

Monitoring Manual

for Grassland,
Shrubland and
Savanna Ecosystems

Volume II: Design, supplementary methods and
interpretation

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

Chapter 10

Plant species richness (modified Whittaker approach)

“Plant species richness” is the total number of species in an area. It is one indicator of biodiversity. This Plant species richness method is based on Stohlgren et al. (1995) and Bull et al. (1998). The Plant species richness method is very time intensive. The number of measurements may be reduced, depending on information requirements and time availability. A minimum estimate of species richness can be calculated from Line-point intercept data. The Line-point intercept estimate of species richness can be supplemented by a thorough search for exotics and other species of interest throughout the plot area.

Note: precise unit conversions are used in this chapter to facilitate calculations.

Materials

- The same transect(s) used for Line-point and Gap intercept
- 100 m (328 ft) tape
- Metal stakes and hammer for marking plot corners
- At least 120 m (400 ft) of twine to mark plot borders
- Clipboard, Plant Species Richness Data Forms, pencil(s)

Standard methods (rule set)

1. Set up plots.

Rules

- 1.1 Lay out the 10 by 30 m plot.
- 1.2 Anchor 100 m (328 ft) tape at point “a” on the plot, 5 m (15 ft 5 in) and 90° away from the “0” end of the transect (Fig 10.1).
- 1.3 Pull the tape out, crossing the “0” end of the transect, to 10 m (32 ft 10 in) (point “b”) and wrap it around another stake (Fig. 10.2).
- 1.4 Continue pulling the tape out, parallel to the transect. At 30 m (98 ft 5 in), insert another stake (point “c”). The tape will read 40 m (131 ft 3 in) at this stake. Continue to point “d.”
- 1.5 Finish by pulling the tape back to point “a.”

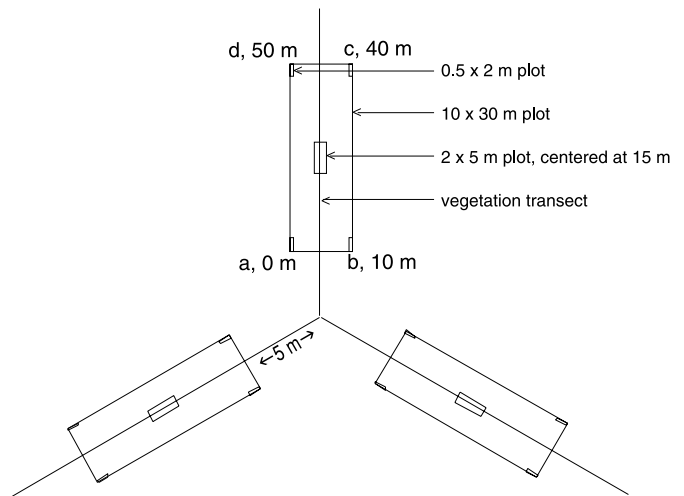


Figure 10.1. Species richness plots and their layout with respect to a monitoring plot. Not to scale.



Figure 10.2. Pulling out tape to set up the species richness plot.

- 1.6 The tape should read 80 m (262 ft 6 in) once you are done.
- 1.7 Pull in the tape, but leave all the stakes in place.
- 1.8 Anchor twine at one of the stakes and string it out where the tape was.
- 1.9 Continue laying out the smaller plots, using twine, as in Figure 10.1.

Species richness

- 1.10 Center the 2 x 5 m (6 ft 7 in x 16 ft 5 in) plot at the 15 m (49 ft 3 in) position on the vegetation transect.
- 1.11 Place four 0.5 x 2 m (1 ft 7 in x 6 ft 7 in) plots in the corners of the large (10 x 30 m or 32 ft 10 in x 98 ft 5 in) plot.
- 1.12 Repeat steps 1.1 through 1.11 for the two remaining vegetation transects, if desired. Due to the high sampling costs, it is generally more cost-effective to sample fewer transects (one can be sufficient) at more locations.

2. Record number of species in each plot.

Rules

- 2.1 Make all observations on all species richness plots on one transect at a time. Complete observations on all transects within a plot. Then move to the next transect.
- 2.2 Use one data form for each transect.
- 2.3 Start with the smallest (0.5 x 2 m or 1 ft 7 in x 6 ft 7 in) plots.
- 2.4 Record all species that occur in a small plot under the appropriate column on the data form (Fig. 10.3).
- 2.5 At least half of a plant base must be inside the plot boundary to be recorded. Plants with less than half their bases in the plot are not recorded.
- 2.6 Record the species in the "Species code" column of the Plant Species Richness Data Form, using one of the following: the PLANTS database species code (<http://plants.usda.gov>); a four-letter code based on the first two letters each of the genus and species; or the common name.



Figure 10.3. Record each plant species within each of the four small (0.5 x 2.0 m or 1 ft 7 in x 6 ft 7 in) plots.

(Relatively) rapid alternatives

The simplest alternative is to use the minimum estimate provided by the Line-point intercept. However, this will miss most species. Another alternative is to search the 10 x 30 m plot without subplots. This is appropriate if the species-area curve is not required.

- 2.7 Move to the next small plot and record all species in that plot in the next column.
- 2.8 Repeat 2.1 through 2.7 until all four small plots are sampled.
- 2.9 Search the 2 x 5 m (6 ft 7 in x 16 ft 5 in) plot and record all species detected.
- 2.10 Search the 10 x 30 m (32 ft 10 in x 98 ft 5 in) plot and record all species detected.
- 2.11 Make sure to include all species already found in the smaller plots in the list for the 10 x 30 m (32 ft 10 in x 98 ft 5 in) plot.

Plant species richness calculations

1. Measure species richness.

Rules

- 1.1 Count all species encountered in all the plots.
- 1.2 Each species is counted only once, no matter how many plots it occurs in.

2. Estimate species richness (not included on data form).

Rules

- 2.1 This should only be calculated by someone with an understanding of linear regression. It is based on the assumption that there is a linear relationship between the number of species and the log of the area for uniform areas.
- 2.2 Graph the number of species found in each plot against the log of the area of each plot (0, 1 and 2.5 for the 1, 10 and 300 m² plots).
- 2.3 The equation below can be used to predict species richness in a larger area *provided that the area is relatively uniform and that the plot is representative of the area.*

$$\text{Species richness} = \text{intercept} + (\text{constant}) \times (\log [\text{area}])$$

- 2.4 For monitoring, it is strongly recommended that only measured species richness be used.

Plant Species Richness Data Form

Shaded cells for calculations

Observer: *James Smith* **Recorder:** *Nancy Brown* **Date:** *29 September 2002*

Total number of plant species encountered in all plots: 33

Plant Species Richness Data Form

Page _____ of _____

Shaded cells for calculations

Monitoring Plot: _____ **Line:** _____

Observer: _____ **Recorder:** _____ **Date:** _____

[illegible]

Total number of plant species encountered in all plots:

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