

Soil microbes shift as shrubs invade remnant hill prairies

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This is a prairie hill remnant. Credit: University of Illinois

Perched high on the bluffs of the big river valleys in the Midwest are some of the last remnants of never-farmed prairie grasslands. These patches, edged by forest, are slowly being taken over by shrubs. A recent University of Illinois study examined the soil microbes on nine patches, also called "balds," that had varying degrees of shrub invasion and found

an interesting shift in the composition of the microbial community.

"When we looked at the soil samples from a lightly encroached hill prairie remnant, it was very clear that there was a set of fungi that look like grassland fungi, a set of fungi that look like tree fungi, and the shrubs between the two have some features of both," said U of I microbial ecologist Tony Yannarell. "As the degree of shrub encroachment increased, the amount of change in the fungal communities also increased, and as the degree of shrub encroachment increased, that shrub fungi joined the forest group to become one big woody community."

Yannarell said that on the balds that were completely encroached, the [soil samples](#) across the entire remnant were the same. "You get this shift toward woody fungal communities that mirror how much shrub density you have in the hill prairie," he said.

Yannarell said that forest and prairie microbial communities are always very different from each other even in this case where they are only a couple of meters apart. And because of the close proximity, with the same overall climate conditions and soil origin, they could rule out a lot of factors that would normally affect a change in microbial community structure.

The microbes in the shrub soil tend to be different, but different parts of the microbial community change in relationship to the shrub, to the forest, to the prairie. The shrub bacteria are more like what they found in open prairie than in the forest. But the shrub fungi looked a lot more like the forest fungi.

"We think what we found is the signature of these early changes, these early shifts of microbial communities toward a woody fungal community," Yannarell said. "This first study only reveals one side of

the change. We think we can firmly conclude that there are some woody, plant-liking fungi. But we don't know if they are enhancing the invasion of it. They could be holding it back if there are shrub diseases.

"We're also interested in knowing if the shrubs have changed these microbes because that could have an effect on a landowner's ability to restore a heavily encroached hill prairie," Yannarell said. "If you cut down all of the shrubs, you haven't changed the [microbial communities](#) that live in the soil that the shrubs created. We want to know if those shrubby communities can be invaded by grasses or have they changed something fundamentally so that it will be harder to restore the prairie," he said.

Yannarell explained that the remnant hill prairies are on portions of the bluffs where the soil is erodible, and because it is facing the sun for more of the year, it's slightly warmer and slightly drier. More frequent fires would tip the balance toward grassland, but fires have been suppressed for many decades in the area because people live and farm nearby. The hill prairies are shrinking as the forest, and now native shrubs, such as dogwood, sumac, shrubby black locust, and eventually red cedar move in.

"We don't know yet what kind of long-term impact this could have on the environment," Yannarell said. "As the environment becomes unfavorable for certain microbes, those microbes will die off," he said. "The shrubs could be driving out grass-loving fungi in favor of shrub-loving [fungi](#). It's yet another example of a monoculture taking over."

Yannarell said that this research will be the foundation for a lot of work they'll do in the future.

More information: "Influence of Shrub Encroachment on the Soil Microbial Community Composition of Remnant Hill Prairies" was

published in the February 2014 issue of *Microbial Ecology*.

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