LESSON 33

Sampling Invasive Plant Populations

OBJECTIVES

Students will understand why scientists use plot samples to estimate the population size or relative abundances of invasive plants. They will know how to estimate the density and percent cover of invasive species in an area, and how to analyze data they collect and interpret the results.

METHOD

Students learn about noxious weed species in their area, and devise a comparative question that can be answered by sampling plant populations. They learn how to randomly select plot locations, make inexpensive and simple quadrat frames, and collect data on the density and percent cover of plants within the plots. They analyze and interpret their results.

MATERIALS

✎ Stakes and flagging (if you want to mark the plot locations for the future)

✎ Random numbers table or phone book

✎ ½ inch PVC tubing and elbows, made into quadrat frames (see instructions in ***Procedure***)

✎ **Plot Sampling Data Forms**

BACKGROUND

Field studies of plant populations can be used to answer questions such as:

- Are certain species more abundant in some habitats than in others?
- Do human factors such as soil disturbance affect plant populations or distributions?
- Do some species have negative or positive associations with other species?
- Do management actions affect plant populations?

Scientists and land managers often do not have the time or resources to count all the plants in the entire area of interest. Instead, they collect samples of data from the area and use it to extrapolate the information to the rest of the site. In order to select a sample that is likely to accurately characterize the area, samples are usually located randomly. This prevents conscious or subconscious bias on the part of the data collector to select certain sites. There are several methods used to sample plants, and which one is used depends on a number of factors, including what you want to know and how much time you have to collect data.

Common methods of sampling include plot sampling and transect sampling. Transect sampling involves sampling plants along a line or transect, and is useful for estimating the relative abundance of species, especially as you move

Grade level: 9-12
Subject Areas: Biology
Duration: 3 class periods, travel time/independent research time
Setting: Classroom and field site
Season: Spring, Summer or Fall
Conceptual Framework Topics: Plant distributions, habitat, invasive species management, plot sampling techniques

from one area to another. Plot sampling allows you to estimate the density and percent cover of different species. This kind of sampling can be used to compare populations in different areas, habitats, or under different disturbance levels, or to monitor the effectiveness of various management regimes.

Density is measured by counting each "stem" (or individual plant) in the plot of a particular species. This works well for plants that are relatively large and easy to distinguish between individuals, and not so numerous that it would take all day to count them. For small, abundant plants or those difficult to distinguish among individuals, percent cover is estimated. You must use the same type of measurement for the same species in all plots you wish to compare. However, you can use one measure for one species in a plot and the other measure for a different species, as long as you don't want to compare those species to one another.

In this lesson your students will use plot sampling to answer a question about plant populations.

PROCEDURE

1. You will first need to determine what question you would like to explore about invasive plant populations. If you have surveyed for invasives in an area (see kNOweeds *Lesson 32: Weed Detectives: Surveying for Invasive Plants*), your students may be able to brainstorm questions about habitats or disturbance based on their observations. Or if your class is taking measures to control weeds in an area (see kNOweeds *Lesson 43: Invasive Plant Management: Plan to Action*), you could use these sampling techniques to monitor your effectiveness by collecting data before and after control efforts.

2. Once your class has developed a question they wish to answer and any appropriate hypotheses and predictions to go along with it, discuss with them the importance of random sampling. (For lessons on random sampling, go to http://www.math.uakron.edu/amc/DataAnalysis_Statistics/OldDataStat/RandomSampling.pdf). Discuss the impossibility of counting every plant in an area, and the need to sample subsets of an area.

3. Have your students learn to identify invasive species in your part of Montana. You may want to direct them to the following sites:
http://www.weedawareness.org/weed_id.html
http://mtwow.org/Weed-ID.html

4. Build your quadrat frames. Simple and inexpensive frames can be constructed from PVC tubing and sleeves (½-inch tubing is strong but still lightweight). You will need 4 sections of tubing cut into 1-meter lengths (it is easily cut with a hacksaw) and 4 right-angle elbows. (Depending on the

kNOweeds

abundance and size of plants you are sampling, you can create smaller or larger frames if you wish). You can easily take one side of the frame off in the field to place it under large plants such as shrubs if you need to, and frames can be transported in pieces in backpacks. You can also mark increments off on the frame in permanent marker to help estimate cover or help remember which part of the plot has already been sampled.

5. Decide on the sampling method(s) you want to use (density and/or cover) for each species. Percent cover is the estimate of the percent of ground within the plot that is covered by the plant species. This can be difficult to estimate; have students practice estimating this in plots on the school grounds. Different students will come up with somewhat different estimates. Try dividing the plot into quarters with string or imaginary lines to help them get a better idea of percentages. They can divide them into even smaller divisions until they get a more consistent "feel" for what constitutes 5%, 10%, and so on. You can also consider having them estimate cover categories: 1-10%, 10-25%, etc. They may also have questions about stem counts, such as what to do if the plot frame lies right on top of a plant. Decide as a group on a consistent way to handle these issues; they probably shouldn't spend an inordinate amount of time on such details as long as they try for consistency. Stress the need to make any comparisons "fair."

6. Select the general area you want to sample and determine how many plots you will sample (try to sample at least 10). Divide students into pairs or small groups, with each group responsible for one or more plots. When you are ready to set up your plots, have students locate plots using random numbers from a random number table or phone book. Start at one "corner" of the study area and have students walk the random number of steps in one direction along the edge of the area. Choose another number and walk into the area that many steps. This is the corner of the first plot. You may want to mark the corners of plots with stakes and/or flagging, depending on where it is, if you plan to re-sample the area, and if you have permission to do so. Repeat the plot selection process for the rest of the plots, being careful not to step on plants in the plot.

7. Have each group put the quadrat frame down at the plot location and begin sampling, filling out the Plot Sampling Data Form.

8. Emphasize to students the importance of cleaning shoes and clothing of any seeds or other plant parts after completing their sampling so as not to spread weeds.

9. After all data are collected, have students share their information and calculate the average density or percent cover for each species. They can use these results to answer their question about invasive species.

kNOweeds

Name _____

Plot Sampling Data Form

Study Area: _____

Plot I.D. Number: _____   Date: _____

Sampled by: _____

Type of habitat sampled (e.g., wetland, forest, riparian, grassland, roadside, etc.) and brief description:

Type of plot (e.g., disturbed or undisturbed, wet or dry, etc., depending on what you are comparing):

Fill out a row of the table below for each species of invasive plants you find.

Plant Species	Density (# per plot)	OR	Percent Cover