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E. Line Intercept Method

1. *General Description* The Line Intercept method consists of horizontal, linear measurements of plant intercepts along the course of a line (tape). It is designed for measuring grass or grass-like plants, forbs, shrubs, and trees. The following vegetation attributes are monitored with this method:

   - Foliar and basal cover
   - Composition (by cover)

   It is important to establish a photo plot (see Section V.A) and take both close-up and general view photographs. This allows the portrayal of resource values and conditions and furnishes visual evidence of vegetation and soil changes over time.

2. *Areas of Use* This method is ideally suited for semiarid bunchgrass-shrub vegetation types.

3. *Advantages and Limitations* The Line Intercept method is best suited where the boundaries of plant growth are relatively easy to determine. It can be adapted to sampling varying densities and types of vegetation. It is not well adapted, however, for estimating cover on single-stemmed species, dense grassland situations, litter, or gravel less than 1/2 inch in diameter. It is best suited to estimating cover on shrubs.

4. *Equipment* The following equipment is needed (see also the equipment listed in Section V.A, page 31, for the establishment of the photo plot):

   - Study Location and Documentation Data form (see Appendix A)
   - Line Intercept form (see Illustration 12)
   - Hammer
   - Permanent yellow or orange spray paint
   - Two stakes: 3/4 - or 1-inch angle iron not less than 16 inches long.
   - Two tapes: 100- or 200-foot, delineated in tenths and hundredths, or a metric tape of the desired length
   - Compass
   - Steel post and driver

5. *Training* A minimum of training is needed to make sure the examiners understand how to lay out baselines and transects and how to make the measurements. The examiner must also be able to identify the plant species.

6. *Establishing Studies* Careful establishment of studies is a critical element in obtaining meaningful data (see Section III).

   a Site Selection The most important factor in obtaining usable data is selecting representative areas (critical or key areas) in which to run the study (see Section II.D). Study sites should be located within a single plant community within a single ecological site. Transects and sampling points need to be randomly located within the critical or key areas (see Section III).

b Pilot Studies Collect data on several pilot studies to determine the number of samples (transects or observation points) and the number and size of quadrats needed to collect a statistically valid sample (see Section III.B.8).

c Number of Transects Establish the minimum number of transects to achieve the desired level of precision for the key species in each study site (see Section III.B).

d Length of Transect The length of a transect is based on the density and homogeneity of the vegetation. If the vegetation is sparse, a longer transect is needed. Transects may be any length (eg. 100 feet, 200 feet, or even longer).

e Study Layout Line Intercept data can be collected using either the baseline or linear study design described in Section III.A.2 beginning on page 8. The baseline technique is the recommended study design.

(1) The study location stake is placed at the beginning of the baseline. After determining the bearing of the study, a stake is placed at the end of the baseline. Transects are run perpendicular to and at random distances along the baseline. Transect location stakes are placed at the beginning and end of each transect. The distance between the stakes dependents on the length of the transect. The height of the stakes depends on the height of the vegetation. (Directions for randomly selecting the location of transects to be run off of a baseline using random number tables are given in Appendix D).

Transect location stakes may be left in place as permanent markers or removed at the conclusion of the study. Permanently marking transects will result in greater power to detect change.

(2) Stretch the transect tapes between stakes as close to the ground as possible, with the zero point of the tape aligned on the baseline (the beginning point of the transect). Do not allow vegetation to deflect the alignment of the tape.

f Reference Post or Point Permanently mark the location of each study with a reference post and a study location stake (see beginning of Section III).

g Study Identification Number studies for proper identification to ensure that the data collected can be positively associated with specific sites on the ground. (see Appendix B).

h Study Documentation Document pertinent information concerning the study on the Study Location and Documentation Data form (see beginning of Section III and Appendix A).

7. *Taking Photographs* The directions for establishing photo plots and for taking close-up and general view photographs are given in Section V.A.

8. *Sampling Process* In addition to collecting the specific studies data, general observations should be made of the study sites (see Section II.F).

Proceed down the tape stretched along the transect line and measure the horizontal linear length of each plant that intercepts the line. Measure grasses and grass-like

plants, along with rosette-forming plants, at ground level. For forbs, shrubs, and trees, measure the vertical projection of the foliar cover intercepting one side of the tape. Be sure not to inadvertently move the tape to include or exclude certain plants. If the measurements are made in 10ths and 100ths of feet, the totals are easily converted to percentages. The measurements are recorded by species on the Line Intercept form (Illustration 12).

9. *Calculations* Make the calculations and record the results on the Line Intercept form (see Illustration 12).

a Cover

(1) Calculate the percent cover of each plant species by totaling the intercept measurements for all individuals of that species along the transect line and convert this total to a percent.

(2) Where the measurements are made in 10ths and 100ths of feet along a 100-foot transect, the totals for each species are the cover percentages.

(3) Calculate the total cover measured on the transect by adding the cover percentages for all the species. This total could exceed 100% if the intercepts of overlapping canopies are recorded.

b Composition With this method, species composition is based on the percent cover of each species. Calculate percent composition by dividing the percent cover for each plant species by the total cover for all plant species.

10. *Data Analysis* It is important to realize that each transect is a single sampling unit. For trend analysis permanent sampling units are suggested. If permanent transects are monitored, use the appropriate paired analysis technique. Use either a paired t-test or the nonparametric Wilcoxon signed rank test when testing for change between years. When comparing more than two sampling periods, use repeated measures ANOVA. If the transects are not permanently marked, use the appropriate nonpaired test.

11. *References*

Brun, Jorge M. and Thadis W. Box. 1963. Comparison of line intercepts and random point frames for sampling desert shrub vegetation. J. Range Manage. 16:21-25.

Buckner, D.L. 1985. Point-Intercept Sampling in Revegetation Studies: Maximizing Objectivity and Repeatability. Paper presented at American Society for Surface Mining and Reclamation Meeting, Denver, CO. 1985.

Canfield, R.H. 1941. Application of the line interception method in sampling range vegetation. J. Forestry 39:388-394.

Canfield, R.H. 1944. Measurement of grazing use by the line intercept Method. Jour. For. 42(3):192-194

Hanley, Thomas A. 1978. A comparison of the line-interception and quadrat estimation methods of determining shrub canopy coverage. J. Range Manage. 31:60-62.

Kinsinger, Floyd E., Richard E. Eckert, and Pat 0. Currie. 1960. A comparison of the line-interception, variable-plot, and loop methods as used to measure shrub-crown cover. J. Range Manage. 13:17-21.

USDI, Bureau of Land Management. 1985. Rangeland monitoring - Trend studies TR4400-4.