ridge Global Change Experiment, a decade-long study in which scientists simulate the impacts of climate change on neighboring grasslands and coastal scrublands in Southern California. Experimental treatments there include nitrogen addition, a common result of local fossil fuel burning, and simulated drought imposed by covering patches of land with waterproof roofs during rainstorms.

In the project's early years, researchers focused on answering climate questions involving plants only. A research team led by Jennifer Martiny, professor of ecology & evolutionary biology and co-director of the UCI Microbiome Initiative, decided to examine whether the vegetation itself influences how climate change affects the bacteria and fungi in the ground. Soil microbes decompose dead plants, regulating the amount of carbon dioxide exchanged with the atmosphere.

The scientists sequenced microbial DNA in the grassland and scrubland, finding that the types and number of bacteria and fungi differed between them. Next, the team compared how the microbes reacted to nitrogen fertilizer and drought by monitoring the microbial DNA in plant litter, primarily dropped leaves and stems, over a three-year period.

"We thought diminished water might cause the scrubland microbial community to become more similar to that of the grasslands because there is evidence that scrublands start to grow increased grasses under drought conditions," said Sarai Finks, the paper's first author and UCI

graduate student. "However, it didn't happen. The two microbial communities remained distinct."

The team also discovered that while simulated drought affected both bacteria and fungi in grassland and scrubland, there were some unexpected differences. Nitrogen addition only affected the bacteria and its impact was far less than that of drought.

"Researchers have looked at this kind of interaction previously, but not on the scale we have done here. We were able to investigate two different kinds of plant communities right next to each other," Finks said, adding that the team hopes their findings will be helpful to other scientists investigating microbial communities. "Microbes are crucial to the carbon cycle and we need to learn what changes in microbial diversity mean for the environment."

The researchers' paper was the latest to be published from scientific data collected before the Silverado wildfire struck the Loma Ridge Global Change Experiment in October 2020. "Scientists are now looking into researching post-fire interactions between plants and the microbial communities at the site," Finks said.

More information: Sarai S. Finks et al, Microbial community response to a decade of simulated global changes depends on the plant community, *Elementa: Science of the Anthropocene* (2021). DOI: 10.1525/elementa.2021.00124

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