Desert Plant Diversity

Objectives:

Students will be able to:

- identify patterns in plant distribution and diversity in an ecosystem. They will be encouraged to develop ideas about why these patterns exist.
- use a vegetation key or make their own vegetation key to identify plants.

Author:

Ecology Explorers Education Team; Adapted from: CAP LTER Desert Plant Diversity Protocol and Obis Plant Patterns activity

Time:

60 minutes

Grade Level:

6-12

Standards:

AZ Science Strands
Inquiry; Life Sciences

AZ Social Studies
Geography

NGSS - Core Ideas
Ecosystem dynamics; Inheritance of traits; Adaptation; Biodiversity and humans

Practices
Investigations; Analyzing and interpreting data; Explanations; Obtaining Information

Specific AZ, Common Core, and NGSS standards on page 3.

Background:
Plants are important components of any ecosystem. They are the base of the food chain taking energy from the sun and converting it into food for all other organisms. Ecologists study patterns of plant distribution and factors affecting plant growth. Plants grow in certain places because environmental factors are suitable for the germination of seeds and continued growth of developing plants. Environmental factors can include abiotic factors such as temperature, light, moisture, soil nutrients; or biotic factors like competition from other plants or grazing by animals. People can also influence distribution patterns. Scientists at the Central Arizona—Phoenix Long-Term Ecological Research project documented the desert plants in Phoenix area parks and preserves using the same transect sampling method as outlined in this lesson (http://caplter.asu.edu/research/research-projects/?id=11).

Vocabulary:
dominants - dominant plants cover more space (they may also be larger but not necessarily) and may influence other organisms.

plant distribution - refers to the arrangement of plants in the area

limiting factors - biotic or abiotic factors that limit the distribution of plants (or animals). Ecologists do research to find limiting factors. Quite often limiting factors are things like light, nutrients, and water. Plants and animals adaptations are also important in determining distribution.

diversity - sometimes called species richness, this is the number of different species living in the same area

community - in ecology, a community refers to all the plants and animals in a particular area. This study looks specifically at the plant community.

transect lines - a method in ecology to survey plant diversity. There are a number of different transect line protocols, the one outlined here is appropriate for deserts.

Advanced Preparation:
You may wish to do step #1 before you visit the field site with your students.

Materials:
- Tool for defining plot size: pole w/ string attached, meter sticks, measuring tape, flagging
- Map of area to be sampled (if available)
- Plastic bags
- Data Sheet (clipboard)
- Colored Pencils
- Plant identification books

Safety Precautions:

▪Bring Water

▪Students should wear closed-toed shoes

Make students aware of potentially dangerous animals
▪and plants

Recommended Procedure:

This method is for sampling on a large scale and in the desert, you will be using a circular plot with radius of 5.6 m (so the area of each circle is 100m2).

Engagement

1) Visually inspect the site. What kind of variation do you see? Select at least two sites to sample; these should have different kinds of vegetation so you can compare them. For example, you may want to do a north-facing slope vs. a south-facing slope.

Exploration

2) Select the sampling spot by throwing a rock (or other small item) over your shoulder. This will be the middle of the plots. If you have a lot of time use the transect line method as described below and do at least two transect lines. If you are in the desert make sure students are aware of poisonous/venomous animals such as snakes and scorpions.

3) Identification of the plants: you can use a standard key to the local plants or make up your own key (described below). It will be important in this lesson to be sure that all the students are using the same name for the same plant (even if it isn't the scientific name).

4) Identify and count how many trees, shrubs and cacti (don't count annual plants) are in each of the circles and record on your data sheet.
   - Don't count the same plant twice
   - Don't count dead plants---be careful to distinguish between dead and dormant plants.

   (Many desert plants loose their leaves in the summer and appear dead, they aren't and will have green in the stems when broken.)

Explanation

5) Once the students have finished their plots it's time to share and compare the data. Consider asking the following questions:

▪Which plant is the most common in each of the plots? (Can you use math to figure this out?)

▪Are some plants found in all the plots?

▪Are some plants found in only a few plots?

▪Which plots had the most plants (total number)?

▪Which plots had the most number of plant species (diversity)?

▪List possible differences between the plots (more water, north slope, south slope, desert wash).

▪Is there a link between environmental factors and the number or kind of plants?

▪Did you notice any tracks or signs of animals in any of the plots?

Expansion

6) At this point you may wish to introduce the following terms and discuss how they relate to the data the students just collected: Dominants, Plant Distribution, Limiting Factors, Diversity, Community

Evaluation:

1. Students complete data sheets with detailed observations.

2. Students should calculate or determine:

▪the dominant plant species in their plot

▪the total number of different plant species (plant diversity).

3. Students' written reflections should display an understanding:

▪ about why data from different plots might vary and the implications of this variation

▪ that the types, numbers and distribution of plants in a particular area reflect the plant's adaptations to local environmental factors.

Extensions:

Students can write reports on the specific plants they found in the study plots. They should be able to find the following information:

▪Where are these plants normally found (range)?

▪When do the plants flower? (if they are flowering plants)

▪Do people use them? (many desert plants were used by Native Americans, we also plant many native plants in our "desert landscapes")

▪Describe the life cycle of the plant and/or how it is adapted to desert life.

Making up your own identification key:
Have each student or pair of students collect leaves from the five most important plants in the area (you can suggest that importance can be size, abundance, beauty, but let the students make the final decision).

As a group, sort the leaf samples out on a large piece of paper or white board (depending on the age of the student you may want to limit your plant diversity search to the 8 most common plants). Have the students select different names/colors for each of the different plants. If they know the common name use it, if they don't know the common name, make something up (i.e. shrub A). Make sure all the children can identify each of the plants.

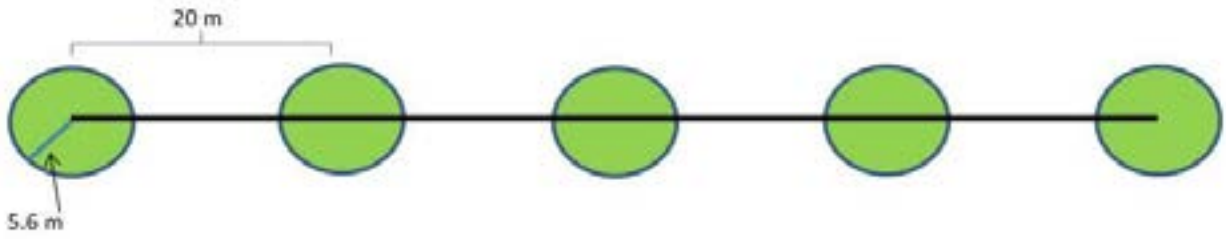
Transect Lines:
This is one common method that CAP LTER desert ecologists have used to survey desert areas in and around the Phoenix metropolitan region.

- The transect should go in a straight line; however along streamsides follow the course of the streambed.
- The transect line should consist of 5 circular plots 20 m apart. Each circular plot should have a radius of 5.6 m (so the area of each circle is 100m^2). If you don't have room to do 5 plots, you can do less but be sure to record this on the data sheet.
- To find the starting point of the transect line pick up a rock and throw it over your shoulder, start the line wherever the rock falls.
- Attempt to remain within your identified vegetation type. For example, if your transect is on a slope go along the slope (sideways on the hill), rather than up and down.

Reference for Desert Plants:

- Bowers, Janice. 1993. Shrubs and Trees of the Southwest Desert. Western National Parks Association: Tucson, AZ, 144pp. ISBN: 1-877856-34-7
- Epple, Anne. 1995. A Field Guide to the Plants of Arizona. Falcon: Guilford, CT, 347pp. ISBN:1-56044-563-7

Standards
Arizona Science Standards
Inquiry Process
S1-C2-GR4-8-PO1
S1-C2-GR4-5-PO4
S1-C2-GR4-5-PO5
S1-C2-GR6-7-PO2
S1-C2-GR6-8-PO5
S1-C2-GRHS-PO5 S1-C3-GR4-8-PO1
Life Sciences
S4-C3-GR7-PO2
S4-C3-GRHS-PO2
S4-C3-GR7-PO3
Arizona Social Studies Standards
Geography
SS4-C1-GR5-PO6
SS4-C1-GR6-8-PO1
SS4-C1-GRHS-PO1
NGSS Core Ideas
ESS2.E: Biogeology
ESS3.C: Human impacts on Earth systems
LS2.C: Ecosystem dynamics, functioning, and resilience
LS3.A: Inheritance of traits
LS4.A: Evidence of common ancestry and diversity
LS4.C: Adaptation
LS4.D: Biodiversity and humans



NGSS Practices
Planning and carrying out investigations
Analyzing and interpreting data
Constructing explanations
Obtaining, evaluating, and communicating information

NGSS Crosscutting Concepts
Patterns
Cause and effect
Scale, proportion and quantity
Stability and Change

AZCCRS/ELA Literacy
RST7: Integration of knowledge and ideas
SL1: Comprehension and Collaboration

AZCCRS/Mathematics
Domains: Number and Quantity, Measurement and Data
Math Practices:
4. Model with mathematics.
8. Look for and express regularity in repeated reasoning.

Student Data Sheet
Desert Plant Diversity

Location (name of park, closest cross streets, etc.):

_____

Date: _____ Survey Site No. _____

Survey Team Members _____

Number of circular plots on transect line: _____ Distance between each circular plot: _____

Survey Site Description (approximate location, GPS coordinates):

_____

_____

_____

Circle Number	**Plant Name** (Scientific Name, Common Name)	**Talley Number**