Name_____

DATA Nugget

Missing species: the biodiversity of prairie remnants

Featured scientists: Mike Grillo and Jeremy Davis from Loyola University-Chicago and Nick Budde from the Forest Preserves of Will County, Illinois. Written with Kerrie Rovito and Katarina Alvarado from Chicago Public Schools.

Research Background:

Illinois is called the "Prairie State." Historically, 60% of the state was covered in different types of **prairies**, or open grassy landscapes with few trees. As far as the eye could see, fields were filled with colorful wildflowers, grasses, and all the species above and below ground that rely on them. However, today only 0.01% of the prairies remain across the whole state! These undisturbed areas are known as **remnant prairies**, and despite their small size, they are still home to a diverse community.

Restored Illinois prairie filled with a diversity of grasses and forbs, as well as microbes, invertebrates, mammals, researchers and more!

What happened to the rest of the prairies? Most were converted by people into agricultural fields to grow crops for food. The soils below prairies are rich in nutrients, and the agricultural lands in Illinois today provide food consumed by millions.

Nick is a land manager whose passion is prairies. In addition to protecting and studying remnant prairies, he creates **restored prairies** by planting prairie plants back into agricultural areas where they were historically found. However, Nick and other land managers are finding something surprising - the restored prairies do not look like the remnant prairies. He noticed that some of the native plants come back and thrive in the restored prairies, while others do not.

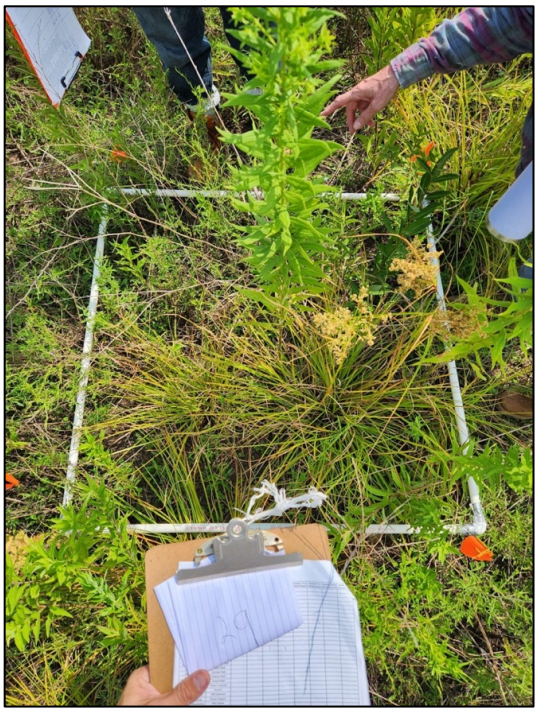
To investigate these missing species, Nick partnered with a local scientist, Mike. Mike grew up in rural Michigan and has always been fascinated with biodiversity. He is passionate about bringing back missing species, because he knows even just one missing plant can have a cascading effect through an ecosystem. For example, wild

lupine plants are a key food source for the endangered Karner blue butterfly. When prairie restorations have higher diversity, we're more likely to benefit other species.

Nick and Mike want to figure out why some species re-establish and others do not. They thought the key might lie belowground. From Mike's past research, he knew that many prairie plants species form beneficial relationships with microbes belowground, called **mutualisms**. Could the root of the problem be explained by what is happening below ground? If these mutualist partners are missing in the soil, some plant species may not be able to survive.

One mutualist in prairies is called **arbuscular mycorrhizal fungi**, or **AMF**. Plants supply these fungi with sugars from photosynthesis. AMF help plant roots gather nutrients and water from the soil. AMF are common in prairie soils, but are often missing from soil that has been used for agriculture. Agriculture removes AMF in several ways. Tractors till the soil, disturbing the fungi below ground. Chemicals may be sprayed to kill harmful microbes, but these chemicals can also kill beneficial fungi, like AMF.

Nick chose an experimental site that was historically a sandy prairie, but had been used as a farm more recently. He used AMF originating from local remnant sand prairies to add to the experimental plots. Nick used a seed spreader to launch the AMF along the base of the plants. He set up three treatments that differed in how much AMF was applied: 1) a low level of AMF, 2) a high level of AMF, and 3) a control where no AMF was added. This setup was repeated 5 times in experimental **blocks**, or similar rectangular plots.



Researchers identifying plants in the remnant prairie site to document species richness.

After the growing season, Mike and his lab identified the plant species in each block. To help out, Jeremy joined Mike's lab after finishing graduate school. He was a good fit because he had been working with similar data. Jeremy used the full dataset to calculate **species richness**, or the number of different plant species in each block.

Scientific Question: How does adding AMF to restored prairies affect plant species richness?

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

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Scientific Data:

Use the data below to answer the scientific question:

AMF Treatment	Species Richness
control	5
control	5
control	7
control	4
control	3
control	4
control	4
control	4
control	4
control	4
low	5
low	3
low	5
low	5
low	4
high	5
high	7
high	6
high	7
high	5

Average Species Richness	
control	
low	
high	

What data will you graph to answer the question?

Independent variable: _____

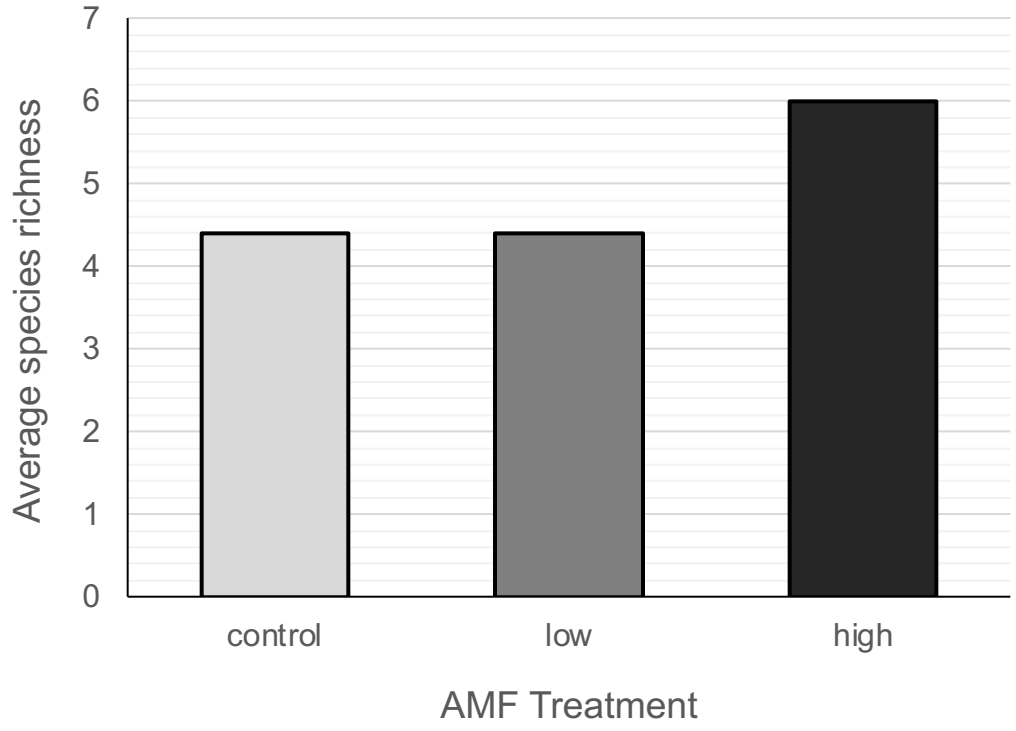
_____

Dependent variable: _____

_____

Name_____

Below is a graph of the data: Identify any changes, trends, or differences that you see in your graph. Draw arrows pointing out what you see and write one sentence describing what you see next to each arrow.



Interpret the data:

Make a claim that answers the scientific question - How does adding AMF to restored prairies affect plant species richness?

What evidence was used to write your claim? Reference specific parts of the table or graph.

Name_____

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about how AMF mutualists could increase plant species diversity in restored prairies.

Did the data support Nick, Mike, and Jeremy's hypothesis? Use evidence to explain why or why not. If you feel the data are inconclusive, explain why.

Apply this research: When land managers create budgets for prairie restorations, they have to carefully consider the cost of adding AMF. The expense of prairie seed and AMF combined is double the cost of just using prairie seed. If you were a land manager looking to restore prairies in Illinois, how would the results of this study impact your decision to use AMF?

Name_____

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Nick, Jeremy, and Mike's research? How do your questions build on the research that has already been done?