

Microbes in Your Soil

CAP LTER Data Explorations



Author: Ecology Explorers Team, adapted from work by Ahmed, Davies, Hall, Grimm, and Sponseller

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.

Objective:

Students will analyze patterns of enzymes produced by soil microbes.

Standards:

Science

Advanced Preparation:

Students should have been introduced to the role of decomposers in an ecosystem.

Students should have been introduced to basic information about population and community ecology.

Students should have an understanding of different land-use types in the Phoenix area.

Materials:

Student Worksheets

Evaluation:

Observation during the activity and participation in discussion.

Student responses to reflection questions.

Extensions:

Have students view this model of the basic soil ecosystem http://ecoplexity.org/soil_model

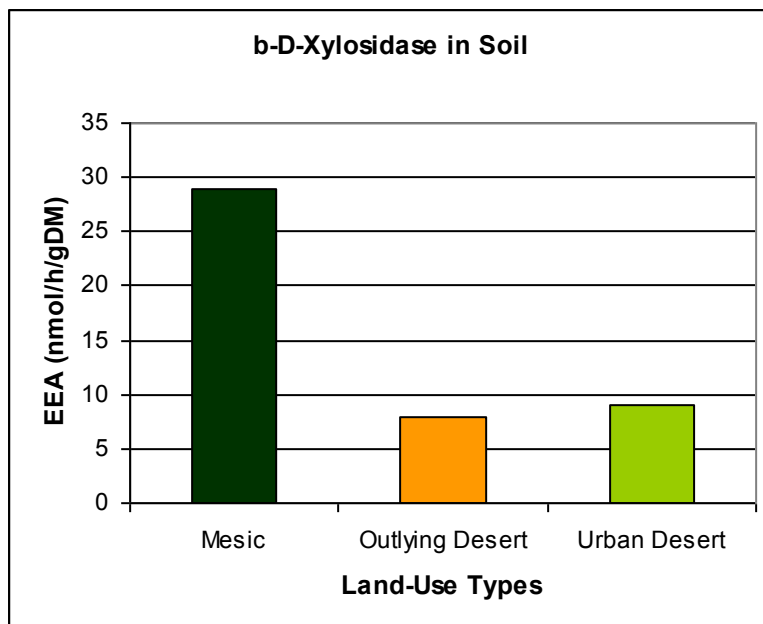
Student Worksheet

Soil Microbes



We all know things decompose (break down into increasingly smaller parts), well most things anyway. An orange slice, or tree leaves dropped in your yard will be gone after a year if you just leave them where they are. This is because arthropods, bacteria, and fungi eat them. When bacteria and fungi (microbes) eat they exude (release) enzymes from their bodies. These are called *extracellular enzymes* and their amount/concentration in the soil is referred to as *extracellular enzyme activity* (EEA). Basically, we digest our foods inside our bodies, they digest outside their bodies. One way to quantify how much microbial activity is present in soils is to measure the amount/concentration of known enzymes. This provides a nice way of estimating how active and what kinds of specific microbes are present.

Graph 1

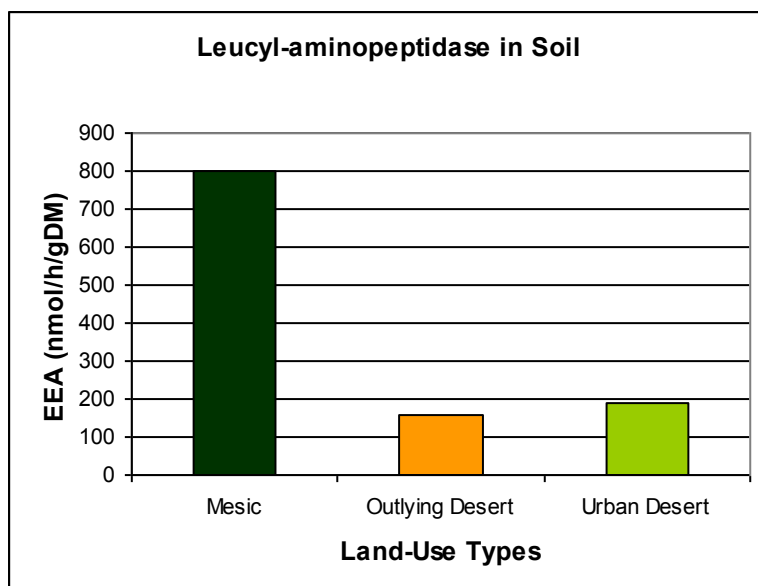


These graphs show a study conducted by ASU scientists who looked at how microbes respond to different types of landscapes.

The landscapes were:

- 1) **mesic** (watered yard),
- 2) **outlying desert** (meaning outside the city)
- 3) **urban deserts** (desert surrounded by city like Papago Park).

Graph 2



Don't worry about the names of the enzymes, just note that these are two different microbial enzymes.

Student Worksheet

Soil Microbes



Questions:

1. Graph 1 shows higher amount of the enzyme in the *Urban Desert* versus the *Outlying Desert*, why might this be?

2. Based on these two graphs discuss where do you think the most types (greatest diversity) of microbes are present in the soil?

3. What might lead to increased microbial activity in these soils? Just brainstorm, there are lots of 'right' answers.
