Environmental Systems and Societies Name:

Estimating Producer Populations Using Quadrats

Learning goal: You will be able to estimate the population size using a quadrat and estimating percent cover.

Success criteria: You will create a data table of the autotrophs in your ecosystem and estimate the percent of your ecosystem covered with them.

Background: When ecologist are trying to understand the structure of an ecosystem they create pyramids to graphically illustrate the relationships in the ecosystem. However, before they can construct these pyramids they need data to use as a guide. The data will include the type of organisms found in the ecosystem, the feeding relationships, the collective biomass of each trophic level and the estimated population size of each species. Unless your time is unlimited, you need to sample an area or a population rather than counting every organism within it. Ecologists make a big assumption when they sample a population, that is they assume the sample is representative of the whole population. To minimize the error inherent in such an assumption they carefully plan their sampling to include:

* A standard sampling method and unit of measure.
* A criteria for what to count.
* How many samples they need.
* Where will they collect the samples from.

The standard sampling unit: The population (or abundance) of plants and sessile animals (animals that cannot move in their adult stage, e.g. barnacles, sea anemones, coral) can be estimated by sampling using a quadrat. A quadrat is a square (or rectangle) of a specific size, which can be divided into smaller subsections. The size of the quadrat depends upon the size of the organisms being counted. If you are sampling tree populations, you will need a much bigger quadrat than if you are sampling lichen on the trunk of a tree.

So how do you know the right size to make the quadrat? To determine the best size to make your quadrat you will need to make several different sized quadrats. As you survey each one record the number of populations found in each size. Plot these on a graph with quadrat size on the x-axis and number of species on the y-axis. When your line graph evens out (the number of species no longer increases), then you know that is the correct size for your study.

How do you know how many quadrats to make? The method is just like the one described in the preceding paragraph--As you increase the number of samples, plot the number of species found. Number of quadrats on the x-axis and the number of cumulative species found on the y-axis. When this number is stable, you have have found all species in the area.

Where do you collect the samples from? There are several ways to decide where to put your quadrats.

1. You can be random about it. There are two ways to do this, but both require you to number your subsections. The first way is to use a random number generator (found on google). The second way is to have an corresponding number of pennies to the number of quadrats required and just toss them on your map. The quadrats with a penny are the ones you sample.
2. But sometimes there are clear areas that are different such as the edge of a lake. In this case we do what is called a stratified random sampling. We follow the method described in step 1, but we divide the quadrats proportionally between the two areas that are different.
3. The final way is along a rope marked at intervals and laid carefully across the area to be sampled. You might use this to look at changes in organisms as a result of changes along an environmental gradient, e.g. zonation along a slope, a rocky shore or grassland to woodland, or to measure the change in species composition with increasing distance from a source of pollution. Continuous sampling records every species on the line but, more often, systematic sampling at set distances is used. Often this is widened out to a belt transect instead of a line and quadrats are placed at intervals along the belt. This is an interrupted belt transect.

Now that you have gained an understanding of how to set up quadrats to sample plant populations here is the assignment:

I want you to take a full sheet of newspaper. Identify the different fonts on the page. Each font (we will count bold or italics as a different font) will become a type of plant. Assign your font a species name (from the autotrophs from your food web). Using the techniques described above determine the size and the number of quadrats required. Then do a random sampling and determine the percent cover for each plant in the ecosystem. Create a data table with the species name and the percent cover.

When you have the numbers in a data table add a column, multiply each percentage by 1000 and that will be your population for each producer. You will turn these numbers into the base for your pyramid of numbers. You will need to add all the numbers together to get a number for the whole trophic level. The next class we will learn how to estimate population size of animals so we can add those trophic levels to the pyramid.

What you need to be able to show me:

* the base level of a pyramid of numbers with the total number of autotrophs.
* A data table with species name, percent coverage, and population estimate.
* A data table and graph showing the number of species versus different sized quadrats.
* A data table and graph showing the number of species versus different number of quadrats.

ENJOY!