Exploring Your World

Quadrat Sampling 101

National Science Education Standards

- Standard C: *Life Sciences* — Populations and ecosystems.
- Standard C: *Life Sciences* — Diversity and adaptations of organisms.
- Standard E: *Science and Technology*— Understandings about science and technology.
- Standard F: *Science in Personal and Social Perspectives* — Populations, resources, and environments.
- Standard F: *Science in Personal and Social Perspectives* — Science and technology in society
- Standard G: *History and Nature of Science* — Nature of science.

OVERVIEW

Students plan and conduct a simple sampling activity to estimate the population of grass plants in an area.

OBJECTIVES

Students will:

1. Understand the importance of sampling in science.
2. Learn how to set up a quadrat.
3. Improve their observation skills.

SUBJECTS

Science, Math, Language Arts

VOCABULARY

estimate, sample, grid, population, quadrat

TIME

50 minutes

MATERIALS

field log; notebook, or notepaper; pencil or pen; string; bamboo skewers; ruler, yardstick, or tape measure; quadrat; grid paper

BACKGROUND

You have just been given the task of finding out how many dandelions or how many blades of grass are on your school grounds. How would you go about finding out? Your problem is similar to the problems scientists face all the time. How many whooping cranes are in existence? How many deer in a forest preserve? How many compass plants are in a section of prairie? You might solve your problem by getting down on your hands and knees and counting every dandelion on the school grounds. This might take you a very long time but if done carefully would give you a precise answer.

It is often unrealistic for a scientist to count every organism in her/his research area. What scientists often do is to work with a sample, a small section or plot of their research area. From their sample the scientist can then estimate many things about their research area without having spent all the time necessary to count each organism.

Selection of a **study site** is the first step in a field investigation of the forest environment. Obviously, scientists establish study sites in areas with properties they want to study. It is recommended that you select more than one site in order to replicate the study. A choice of several sites of different management history or successional stage will allow you to compare differences in what the students sample. You can consult with the US Forest Service, the state department of forestry, certified foresters, or university scientists about appropriate locations for your study site. If you work at a private site make sure your obtain appropriate permits for use. If possible, choose a site that is close to the road for easy access. This can come handy in case of an emergency or if you want to visit the site more often to resample your plots. Students can build and post a simple sign at their study site to notify visitors of an ongoing investigation.

When scientists investigate a forest it is not feasible to take measurements (**sample**) from the entire area. For example, it would expensive and time-consuming and often unnecessary to measure all trees in a 50-acre forest to estimate the average diameter or age of trees in this area. Instead, scientist select **sample plots** or **points**. These are locations uniformly or randomly distributed throughout the study area. Scientists then take measurements or sample these areas and extrapolate their results to the entire study site and other similar areas. Study plots can be square, rectangular or circular in shape. Sometimes, scientists do not establish permanent plots but instead they sample along a transect line. For example, in vegetation studies, they may want to count the number of plants that touch a sampling line stretched for many meters through the forest. Keep in mind several basic rules that scientists use to obtain a more representative characterization of the vegetation they sample:

- ✿ Two-dimensional plots such as squares and circles give you a better information about the plant community at each point of observation than linear transect plots.
- ✿ You are better off if you sample several smaller plots than one large plot at your study site.
- ✿ If you want to increase the accuracy of your sampling then increase the number, not the size of your sample plots.

ACTIVITY

1. Make a square-foot quadrat like the one shown here. **Make** marks every 2 inches along the four inside edges. (To use metric measures, make the quadrat 25 centimeters long on each inside edge. Measure off 5-centimeter marks on each of those edges.)

2. Choose a grassy area to study—a backyard, part of a baseball diamond, or some other grassy place. The area should be roughly a square or a rectangle. (Get adult help in figuring out the area, in square feet, of the grassy plot.)

3. Use a tape measure or yardstick to **measure** the four sides of the whole grassy square or rectangle, in feet.

4. Using grid paper, **draw** a scale map of the area:

One grid square = 1 square foot of your area.

Mark the measurements on this plot map.

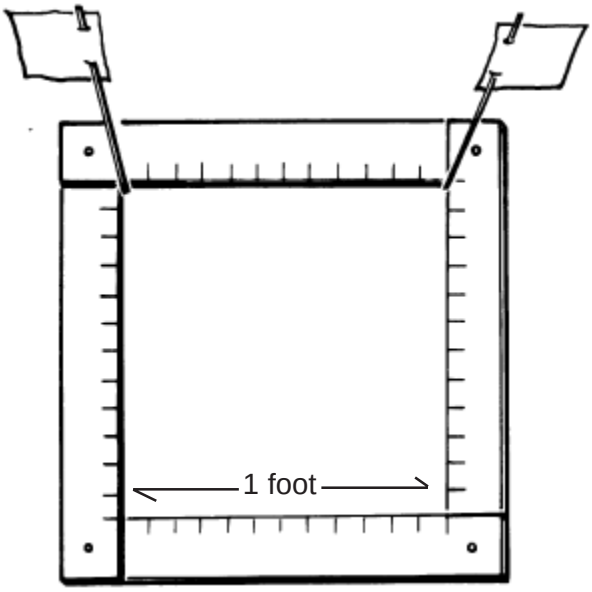
5. How large is your area in square feet? You can find out in one of two ways:

a. WAY #1: **Count** grid squares within the borders drawn on your map.

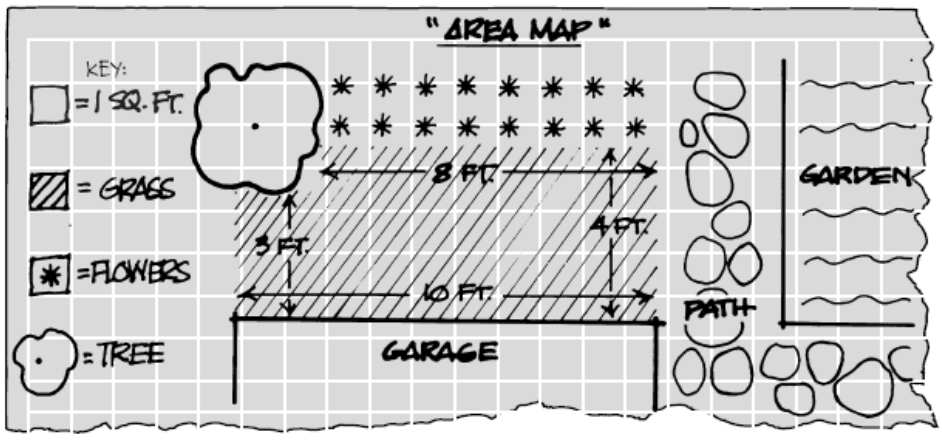
b. WAY #2: **Multiply** the width (in feet) times the length (in feet) of your area.

WIDTH (in feet) X LENGTH (in feet) = AREA (in square feet)

Record the area in your field log.



*You can build a simple quadrat out of study cardboard or light wood strips. Cut four strips of equal size. The **interior** of the quadrat should measure 1 foot X 1 foot (or 25 cm X 25 cm if you choose metric). With an indelible marker, mark your strips at 2 inch intervals (or 5 cm). Secure the corners with glue and let dry. A wooden quadrat will be more durable, but cardboard will work well for limited use.*

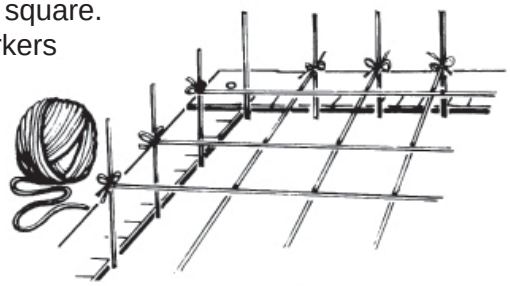


Activity (continued)

Now you'll estimate how many grass plants there are in that plot. To take a random sample, **turn** your back to the place and **toss** the quadrat over your head.

7. Wherever it falls, **place** one skewer at each corner of the quadrat's inside square: This is your study area. **Mark** its approximate position on your plot map.

8. Place a bamboo skewer every 2 inches along the quadrat's inside square. **Connect** the bamboo markers with string.



9. Draw the string grid in your log. Choose one of the 2-inch squares. **Mark** the square that you chose on your drawing.

10. a. Count the number of grass plants within that square. To be accurate, you need to count grass stems, not the number of grass blades. **Find** stems by pulling back the blades (or leaves) of grass and reaching down to soil level. **Record** this number.

b. Count the number of 2-inch squares in your quadrat. **Record** this number.

c. Multiply the number of grass plants in one square by the total number of squares in the quadrat. This total is the estimated number of grass plants in the quadrat.

a. *NUMBER OF GRASS PLANTS IN 2-INCH SQUARE*

b. *X* *NUMBER OF 2-INCH SQUARES IN QUADRAT*

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c. *ESTIMATED NUMBER OF GRASS PLANTS IN QUADRAT*

11. How many grass plants are in your whole plot? To **find out**, multiply again:

ESTIMATED NUMBER OF GRASS PLANTS IN QUADRAT

X *NUMBER OF SQUARE FEET IN WHOLE PLOT*

ESTIMATED NUMBER OF GRASS PLANTS IN WHOLE PLOT

12. Take two more random samples (repeat Steps #6 through #10 two times). With each new sample, estimate how many grass

plants are in your whole plot (do Step #11 two times).

Observations and Conclusions

1. Look again at the 2-inch squares within the three quadrats where you counted grass (your samples). Then look at the whole plot. Do the samples seem to be exactly like the whole plot? Describe any differences you see.

2. You made three estimates for total number of grass plants. Were they all the same?

Conclusions, based on observation:

a. Do you see any reasons why these three estimates may not be accurate? Please explain?

b. How might you use the three to come up with an estimate that's more accurate? Hint: To find an average…

ADD THE THREE SAMPLES

Sample A: 12,123
Sample B: 9,892
+ Sample C: 23,611
TOTAL: 45,626

DIVIDE BY THE NUMBER OF SAMPLES

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15,208 R2
3)45,626
 -3
  15
 -15
   06
   06
    026
   -24
     2
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EXTENSIONS

Try estimating the sizes of other populations. For example, estimate the population size of your school. Select one sample classroom. Count the number of students in it. Count the classrooms in your school. Multiply the two numbers. Check with your teacher or principal and see how accurate your estimate is. What factors might influence accuracy?

ASSESSMENT

1. Have student teams present their survey findings in a class presentation.

2. Have teams prepare a site report that documents there findings, their process and ways to improve their survey methods.

CREDIT

This activity is adapted with permission from Facts on File . Facts on File is a company that offers an extensive collection of curricular materials for educators. This activity is from their new Junior Environmental Activities on File series. Go to *http://www.factsonfile.com/* for more information about this award-winning environmental education curriculum.

Student Page

Name _____

Our Findings

Legend

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