Monitoring Manual

for Grassland, Shrubland and Savanna Ecosystems

Volume II: Design, supplementary methods and interpretation

by
Jeffrey E. Herrick, Justin W. Van Zee,
Kris M. Havstad, Laura M. Burkett and Walter G. Whitford

with contributions from
Brandon T. Bestelmeyer, Alicia Melgoza C., Mike Pellant,
David A. Pyke, Marta D. Remmenga, Patrick L. Shaver,
Amrita G. de Soyza, Arlene J. Tugel and Robert S. Unnasch

USDA - ARS Jornada Experimental Range
Las Cruces, New Mexico

Printed 2005

Publisher:
USDA-ARS Jornada Experimental Range
P.O. Box 30003, MSC 3JER, NMSU
Las Cruces, New Mexico 88003-8003
http://usda-ars.nmsu.edu

ISBN 0-9755552-0-0

Distributed by: The University of Arizona Press
Tucson, Arizona, USA
800-426-3797
www.uapress.arizona.edu

Cover: RB Design & Printing
Las Cruces, New Mexico 88001

Cover illustration:
Collecting Line-point intercept data
in a south-central New Mexico desert grassland.

Chapter 15

Density, frequency and Line-point intercept alternative methods

This chapter includes a brief discussion of density and frequency methods, and alternative Line-point intercept methods. Density and frequency are generally used for individual species of interest, although it is possible to use them for all species encountered in an area. For more information on density and frequency, see Elzinga et al. 2001.

Density

Plant density is simply the number of individuals per unit area. It is particularly useful for monitoring vegetation where cover varies widely during the season (e.g., annuals). It is not appropriate where individuals are difficult to distinguish (e.g., many rhizomatous grasses).

Method. Count the number of individuals of the species of interest that have at least 50 percent of their base in a subplot (quadrat) or other plot of defined size. The subplots should be large enough so that most of them include more than one individual of each species that is being monitored. Multiple noncontiguous subplots are randomly or systematically located in the plot.

Calculations. Add the number of individuals found in each subplot. Divide this sum by the area of subplots to generate the average density (number per square meter or square feet). To convert to the number per hectare, multiply the density by 10,000 (if working with square meters). To convert the density in number per square feet to the number per hectare, multiply by 107,639.

Frequency

Plant frequency is the proportion of subplots out of all subplots of a specified size that contain a particular species. It is a rapid and useful indicator of the spatial distribution of different species, and is appropriate for the same types of species as density (above). Two methods for collecting frequency data are the rapid method and the intensive method. The rapid method generates data for just one species. The intensive method produces data for many species. Data collected with the intensive method (below) can generate information about fine-scale associations among species.

Rapid method. Define and use only one subplot size. The subplot should be small enough to ensure that the species of interest does not occur in all subplots. This is because if the species occurs in all subplots, frequency will always be 1.0. Randomly or systematically locate and establish subplots. Count the number of subplots in which at least one individual of the target species is located. A species must have at least 50 percent of its base in a subplot to be considered present.

Intensive method. Define and use only one subplot size. Subplot size should be selected based on the species of greatest interest. Randomly or systematically establish subplots. Make a comprehensive species list. For each subplot, record whether or not each species occurs in that subplot. A species is recorded for a subplot if at least 50 percent of at least one plant base falls within the subplot.

To increase speed, use a species list with tally marks or dot boxes. A dot box consists of four dots in a square connected by four lines with an "X" in the middle. Each dot and each line represents a plot in which the species occurs, for a total of 10 individuals per complete dot box.

Calculations. Divide the number of subplots in which the species occurs by the number of subplots searched. This is frequency.

Line-point intercept alternatives

Line-point intercept can be used to generate more indicators than virtually any other monitoring method. Adding height measurements (Option B in Table 15.1) generates additional information on vegetation structure. Options D through H take less time, but generate fewer indicators.

Typical applications. Line-point intercept (Table 15.1: A-E) should be used where precise, repeatable measurements are required. Options D and E can reduce time where changes in species composition (e.g., grass to shrub, or annuals to perennials) are not important. Option D is ideal where the primary objective is to document changes in erosion resistance.

Figure 15.1. Line-point intercept with height alternative.

Step-point intercept methods (Table 15.1: F-H) require less time because no tape is required. They can be relatively accurate *provided that a pin is used in place of the toe of your boot.* Using the toe can significantly overestimate cover because plants are pushed over by the foot, which artificially increases measured cover data.

Quadrat-point intercept. Where quadrats (or subplots) are being used along a line (e.g., to monitor frequency or density), points on the four corners of the frame can sometimes be used to replace four points along the line, provided that the points are sufficiently far apart. The minimum distance varies with plant community. To determine whether or not this method is appropriate, randomly select six transects and compare means and variability for both methods. For example, a 50 m transect with 100 points with a point every 50 cm would be compared with a 50 m transect with 25 frames (four points each), one frame located every 2 m.

Table 15.1. Alternative Line-point intercept methods comparison. See also quadrat-point intercept below.

		Modifications from Standard (Alternative A = Quick Start)			------Indicators------				
Alternative		**Method**	**Form**	**Time**	**Accuracy & Repeatability**	**Canopy/ Basal**	**Comp-osition**	**Structure**	**Ht.**
		----------Line-point intercept----------							
A	Standard (Quick-Start)	None	None	Mod. to High	High	Yes/Yes	Yes	Yes	No
B	Standard + height	Add height of highest intercept at least every 10th point	Add height column	High	High	Yes/Yes	Yes	Yes	Yes
C	Standard + dead	Only record each species once, but if you intercept a dead plant part for a given species, place a check in the "Dead" column	Change "Height" in Option B to "Dead"	Mod. to High	High	Yes/Yes	Yes	Yes	No
D	Total, canopy, basal cover only	Record first intercept + any plant basal hits	Delete lower canopy layers	Mod. to Low	High	Yes/Yes	No	No	No
E	Total cover only	Record only first intercept (canopy, litter, rock, etc...)	Delete lower canopy layers and soil surface	Low	High	Yes/No	No	No	No
		----------Step-point Intercept with Pin----------							
F	Standard (Quick-Start "Semi-quantitative alternative"	Pace transect, drop pin 15 cm (6 in) in front of toe	None	Mod.	Mod. to Low	Yes/Yes	Yes	Yes	No
G	Total, canopy, basal cover (species not recorded)	See D and F	See D	Low	Mod. to Low	Yes/Yes	No	No	No
H	Total cover (species not recorded)	See E and F	See E	Very Low	Mod. to Low	Yes/No	No	No	No

Line-point Intercept with Height Data Form

Page ____ of ____ **Shaded cells for calculations**

Plot: _____ Line No.: _____ Observer: _____ Recorder: _____

Direction: _____ Date: _____ Intercept (point) spacing interval = _____ cm (_____ in)

Pt.	Top canopy	Ht.	Lower canopy layers			Soil surface	Pt.	Top canopy	Ht.	Lower canopy layers			Soil surface
			Code 1	Code 2	Code 3					Code 1	Code 2	Code 3	
1							26						
2							27						
3							28						
4							29						
5							30						
6							31						
7							32						
8							33						
9							34						
10							35						
11							36						
12							37						
13							38						
14							39						
15							40						
16							41						
17							42						
18							43						
19							44						
20							45						
21							46						
22							47						
23							48						
24							49						
25							50						

% canopy (foliar) cover = ____ canopy pts (1st col) x 2 = ____%

% bare ground* = ____ pts (w/ NONE over S) x 2 = ____%

% basal cover = ____ plant base pts (last col) x 2 = ____%

Top canopy codes: Species code, common name, or NONE (no canopy)

Lower canopy layers: Species code, common name, L (herbaceous litter), W (woody litter, >5mm [$^1/_4$ in] diameter)

Unknown species codes:

AF# = annual forb
PF# = perennial forb
AG# = annual grass
PG# = perennial grass
SH# = shrub
TR# = tree

Soil surface codes (do not use litter):

Species code (for basal intercept)
R = rock fragment (>5mm [$^1/_4$ in] diameter)
BR = bedrock
M = moss
LC = visible lichen crust on soil
S = soil, without any other soil surface code
EL = embedded litter
D = duff

*Bare ground occurs ONLY when Top canopy = NONE, Lower layers are empty (no L), and Soil surface = S