Plant diversity is key to maintaining productive vegetation

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Vegetation, such as a patch of prairie or a forest stand, is more productive in the long run when more plant species are present, a new University of Minnesota study shows. The unprecedented long-term study of plant biodiversity found that each species plays a role in maintaining a productive ecosystem, especially when a long time horizon is considered. The study found that every additional species in a plot contributed to a gradual increase in both soil fertility and biomass production over a 14-year period.

The research paper, published in the May 4 edition of the journal *Science*, highlights the importance of managing for diversity in prairies, forests and crops, according to Peter Reich, a professor in the university's forest resources department and the study's lead author.

Reich and his colleagues examined how the effect of diversity on productivity of plants changed over the long term in two large field experiments at the University of Minnesota's Cedar Creek Ecosystem Science Reserve in central Minnesota. These are the longest-running biodiversity experiments in the world, and contain plots with one, four, nine or 16 different species of plants. Reich's research was done using long-lived prairie plants, but serves as a model system for all vegetation, whether prairie, forest or row crop. The study also showed how diversity works by demonstrating that different species have different ways to acquire water, nutrients and carbon and maintain them in the ecosystem.

"Prior shorter-term studies, most about two years long, found that

diversity increased productivity, but that having more than six or eight species in a plot gave no additional benefit," Reich said. "But we found that over a 14-year time span, all 16 species in our most diverse plots contributed more and more each year to higher soil fertility and biomass production. The take-home message is that when we reduce diversity in the landscape--think of a cornfield or a pine plantation or a suburban lawn--we are failing to capitalize on the valuable natural services that biodiversity provides."

Collaborators on the project included scientists David Tilman and Sarah Hobbie from the university's department of ecology, evolution and behavior as well as colleagues in the department of forest resources and from two European universities. Reich is also jointly affiliated with the Institute on the Environment at the University of Minnesota and the Hawkesbury Institute for the Environment at the University of Western Sydney, in Australia.

Previous studies have examined only shorter-term impacts of biodiversity on productivity. "This study reveals what short-term experiments have missed: the effects of biodiversity loss on ecosystems are more complex, severe and unpredictable than previously thought," says Matt Kane, program director for the National Science Foundation's Long-Term Environmental Research site network, which includes Cedar Creek. "This work shows the importance of doing long-term research, in this case documenting for the first time the critical importance of biodiversity for ecosystem health and sustainability."

Provided by University of Minnesota