Chapter 4

Estimating Plant Densities Using Transects

Matthew E. Andersen

Department of Biological Sciences
University of Nevada, Las Vegas
Las Vegas, Nevada 89154-4004

Matthew Andersen received his B.A. in 1986 from Sonoma State University, California. He was an honors student for his undergraduate work and is now a doctoral student at UNLV. He has worked in biomedical research and as a pathologist's assistant. His Ph.D. research is on the molecular systematics of fish, particularly speckled dace, *Rhinichthys osculus* (Cyprinidae).

Reprinted from: Andersen, M. E. 1993. Estimating plant densities using transects. Pages 51-56, *in* Tested studies for laboratory teaching, Volume 14 (C. A. Goldman, Editor). Proceedings of the 14th Workshop/Conference of the Association for Biology Laboratory Education (ABLE), 240 pages.

Contents

Introduction

This laboratory provides the framework for a productive introductory biology field trip. The instructor has the opportunity to familiarize the class with their neighboring vegetation while introducing them to a basic method in ecology. By conducting the same measurements in varying habitats, the basis for quantification of observable differences is possible. Metric area measures are utilized.

On arriving at the first location, the instructor should introduce major plant types and their names. For example, in the Mojave desert habitat surrounding UNLV, I show students four or five perennial plants they are responsible for. I tell them there are three names possible for each plant: common name, genus, and specific epithet. They will be asked to respond to test questions with two of the three names. I have regularly been pleasantly surprised at how many students are successful in mastering the names in this fashion. Students work in groups, ideally of four individuals. They extend a meter tape out to define a 20-m transect. Using meter sticks, they measure the widths (in meters) of the major perennials intersected by the transect and record their data. This is repeated at two additional elevations, where changes in the vegetation types and quantities can be observed. The calculations are made in the following laboratory period.

The following **materials** are required for Week 1: meter tapes (minimum of 20 m in length; 1 per group) and meter sticks (2 per group). In Week 2 each student will require the following: calculator and approximately 10 sheets of graph paper.

Student Outline

The field trip you are taking is designed to acquaint you with the study of *ecology*. Ecology is the study of the relationships of organisms or groups of organisms to their environment. An organism's environment includes not only physical factors such as light, temperature, rainfall, humidity, and topography, but also all living things that directly or indirectly influence the life of the organism, such as parasites, predators, mates, and competitors. Anything not an integral part of a particular organism is part of that organism's environment.

A group of organisms of the same species in its native situation constitutes a *population*. Likewise, all the populations in a given area constitute a *community*. The community and the physical environment function together as an ecological system, or *ecosystem*. The place where an organism would normally live is defined as its *habitat*. The ecological *niche* is the functional role of the organism in the ecosystem.

On this trip we will visit three different ecological areas as we go in altitude from approximately 400 m to 1500 m. You will be responsible for determining what major populations comprise each community. Each community will have different environmental factors influencing it.

In order to have a starting point to begin your analysis, you must consider food chains and remember that the kinds and numbers of *producers* (plants) influence the other organisms in the

chain. It is the *abiotic* (non-living) environmental factors that influence the lands of producers found in any given area.

Most ecological communities have *indicator plants* that may dominate the area. The indicator plants are usually shrubs or trees – *perennial* plants that keeps growing from year-to-year. In the spring and fall, you may find an abundance of smaller flowering plants in these areas. These plants, *annuals*, live only a relatively short time (less than a few months), flower profusely, and leave behind their seeds for the next year. Because they are not present year-round, they are not used as indicator plants of an ecological community.

Ecologists compare areas by use of indicator or dominant plants. The type or size of plant may vary from one area to another so they use the amount of plant cover and the densities of plants to compare one area with another.

Objectives

Conceptual: Understand how plant communities change with different environmental factors.

Procedural: Become familiar with the techniques employed in vegetation sampling.

This is a 2-week laboratory exercise. During the first week you will collect data on plant communities at different elevations along Blue Diamond Road. Each of these communities is subjected to different environmental conditions (precipitation, temperature, wind, etc.). During the second week you will calculate various measures of each community and then compare the plants and community structures of the various sites.

Procedure: Week 1

The vegetation analysis will be conducted using the line intercept technique. In a general sense this technique involves laying out a transect line and then measuring various parameters of the plants intercepted by this line.

At each stop/location:

1. Work in groups of four to six. Have two people be the transect markers, and the remaining individuals be identifier/recorders.

2. The group should make an overview observation of the test area. Walk around the area and look at the vegetation and decide which perennial plants are the most predominant in the area as a whole. Use the illustrations provided by your instructor to determine the four most dominate species in the area. Each of the identifier/recorders will be responsible for one of these species.

3. The transect markers will measure out a 20-m transect (line) parallel to the lines laid out by other groups. The identifier/recorders will move along this line and record the length of the transect line that intersects any individual plants belonging to their species, as well as the maximum width of the plant perpendicular to the transect line. These data should be recorded in Table 4.1. One of the identifier/ recorders will also be responsible for measuring the length of the transect line which intersects bare ground.

4. The transect markers should rate the soil at their feet as either sandy, rocky or gravely. Feel the soil to determine if dry, damp, or wet.

5. Now look at other plant growth besides perennials. Are any grasses or small flowering plants (annuals) growing along the transect line? Are they abundant or sparse? Do you see them only under shrubs or out in the open? Make any appropriate comments.

6. Finally have all team members look very closely along the transect line to see if there is any evidence of animal life (e.g., footprints, droppings, chewed leaves, insects, burrows). Don't forget to check under rocks.

7. From these data and observations you will be able to make ecological descriptions of each area.

Table 4.1. Data collection sheet.

Date:	Locality:	
Observer name:	Transect length:	
Species	Length of intercept (m)	Maximum width (m)

Procedure: Week 2

During the second week of this laboratory exercise you will calculate various parameters of community structure from the data collected during Week 1. These data will then be used to compare the three communities which you visited.

1. Summarize the data collected during Week 1. For each species in each location determine and record (in Table 4.2) the following:

   (a) Total number of individuals encountered (*N*).

   (b) Total of reciprocals of maximum plant widths (1/*M*).

2. With these values three measures of vegetational composition can be obtained for each location visited: (a) density, (b) dominance of cover (as a percentage of ground surface), and (c) total coverage. The formulae for these measure are given below.

$$Denisty = \left(\Sigma \frac{1}{M}\right)\left(\frac{unit\ area}{total\ transect\ length}\right)$$

$$Dominance\ or\ cover\ = \frac{total\ of\ intercept\ lengths\ for\ a\ species}{total\ transect\ length}\ x\ 100$$

$$Total\ coverage = \frac{(\ total\ transect\ length\ ) - (\ total\ bare\ ground)}{total\ transect\ length}\ x\ 100$$

3. Once these values have been determined compare the plants found in the different communities and the structure of those communities. Use the combined data from all the groups in your lab section.

4. For any species recorded from at least two sites plot the density and per cent cover for that species at each of the locations from which it was recorded. On a separate figure plot the total coverage at the three different elevations.

5. Answer the following questions:

   (a) Are the dominant plants species the same at all three locations?

   (b) How do the densities of plant species found at several sites differ from one site to the next?

   (c) How does the per cent ground cover for species found at several sites differ from one site to the next?

   (d) How does the total coverage differ between the three sites visited?

Acknowledgments

I am indebted to Roberta Williams and Bill Wischusen for their guidance and assistance with the presentation of this exercise.

Table 4.2. Summary of vegetational measurements obtained by the line intercept technique from three elevations/sites.

Date: Elevation:
Observers:

Species	N	$\Sigma(1/M)$	Density/ha	% Cover

Date: Elevation:
Observers:

Species	N	$\Sigma(1/M)$	Density/ha	% Cover

Date: Elevation:
Observers:

Species	N	$\Sigma(1/M)$	Density/ha	% Cover