My Mycorrhizae

CAP LTER Data Explorations

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Time: 15-30 minutes
Grade Level: 9-12

Background:
The Phoenix urban core is composed of several contiguous cities and is situated within the Sonoran Desert. This area is being studied by scientists as part of the long-term ecological research network (LTER) funded by the National Science Foundation. Our project, the Central Arizona-Phoenix LTER (CAP LTER) is focusing on researching the effects of urbanization on the surrounding desert ecosystem and vice versa. The Phoenix area is growing rapidly with a population of 300,000 people in 1950 and 3 million+ in 2005. The area receives annual precipitation of 180 mm (6 inches) and can experience summer temperatures as high as 48 C (115 F). The rain comes twice a year (winter & summer), which contributes to the high species diversity of the Sonoran Desert as compared to the North American deserts. Urbanization of this area has led to decreased agricultural development (formerly focused to the west, south, and southeast of the urban core) and increased water control via dams, reservoirs, and canals. The data presented here was collected by faculty and graduate students over several years of the CAP LTER projects.

Objective:
Students will analyze patterns of fungal species associates with plant roots (mycorrhizae) in urban Phoenix.

Standards:
Science

Advanced Preparation:
Because fungi and symbiosis can be rare subjects for young students it is suggested this lesson follow some sort of general introduction to fungi and/or microorganisms as well as a general intro to symbioses. Common symbioses for young learners include clown fish-anemones, acacia thorn ants, and human gut bacteria.

Materials:
Student Worksheets

Evaluation:
Observation during the activity and participation in discussion.
Student responses to reflection questions.

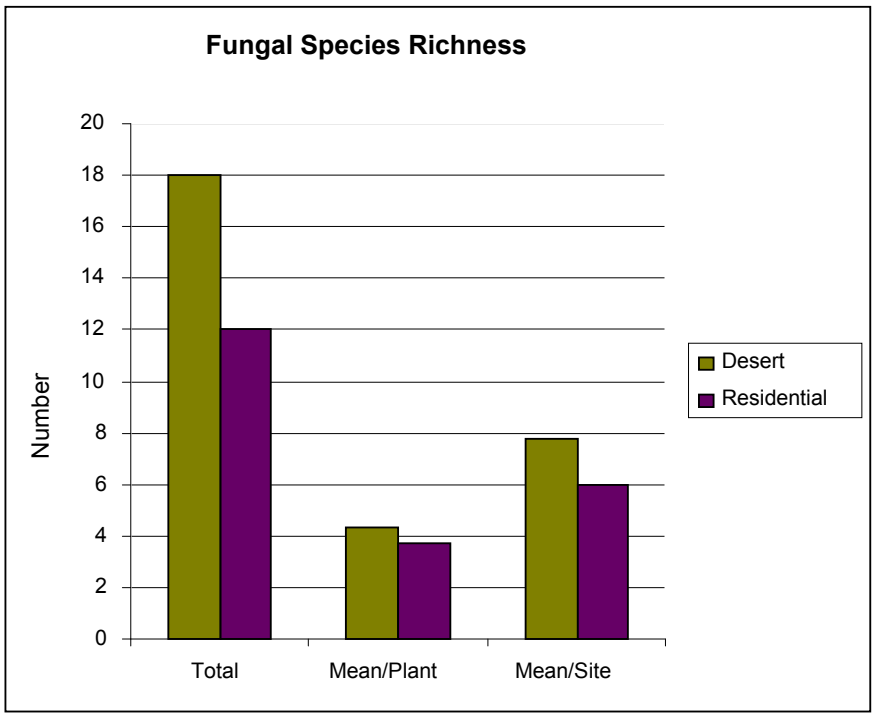
Extensions: Possible protocols for assessing other soil fungi (not mychorrhizae) can be found here, they may or may not work with desert soils http://ecoplexity.org/node/107

Mycorrihizae in the Environment

Symbiosis is when two organisms have a close connection within an ecosystem. Examples include pollinating bees and flowers, gut bacteria and humans, pathogenic fungi and conifer trees. Symbiotic relationships can be beneficial, harmful, and/or neutral. Mycorrhizae are fungi symbiotic with plants. They infect the roots of all types of plants. These fungi often provide a benefit to the host by increasing plant nutrient uptake or tolerance to drought. The fungus gets a return of carbohydrates (sugars) from the plant; this positive interaction between symbiotic organisms is a mutualism.

Mycorrhizal density (amount) or diversity (number of different species) can indicate something about the health of the plants or the quality of the soil habitat. Typically increases in both density and diversity are correlated with increases in plant performance (growth, seed production) as well as the number and types of plants present. So, mycorrhizae are a good way to teach about the interconnectedness between soil and plants as well as between different types of organisms.

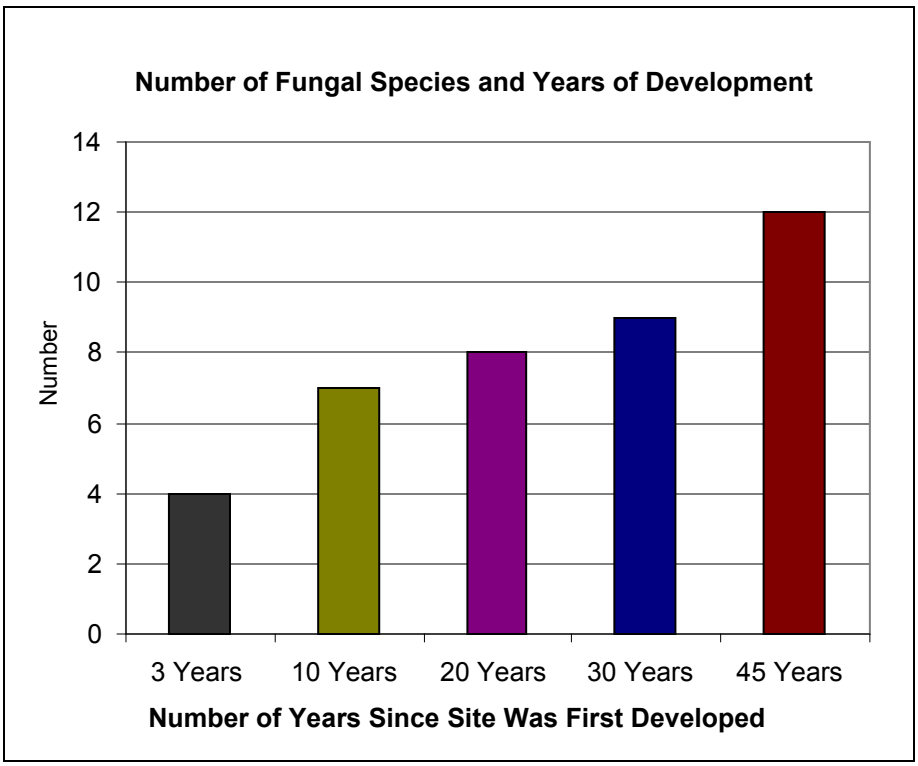
The following are graphs of Mycorrhizae species found in Phoenix area plants. Some of the plants were from the desert, others were from neighborhoods (residential)



Graph 1 Notes:

'Mean/Plant' refers to the average (mean) number of fungal types (species) found per plant root examined and within each type of site (desert or residential).

'Mean/Site' refers to the average (mean) number of fungal types (species) found per site (desert or residential).



Graph 2 Notes:

Number of years since development refers to when the neighborhood was constructed. Generally, after a neighborhood has been developed, the soil remains relatively undisturbed.

Questions

1. What does Graph 1 suggest in terms of differences between fungal diversity (species richness) in desert versus residential sites?

2. Give two reasons why these differences in fungal diversity might exist between desert and residential areas.

3. Since mycorrhizal fungi and plants are often involved in mutualistic symbioses, what might these differences mean in terms of what plants need in desert versus residential settings?

4. Why do you think fungal diversity increases in plant roots over time (graph 2)?