APPENDIX C

U.S. FISH & WILDLIFE SERVICE

ESTIMATING WILDLIFE HABITAT VARIABLES@

Biological Services Program

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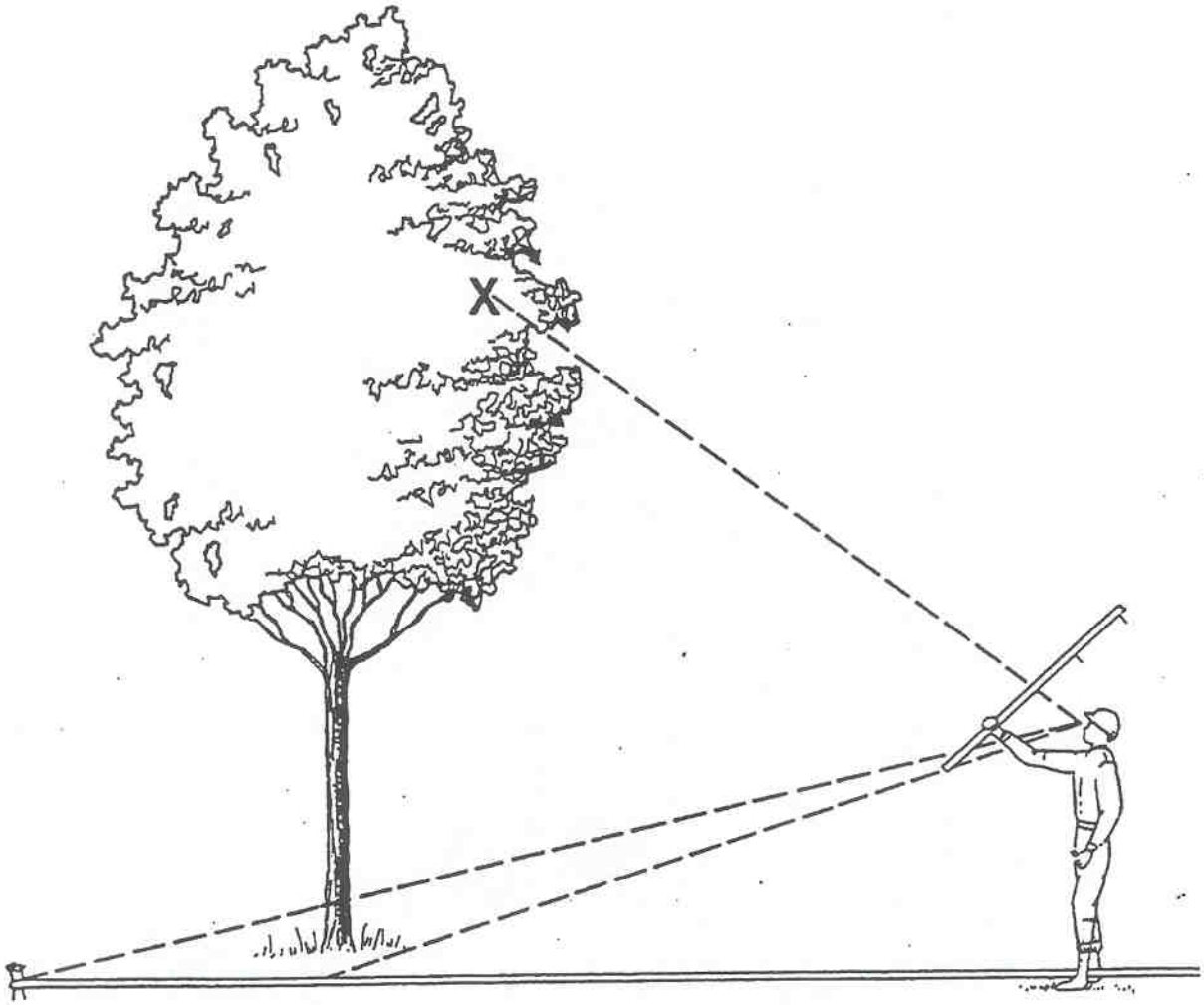

Fish and Wildlife Service

U.S. Department of the Interior

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ESTIMATING WILDLIFE HABITAT VARIABLES

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Use: In forestry to calculate total volume of harvestable wood on the site.

Suggested techniques: Line Intercept (p. 40); Bitterlich Method (p. 43); Calculated Cover (p. 50); Point Intercept - Step Point (p. 50); Point Intercept - Pin Frame (p. 52). See Table 3 for a comparison of these techniques' suitability under various study conditions.

2.3.3 Canopy Cover (and Brushpile Cover and Bare Ground)

The projection used in the definition of cover (section 2.3.1, above), is the general outline of plants, ignoring minor gaps between branches and holes in the center of the plant. This is typically used for single strata (layers) in the vegetation. It is hard to define the general outlines when plants have overlapping branches. Hence, it is used most when plants do not overlap much. It is also called "crown closure." Brushpiles can be treated with this concept. Bare ground is sometimes calculated by subtracting absolute cover values for all the plants in the community from 100%. Under this approach, litter is often treated as "bare ground", and patches of bare soil underneath trees and shrubs are not counted as "bare ground" (see also Foliar Cover, section 2.3.4). Canopy cover is used in forestry to calculate total volume of wood on a site from aerial photos, and in wildlife management as an indication of the amount of vegetation in various strata (and, hence, to indicate the availability of food and cover).

Suggested techniques: Line Intercept (p. 40); Bitterlich Method (p. 43); Calculated Cover (p. 50); Point Intercept - Step Point (p. 50); Point Intercept - Pin Frame (p. 52); Point Intercept - Spherical Densiometer (p.)55; Point Intercept - Canopy Camera (p. 56); Ocular Estimation of Cover (p. 58); and RS: Crown Density Scale; Bitterlich Method; Ocular Estimation of cover. See Table 4 for a comparison of these techniques' suitability under various study conditions.

2.3.4 Foliar Cover (and Litter Cover and Bare Ground)

The projection used in the definition of cover (section 2.3.1, above) is for each separate plant part. Thus, gaps between leaves or branches do not contribute to the measured cover. As usually applied, "foliar" also includes stems, flowers, and all other plant parts. Litter on the ground, e.g., dead leaves and branches, is usually treated with this concept. What constitutes "litter" must be clearly defined, because there is a continuum between freshly fallen plant parts and highly decomposed material whose source can no longer be recognized. Bare ground is sometimes measured directly in terms of this concept. However, bare ground is also sometimes measured wherever there are no plant parts or litter close to (above) the surface, even though taller plant parts (e.g., a tree's branches are present above the point) (see also Canopy Cover, section 2.3.3). Foliar and litter cover are used in forestry and range management to predict erosion rates; foliar cover is used in ecology to predict primary production.

Suggested techniques: Point Intercept - Step Point (p. 50); Point Intercept - Pin Frame (p. 52); Point Intercept - Spherical Densiometer (p. 55); Point Intercept - Canopy Camera (p. 56); Ocular Estimation of Cover (p. 58).

3.14 CALCULATED COVER

3.14.1 Variable Estimated

Canopy or Basal Cover of trees or shrubs(pp. 5, 7).

3.14.2 Description

In summary, the results of a measurement of density and of mean canopy area or basal area for the same site are used to calculate cover.

If data are available on density (Techniques 3.20 or 3.21) and mean canopy or basal area for plants (Techniques 3.1 and 3.23) on the same site, these estimates can be combined to estimate cover. The following formula applies:

$$C = 100\ AD$$

where C = cover (%)
A = mean area per plant (area)
D = density of plants (number per unit area, where the area units are the same as area for A, above)

3.14.3 Accuracy

The accuracy of the calculated cover is a function of the accuracies of the constituent measurements of density and mean area . For basal area of trees, it is usually medium to low in accuracy. For canopy cover, it tends to have low accuracy, due to deviations of canopy shape from circular.

3.14.4 Application Notes

This technique is most appropriate where the separate measures of density and canopy or basal area are required for other purposes. A convenient sampling approach is to combine T-square Nearest Neighbor Sampling (p. 62) for density with Crown Diameter (p. 15) or Diameter Tape (p. 18) and Averaging (p. 69). Each plant measured for the T-square sampling can also be used for area measurement. If the average area per plant is not required, it is usually preferable to measure cover with the Line Intercept (p. 40), Bitterlich Method (p. 43), Point Intercept-Spherical Densiometer (p. 55), or RS: Crown Density Scale at the same time density is being measured. One convenient way to do this is by combining a Line Intercept (p. 40) for measuring cover with a belt Quadrat (p. 65) for measuring density. The line transect forms one side of the belt quadrat.

3.15 POINT INTERCEPT-STEP POINT

3.15.1 Variables Estimated

Canopy cover of herbs, shrubs or trees, basal cover of herbs, foliar cover of low herbs, litter cover, or bare ground (pp. 5, 7).

3.15.2 Description

In summary, data are collected by recording what is present at (or directly above) the toe of a boot as one walks a line transect.

A V-shaped notch is cut in the sole at the toe of one boot of the person that makes the measurements (see Equipment section, below). Within the site, one or more line transects are laid out (see Appendix A). The observer walks along the transect and records a sample point each time the notched boot is placed on the ground. It is essential to walk straight and maintain a constant step length irrespective of barriers, briar patches, change in slope, and other factors. For each sample point, the observer records the item which occupies the line of sight for the majority of the notch. The observer must take care to exclude litter and vegetation which is pushed out of its undisturbed position. It is often desirable to record separately for each point the data for herbs, shrubs less than eye height, and taller trees and shrubs. The taller plants can be sampled by visual estimation of the location of a vertical line above the notch, or using the Vertical Rod (p. 39), which is more accurate.

General calculations are as follows for each category (X) recorded (e.g., plant species):

$$\% \text{ ground cover} = \frac{\text{no. hits on X}}{\text{total no. sample points}} \times 100$$

This method has been modified by the addition of a pointed pin or rod (R. Francis, pers. comm.). The toe of the boot is lifted upward, and the pin or rod can be slid through the notch and used to select the sample point.

3.15.3 Accuracy

This technique is rather crude. Errors in pacing the transect invariably occur, usually resulting in underestimation of shrubs and other obstacles. In addition, it is often hard to eliminate errors caused by moving vegetation out of its original position. The pointed rod may alleviate some of this bias (R. Francis, pers. comm.). Estimation of taller vegetation (e.g., trees) by line of sight is even less accurate than the results for low grasses and forbs, but using the Vertical Rod (p. 39) will give results whose accuracy is comparable to those for herbs. Error can also result from the uniform spacing of points. This can be minimized by using several short transects, rather than one or two long ones.

3.15.4 Application Notes

This technique permits collection of many data points quickly. This is an advantage if the site is relatively heterogeneous. One person can easily apply this alone. It is best in grasslands, savannas, and open forests on even terrain. If conditions make it difficult to walk in a straight line, or if accuracy is needed, an alternative technique should be used such as: Line Intercept (p. 40); Bitterlich Method (p. 43); Point Intercept-Pin Frame (p. 52), Spherical Densiometer (p. 55), or Canopy Camera (p. 56); or RS: Crown Density Scale.

3.15.5 Training

This technique can be learned in less than 1 hr. A 1/2 hr practice session in the field is usually adequate (J. Hagihara, pers. comm.). Complex communities may require 4 hr of practice (R. Francis, pers. comm.).

3.15.6 Equipment

Pointed rod (option). One notched boot (The notch should be in the tip of the toe, 0.3 cm (1/8 in) wide and 0.15 cm (1/16 in) deep.

3.15.7 Cost

One-half to 1 hr per 200 m transect.

3.15.8 References

USDA Forest Service 1970.

3.16 POINT INTERCEPT-PIN FRAME

3.16.1 Variables Estimated

Basal, canopy, or foliar cover of low shrubs and herbs (pp. 5, 7).

3.16.2 Description

In summary, a frame is repeatedly set up in the site. The frame is used to identify specific points on the ground. Each point is scored for what is present.

A random point is selected within the site (see Appendix A). This point locates one end of the frame. Next, a random direction is selected (see Appendix A) to determine the location of the other end of the frame. The frame is erected by pushing the points into the ground or by using the support rod (see equipment section below).

A sample point is determined either by sighting through the frame's crosshairs, or by lowering a pin until its tip first contacts a plant or the ground (Fig. 14). What is contacted is recorded for each point. For basal cover, it may be necessary to look beneath the first contact (or extend the pin) until it is clear what is contacted at the specified height for measurement. For canopy cover, it must be decided whether or not the point lies within a plant canopy's projection. After reading all the points in the frame, a new location is selected and the process is repeated.

Cover is calculated by:

$$\text{Cover of X (\%)} = \frac{\text{Number of hits on X}}{\text{Total number of points}} (100)$$