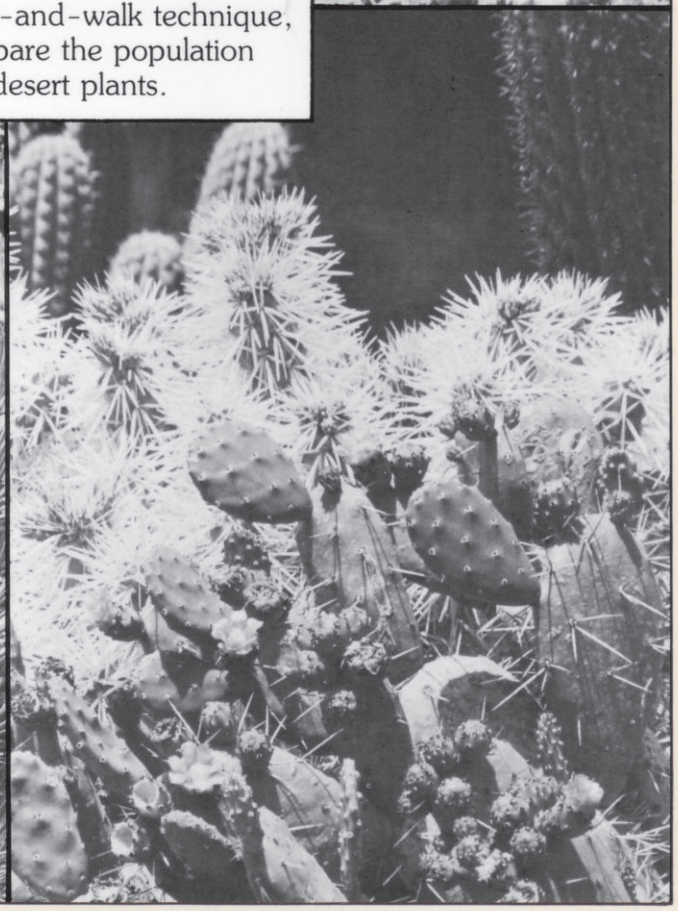
CACTUS WHEEL

BIO KEY

Bio-technique
Sampling
Population Density

OVERVIEW

Using a simple hunt-and-walk technique, the youngsters compare the population densities of several desert plants.



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BACKGROUND

When a biologist investigates an area, one of her first tasks is to take an inventory of the organisms living there. Counting every single plant or animal would be quite tedious, so biologists have developed a variety of sampling techniques to simplify the counting process. For example, by accurately counting the number of fence lizards (or any other organism) in a small, randomly selected portion of a large area, the biologist can estimate the size of the lizard population in the entire area.

She can go one step further and determine the ***population density.*** By accurately measuring out a standard-size portion of the area (for example, 100 square meters) and then counting the number of lizards in that portion, she might find that the population density is five fence lizards per 100 square meters. Population density is a valuable concept for comparing the distribution of organisms in different parts of an organism's habitat.

A second way to look at population density is to consider the size of the area that supports a standard number of organisms. Five lizards living in an area of 1000 square meters represents a population density lower than five lizards living in an area of 100 square meters. The smaller the area containing a certain number of plants, the *denser* the population. In this activity, the areas will be circles, the organisms will be plants, and the standard number will be the number of kids in your group.

A desert habitat is a good place to introduce the youngsters to the concept of ***population density*** because cacti and most other desert plants are usually easy to find and have low population densities compared to plants in other habitats.

CHALLENGE: DETERMINE THE POPULATION DENSITIES OF SEVERAL DESERT PLANTS.

MATERIALS

For each team of two:
1 pencil and piece of paper
2 Action Cards (Optional: See the "Action" section.)

For the group:
1 sheet of Action Cards*
1 data board* with two sheets of paper
1 marking pen*
1 metric ruler*
1 pencil compass* for drawing circles
1 large comb* (required only if cholla cacti are present. See the "Preparation" section.)

*Available from Delta Education.

PREPARATION

Group Size. This activity works best with groups of fifteen or less. For more youngsters, form two groups with separate leaders.

Time. Plan on forty to fifty minutes for this activity.

Site. *Cactus Wheel* is designed for desert areas, but can be used at any site with plants. Keep in mind, however, that counting plants is more difficult if the plant growth is dense. The site should contain at least four different kinds of plants.

CACTUS WHEEL

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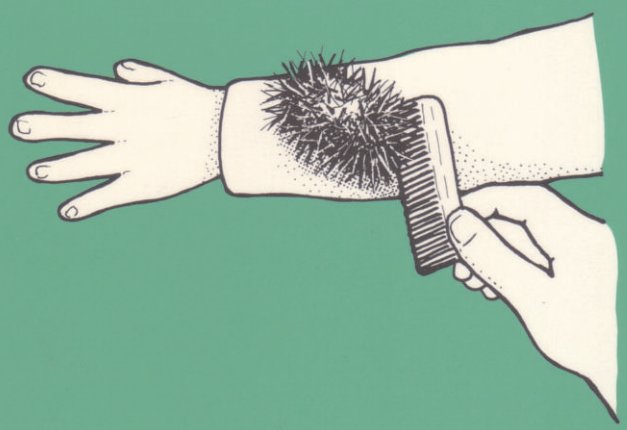
Safety. *Keep off the cactus!* Be careful while working around cacti, particularly the chollas. If a youngster does happen to get a piece of cholla stuck to him, don't grab the cholla to pull it off. Rather, slip a large comb in between the skin or clothing and the cactus, and then flip the piece of cactus away. Don't flip it on someone else! Warn the kids about the dangers of cacti before starting the activity.



ACTION

Pacing Out the Cactus Wheel

1. Tell the youngsters that they are going to survey some of the common plants living in the area.

2. Point out a common plant (barrel cactus, for example). Tell everyone that you will stand next to this barrel cactus while they each find another barrel cactus as close to you as possible. Optional: If you want the youngsters to take a close look at their plants when they find them, give them each an Action Card now.

3. Send the youngsters out to find their barrel cacti. They can move out in all directions to search.

4. Once the youngsters have found their cacti, give them a few minutes to answer the Action Card questions.

5. Now, tell the youngsters to walk toward you, taking *normal* strides and counting each stride they take.

6. Record in a column on the data board the number of steps each youngster takes. Label the column "Barrel Cactus."

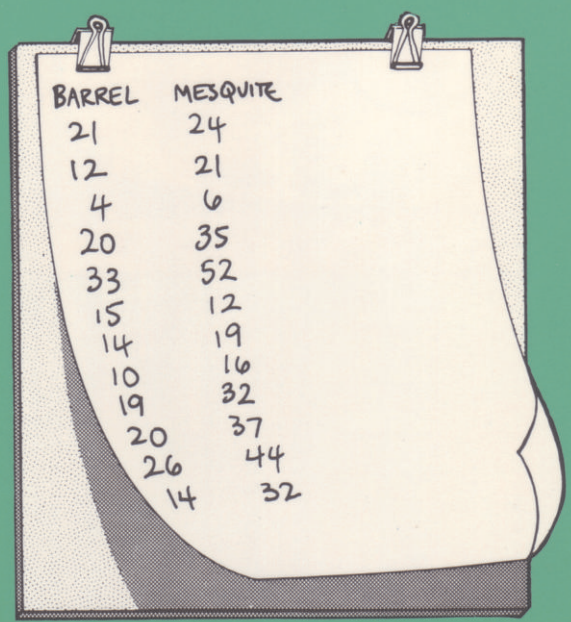
7. Now select a second kind of common plant and stand next to it. Ask the kids to repeat the process of searching for the nearest plant of the designated type, standing next to it, and counting the number of steps back to you. Record and label the results on the data board.

8. Repeat this "rolling the cactus wheel" procedure with two or three other kinds of plants.

Calculating Population Densities

Note: This section assumes a group size of twelve youngsters. Wherever you see 12 in the text, substitute the number of kids in your group.

1. Divide the group into pairs and give each pair a column of figures (i.e. the columns of figures under "Barrel Cactus" and the other plants surveyed) to average. Tell the teams to add the column of 12 numbers (i.e. numbers of strides) and to divide the total by 12 (the number of plants). The result is the average distance (measured in strides) of the 12 plants from the "hub" plant.



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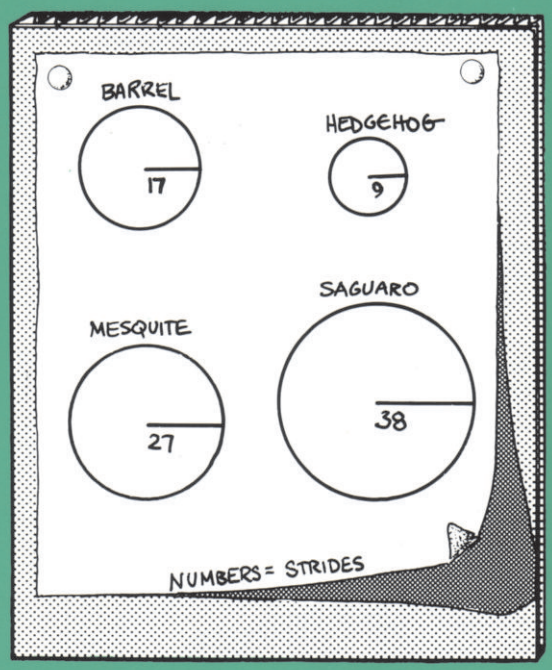
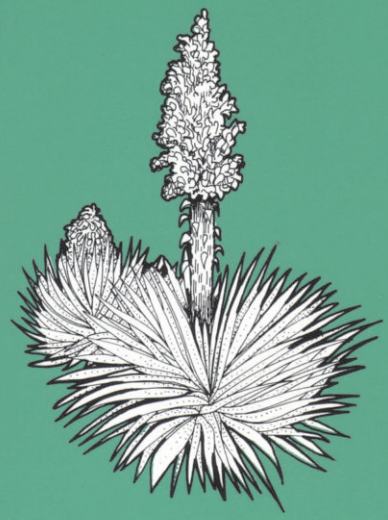
2. Explain that each group of plants the youngsters found is a plant population. Define ***population*** as a group of organisms of one kind that lives in the same area. Add that the average distance of each kind of plant from the hub can be used to compare the abundance or ***population density*** of each kind of plant surveyed. Point out that there is a high-density (close together) population of people around you. If all the youngsters were spread out over 100 square kilometers, they would represent a low-density (spread out) population.

3. To compare the population densities for each kind of plant, place a second sheet of paper on the data board, and use the pencil compass to draw separate circles that represent the different populations. (See the illustration.)



a. Use a scale of 1 cm for each stride. Use the metric ruler to set the compass at the average distance for one plant population and draw a circle.
b. Label the circle with the name of the population and the length of the radius. (The radius is the average distance.)
c. Repeat this process for all of the populations.



GETTING THE POINT ACROSS

1. Ask the youngsters to look at the cactus wheels on the data board. Which population of plants is the most dense? The least dense? (Note: The smallest circle represents the most dense plant population and the largest circle represents the least dense plant population.)

2. Compare the size (height) of the plants with their population densities. Do the smaller plants tend to have higher population densities than the larger plants have?

3. Does it look like the population density of any plant might vary from place to place? Why might that be?

4. What conditions do you think influence the population densities of the desert plants?

BRANCHING OUT

Determine the most and the least densely populated plants in an area. Then move to a different site and "roll the cactus wheel" for these same two kinds of plants. How do the population densities at the second location compare with those at the first site? How do you account for any differences?

Cactus Wheel
Action Card

1. Does your plant have spines? Are the spines all the same or are they of different sizes?

2. Does your plant grow alone or in groups?

3. Are there any other plants growing under or close to your plant?

4. What evidence can you find that your plant might be food for an animal? What kind of animal?

5. How does your plant reproduce? Can you find seeds or pieces of plant starting to grow?

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