FREQUENCY DISTRIBUTION OF HILL PRAIRIE PLANTS

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Little remains today of the original prairie vegetation of Illinois described by Weaver (1954) and mapped by Vestal (1931). Study of remaining patches becomes increasingly difficult as prairie areas are engulfed by urbanization. While our floristic knowledge of prairie vegetation is considerable (Evers, 1955), more knowledge of spatial and successional relations of the vegetation are needed. Many undisturbed hill-prairies provide an adequate community for these studies. These prairies, dry grasslands on hills and bluffs bordering the Mississippi and Illinois Rivers, although areally restricted (usually less than an acre in extent), are geographically widespread throughout the state. This paper adds information about the spatial relations of the plants of one of these prairies. One of the largest of this type of prairie in the state occurs at the top of a south facing slope of a bluff bordering the Illinois River in Pere Marquette State Park, SE ¼ Sec. 9 T. 6 N., R. 13 W., Jersey County, Illinois. The slope of the prairie varied from 26 to 36 per cent. The soil, derived from a wind-blown loess, ranged from 50 to 65 per cent silt plus clay.

Methods of Study

All data came from a 30-meter square laid out in the middle of the prairie. The plot was subdivided into 900 square quadrats, one meter on a side. In each of these quadrats were placed several smaller square quadrats of the following sizes: ½ meter x ½ meter $(m/2)^2$; dm^2, cm^2, and a point. The $(m/2)^2$ quadrat was placed at random in this m^2 quadrat, and the smaller quadrats were nested within a regular fashion. Each frequency figure is based on 900 sample points, although only ninety of the quadrats were used for cover estimation.

The frequency figures, and the frequency curves, are based on two features: first, the rooted occurrence of the species; and second, on rooting and/or coverage alone of a portion of the quadrat. In other words, for coverage determination, foliage presence above the quadrat was sufficient for it to be considered present for frequency purposes.

Results

A total of 65 plant species were observed in the plot. These included 3 mosses, 1 lichen, 1 gymnosperm and 60 flowering plants. Of this assortment, only 6 species of grass were found, despite the fact that grasses completely dominated the herbaceous vegetation. The dominant grass species was *Andropogon scoparius*, a feature consistent with other hill prairies (Evers, 1955). Table 1 shows that coverage of this

single species exceeded that for all other plants combined. The other species were rooted between the clumps of this grass.

The high coverage values of *A. scoparius*, plus the consistent presence of this plant throughout the plot, resulted in high frequency values for the larger quadrats as shown by Table 2. Note that the frequency values for all species decrease as the size of the plot decreases and that the rooted values are consistently lower than the coverage values. Figures 1 and 2 illustrate these frequency values graphically.

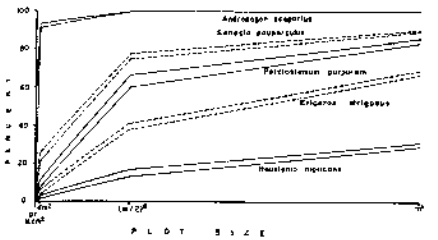

FIGURE 1.—Frequency curves for selected common prairie plants. Upper line represents frequency values based on coverage; lower line based on rooting.

TABLE 1.—Percent of Plant Coverage in 90 m² Quadrats for those with Coverage 0.2 percent or more.

Species	Percent Cover
Andropogon scoparius	53.5
A. gerardi and *Sorghastrum nutans*	3.1
Bouteloua curtipendula.....	1.6
Houstonia nigricans	1.6
Senecio pauperculus.....	1.0
Solidago nemoralis.....	0.9
Erigeron strigosus.....	0.7
Petalostemum purpureum..	0.7
Desmodium sessilifolium...	0.4
Kuhnia eupatorioides.....	0.2
Dermatocarpon hepaticum..	0.2

Several species were discovered that did not appear on the list of hill-prairie plants recorded by (Evers, 1955). The more common species that apparently favor the hill-prairie habitat are listed in Table 3.

DISCUSSION

The data show correlation between frequency and coverage in that those plants with the largest coverage also possess the highest frequency values. The exceptions occur with small

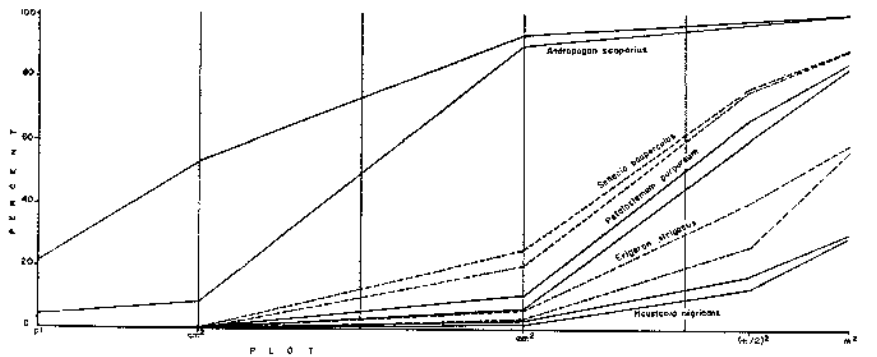

FIGURE 2.—Frequency curves for selected common prairie plants plotted on semi-logarithmic scale. Upper line represents frequency values based on coverage; lower line based on rooting.

TABLE 2.—Frequency Distribution of Most Common Plants by Quadrat Sizes for Rooted Plants (R) and Covered (C).

Species		Quadrat Size pt.	cm^2	dm^2	$m/2^2$	m^2
Andropogon scoparius	R	4.6	8.6	90.6	99.8	100
	C	21.3	53.4	93.4	99.8	100
Sorghastrum nutans & Andropogon gerardi	R	0.1	0.3	36.2	86.5	95.3
	C	1.0	3.2	40.4	88.2	96.6
Senecio pauperculus	R	0.0	0.0	20.3	75.9	88.5
	C	0.4	0.6	25.7	77.2	88.9
Weisia controversa	R	0.9	0.9	17.0	54.3	87.8
	C	0.9	0.9	17.0	54.3	87.8
Petalostemum purpureum	R	0.0	0.0	7.0	59.4	83.5
	C	0.2	0.3	11.1	66.0	85.5
Dermatocarpon hepaticum	R	1.0	1.7	8.5	39.6	68.9
	C	1.0	1.7	8.5	39.6	68.9
Erigeron strigosus	R	0.0	0.0	3.7	36.6	66.0
	C	0.3	0.7	6.2	40.8	68.9
Desmodium sessilifolium	R	0.0	0.1	3.6	36.3	56.8
	C	0.1	0.3	4.4	38.2	59.4
Houstonia nigricans	R	0.0	0.0	1.7	13.3	28.8
	C	0.1	0.3	3.4	17.0	30.6

TABLE 3.—Common Species from Pere Marquette Prairie not Listed by Evers (1955). Figures are Rooted Frequencies Based on 900 m^2 Quadrats. Nomenclature According to Jennings, 1951 (moss), Fink, 1935 (lichen) and Fernald, 1950 (vascular plants).

Species	Frequency of occurrence
Moss	
Weisia controversa	87.8
Lichen	
Dermatocarpon hepaticum	68.9
Vascular Plants	
Asclepias hirtella	0.7
Desmodium paniculatum	2.2
Lespedeza violacea	0.3
Spiranthes gracilis	3.3
Verbascum thapsus	2.2

plants such as *Weisia* and *Dermatocarpon* which have high frequency values, but little coverage. Conversely, large plants like *Kuhnia*, which have considerable coverage, have a spotty distribution and low frequency of occurrence.

Table 2 illustrates the dependence of frequency values on quadrat size, well illustrated by Cain and Castro (1959) and Evans (1952) and shows that the selection of optimum quadrat size can maximize frequency variation and provide more information. In this plot the dm^2 quadrat gives the widest range of values for the most common species.

The frequency curves illustrate the data in Table 2 graphically. The variability of these curves makes construction of a mathematical frequency equation difficult, yet this would be a far more desirable way to illustrate frequency data than a single frequency figure. The curves of very frequently occurring species show sharp breaks in the smaller quadrats, and an almost linear line over the larger values (fig. 1). This break disappears when the curves are drawn on semilogarithmic paper (fig. 2), and indicates that frequency log-area plotting should prove far more useful in detailed analysis of this relation.

Summary

This investigation revealed several additional features about the structure and composition of hill prairie vegetation. Little bluestem (*A. scoparius*) is the species with highest frequency and coverage values in this prairie. Seven heretofore unreported prairie species are added to the floristic hill prairie list of Evers (1955). The frequency values for all plants increased with quadrat size, but the coverage values were higher or equal to the rooted values.

Acknowledgments

The authors express appreciation to the Illinois Department of Conservation and to Mr. Studebaker, Pere Marquette Park Superintendent, for permission to carry out this study in the State Park; to Mr. R. Pursell, Botanist, Penn State School of Forestry, for determination of the mosses; to Dr. Mason Hale, Curator of Cryptogams, Smithsonian Institution, for the lichen determination; and to Dr. Robert Evers, Botanist, Illinois Natural History Survey, for determination of many of the vascular plants.

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Manuscript received May 24, 1962.