Preliminary Studies in the Evaluation of Grassland Sampling Techniques in Tall-Grass Prairie Sites

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INTRODUCTION

Within a grassland, the diversity of growth forms and the fact that grassland plants are not randomly distributed has, thus far, proved to be a barrier to the development of a sampling procedure which does not show a bias for a particular growth form.

Many methods utilized for grassland analysis (Phillips, 1959; Brown, 1954) have been abandoned because of bias or the length of time required to secure reproduceable data.

I have initiated a study to evaluate sampling methods currently in use, as to their accuracy and reproduceability and the time required for sampling. It is hoped that this will ultimately lead to the development of a sampling method which will correlate frequency, density, and yield.

METHODS OF ANALYSIS

This preliminary study involved the use of three sampling tools: (1) a modification of the line transect known as the meter line transect (Weaver and Clements, 1929); (2) a modification of the point-centered quarter method (Cottam and Curtis, 1956) developed by Dix (1958); and (3) the point transect method (Levy and Madden, 1933).

All readings were taken at ground level to insure consistency. A number of calculations can be made with data obtained by the methods; however, only relative density and relative frequency values are reported in this paper.

The nomenclature used is that of *Keys to the Flora of Oklahoma* (Waterfall, 1962).

The sampling for Site 1 was done by a graduate student, Mr. D. D. Plummer, who was familiar with the vegetation and about equally well-versed in the use of all three methods. The number of samples taken were based on figures reported as adequate by other workers (Clark and Evans, 1954; Whitman and Siggeirson, 1954; Kemp and Kemp, 1956; Dix, 1960). All samples were taken along established compass lines. All three methods were utilized on this site.

In Site 2, only the point-centered quarter and point transect methods were utilized. Sampling points were determined on a systematically random basis. Samples were taken by students who were only slightly familiar with either method. Identification of species was carefully supervised. A large number of samples was taken by each method to reduce the margin of error.

DESCRIPTION OF AREAS

Site 1 is a tall-grass prairie on a somewhat shallow soil (A horizon = 10 to 28 in. deep). It is mowed annually and contains little mulch. The species appear to be nearly randomly distributed.

The second site is a protected tall-grass prairie, heavily mulched, and with a more diverse vegetation than the first site. The A horizon is greater than 30 in. deep.

RESULTS

For purposes of clarity only the species of greatest abundance are reported. It can be seen (Table 1), that on the first site, correlations among sampling methods are very good. However, it is also noted that the dominants are of similar growth form. Few forbs or woody species occur in this prairie. Only nine species were sampled, eight grasses and one forb. It was noted that the point-centered quarter sampled a significantly higher number of "other" species. These were primarily single-stalked species such as *Panicum oligosanthes* var. *scribnerianum, Panicum virgatum,* and *Cyperus* sp.

TABLE I. RELATIVE DENSITY AND RELATIVE FREQUENCY VALUES OBTAINED BY THREE GRASSLAND SAMPLING METHODS IN A MOWED TALL-GRASS PRAIRIE SITE NEAR STILLWATER, OKLAHOMA.

Species	POINT-CENTERED Quarter (60 sets)		POINT TRANSECT (200 sets)		METER LINE TRANSECT (50 sets)	
	R. D.*	R. F.**	R. D.	R. F.	R. D.	R. F.
Andropogon scoparius	47.5	37.9	51.4	41.7	46.6	31.5
A. gerardi	15.0	17.6	17.6	20.5	16.3	21.0
Sorghastrum nutans	19.6	21.5	20.7	23.1	21.9	21.7
Bouteloua hirsuta	10.4	12.0	7.9	10.8	11.6	20.3
Others	7.5	10.0	2.4	3.9	3.6	5.5

*R. D. = relative density
**R. F. = relative frequency

It took one sampler and a recorder 2.5 hours to run 2000 points with the point transect. Of these, 420 were hits on species. With the point-centered quarter, it took 1.5 hours to run 60 sets or 240 hits. It took 2.4 hours to run 50-meter line transects which obtained 320 hits. On a per hour basis, the point transect ranked first with 168 hits per hour; the point-centered quarter was second with 160; and the meter line transect, third, with 133 hits per hour.

In the protected prairie (Table 2) some inverse relationships between sampling methods were observed. Point transect data indicate *Andropogon scoparius* to be the major dominant with *A. gerardi* second. Point-centered quarter data show the reverse. The latter method also shows an abundance of forbs. *Artemisia ludoviciana* would be considered an important species. Point transect results show no single forb to the abundant.

TABLE 2. RELATIVE DENSITY AND RELATIVE FREQUENCY VALUES OBTAINED BY TWO GRASSLAND SAMPLING METHODS IN A PROTECTED TALL-GRASS PRAIRIE SITE NEAR STILLWATER, OKLAHOMA.

Species	POINT-CENTERED QUARTER (200 sets)		POINT TRANSECT (370 sets)	
	R. D.	R. F.	R. D.	R. F.
Andropogon scoparius	25.4	23.8	36.6	30.0
A. gerardi	34.1	29.2	33.7	31.4
Sorghastrum nutans	19.1	15.5	13.9	10.5
Paspalum ciliatifolium	3.4	4.0	2.2	2.4
Artemisia ludoviciana	4.9	7.0	0.9	1.1
Other grasses	7.6	10.7	10.1	21.6
Other forbs	5.5	9.8	2.6	3.0

Despite the disagreements in measurement of abundance, approximately the same number of species were sampled by each method.

It took one sampler and a recorder one hour to run 620 points of which 76 were species hits by the point transect method. With the point-centered quarter method, the same personnel ran 22 quadrats or 88 hits per hour.

DISCUSSION

From these data and the previously mentioned related literature, certain generalities are indicated.

(1) The point-centered quarter, point transect, and meter line transect methods show a good correlation regarding dominants in tall-grass prairie sites if the vegetation is nearly uniform.

(2) The time involved in sampling equivalent numbers of species is not significantly different between the two point-methods. The meter-line transect is considerably slower.

(3) The point-transect basal contact method has been reported as favoring short grasses and bunch grasses, and under estimating single stalked grasses and forbs. This is not contradicted by these data.

(4) Both point methods give reproduceable data.

(5) Neither method correlates with yield data.

(6) The point-centered quarter method has been said to favor randomly distributed species such as single stalked forbs. These data indicate this possibility.

(7) Density figures are good only when random distribution occurs, so both methods may be lacking, since grassland vegetation is not randomly distributed.

It is thought, although by no means concluded from these preliminary data, that the point-centered quarter method may be extremely valuable in sampling where diverse growth forms exist, such as in a forest, where it may be desirable to sample trees, shrubs, and herbs by the same method. The point transect has proven to be extremely useful in measuring basal area of prairie vegetation. This is a very useful figure. It may be that utilizing an all-points contact method, whereby aerial as well as basal cover is measured, will overcome the under-estimation of single stalked species. These data are preliminary and it is hoped that future work may resolve some of the current discrepancies.

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