Quadrant Method

Objective:

To enable students to use the quadrant method for studying communities while calculating the density and frequency of species in a particular community.

Time:

This lab will take approximately 1 1/2 hours to complete from sampling to calculations.

Materials:

- 10 hula hoops
- 50 m tape or meter stick
- Marking flags

Background Information:

Learning to sample communities is a basic concept in Environmental Science. Scientists can use tag and release sampling techniques to count species such as deer. They can use mark and recapture to sample for insects. In order to sample for plants, scientists take small quadrants and estimate the types, species, and numbers of plants in a given area.

Procedure:

(The following procedure describes sampling in a grassland environment. If a grassland is not available in your area, you may substitute other community types with a slight modification of procedure.) Other communities may include forest floor, chaparral, or mixed conifer forest, beach dunes, etc.

. Divide the class into groups of two to three students. (All 10 hula hoops must be thrown out and the plants counted.) Each group will count the plants in one quadrant in the field and will provide the rest of the class with its totals when all students return from the field.
. The teacher will find five major plant species that are common in the community. The class will designate them as Species A, Species B, and so on, and will record them in Data Tables. (Be certain the entire class uses the same letter to represent the same species.)
. Assist instructor with plant classification chart or weblinks to classification of species for various areas. Also differentiate between monocot and dicot plants
. Lab would be more useful if drawings of common examples of plants were included
. Define the total study area by measuring the desired area (i.e., for our 100-square-meter plot, measure 10 meters to a side and mark each corner with a flag).
. udents should stand on the edge of the study area, close their eyes, and throw the nula hoop into the area randomly. The area that each group will study will be determined by where the hula hoops land.
. Count all individual plants belonging to the five species.

. Put your results into a spreadsheet or on the board and then enter the rest of the class results on your Data Table. Each group in the class should record the number of plants counted by species in each quadrant surveyed in the community.
. Complete the calculations and answer the questions.

Formulas:

Density = $\frac{\text{Number of individuals}}{\text{Area sampled}}$

Frequency = $\frac{\text{Number of quadrants in which a species occurs}}{\text{Number of quadrants examined}}$

Relative density = $\frac{\text{Density of a given species}}{\text{Density of all species}} \times 100$

Relative frequency = $\frac{\text{Frequency of a given species}}{\text{Frequency of all species}} \times 100$

Data and calculations:

Data Table 1

Quadrant #	Species A	Species B	Species C	Species D	Species E	Total
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
Total						

. Find the total density for all plants in all quadrants:

a. Add up the total number of plants: _____ plants
b. Add up the total number of quadrants: _____ sq. meters
c. Divide A by B to find the total density = (A/B) = _____ plants/m^2
(Put this number in all of the rows in column 4 in Data Table 2.)

. Determine the relative density of the five species (i.e., the density of a species relative to the other species):

a. Fill in column (1) for the five species using the information from Data Table 1.
b. Divide the total number of plants in column 1 by the total number of quadrants in column 2 for each species and put the answers in column (3).
c. Divide column (3) by the total density (column 4) to find the decimal density number; enter your results in column (5).
d. Multiply each row by 100 to convert the decimal density to a percent relative density. (Hint: The sums of the relative densities should be very close to 100%.) Enter your results in column (6). (Relative density can be thought of as percent coverage of plants in the area.)

Data Table 2

Species	(1) Total no. of plants	(2) Total no. of quadrants (m^2)	(3) Species density/m^2 (1) ÷ (2)	(4) Total density (plants/m^2)	(5) Decimal density no. (3) ÷ (4)	(6) Relative density (%)
A		10				
B		10				
		10				
D		10				
E		10				

3. Determine the total frequency for all the quadrants sampled:

a. How many quadrants had plants? _____
b. How many quadrants were surveyed? _____
c. Divide A by B to find the total frequency = (A/B) = _____ (Enter this number in all of the rows in column 4 of Data Table 3.)

Determine the relative frequency of each plant species:

a. Record the number of quadrants that had each particular species in column (1).
b. Divide column (1) by (2) to get a species frequency; enter your results in column (3).
c. Divide species frequency (column 3) by the total frequency (column 4); enter your results in column (5).
d. Multiply each row by 100 to change the decimal frequency of each species to a relative frequency; enter your results in column (6). (Relative frequency can be thought of as the chance of getting this plant in the quadrant if thrown out randomly.)

Data Table 3

Species	(1) Number of quadrants species occurs in	(2) Total no. of quadrants	(3) Frequency of species (1) ÷ (2)	(4) Total frequency	(5) (3) ÷ (4)	(6) Relative frequency (%) (5) x 100
		10				
		10				
		10				
		10				
		10				

Analysis:

1. Did all quadrants contain at least one species of plant? Were any quadrants devoid of plant life?

2. Based on the relative density of each species, which plant is the most dominant? Does this correspond with your answers to Question 1?

3. Based on the relative frequency of each species, which plant occurs most frequently? Is this the same species that was most dominant? Why or why not?

4. According to the relative frequency of each species, are the plants in the community uniformly distributed, randomly distributed, or clumped in groups? (Use Figure 6.3 on page 152 of your te help you answer this question.)

5. What is the relationship between density and frequency? Can a species of plant have a high rel density but a lower relative frequency, or vice versa?