
The Quantitative Phenology of Two Plant Communities in Osage County, Oklahoma

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During different seasons of the year animal species frequently use different components of their habitats. Many times the reason for this is not readily apparent. In a study of the greater prairie chicken (*Tympanuchus cupido pinnatus*) this phenomenon was recognized and it was wondered whether the availability of green plants as food might not be a determining factor in their daily movements, at least during the winter months. Consequently this study was begun as an attempt to find plant phenological features influencing movements of animal species.

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The tall grass association of this study has been described by Anderson and Fly (1955) as the "Ordinary upland site" referring to the soil classification. It is defined as lands having sufficient depth of soil with medium or loamy texture and hence with suitable soil-plant moisture relations to support the type of vegetation usually considered climax.

The short-grass association of this study is Anderson and Fly's "Very shallow site" which is defined as lands having insufficient depth of soil for "normal" water storage, hence supporting under proper grazing a vegetation distinctly preclimax.

The study was carried out on the K. S. Adams Ranch in Osage County, Oklahoma, in two pastures approximately one mile apart. The plots were set out in pairs as the short grass sites are usually small interdigitations within the larger areas of the tall grass site.

The following results are based on a series of 10 one-square-meter plots placed at random in each plant community. The plots were marked with wooden stakes in two corners. They were analyzed once a month in the following manner. A plot frame consisting of 4 hardwood-sticks, 2 slightly longer than the other 2 and with holes at each end to receive stabilizing pins, was placed around the plot (Figure 1). All 4 sticks were marked in metric units. After the bounds of the plot were thus established, one of the sticks was removed and set at the 10 cm mark (Figure 2). The investigator then made estimations of the total green cover by species present within the space of a subplot measuring 1 m by 1 cm. After the completion of this subplot the two movable sticks were moved to the next 10 cm mark, and so on, until estimations of the entire plot were completed (Figure 3).

Data concerning the number of plant species present on the plots each month was thought to be of interest and is presented in Figure 4. The stippled columns represent the number of species present at each measurement period in the short-grass association, the hatched in the tall-grass association. These data show that in general there are more species present in the short-grass plots, and that during the months of April, May, and June the number of species in the short-grass plots was considerably higher than in the tall-grass plots. In October, November and December the number of species in the two plant associations was almost equal.

Figure 5 shows the average percent of the total plot covered by green foliar materials. A striking difference in the total green plant cover was noted in the months of March and April. The short-grass vegetation had fifteen and twenty-five percent more green plant materials available for the birds during these months. Kelting (1957) reports that burning favors growth of green plants after the second week in April. Apparently this may be related to the low growth form which would allow penetration of the sun's rays at an earlier date than the tall grasses would allow if not burned.

The total green cover on the short-grass association continued to be greater through the summer months, although the difference became smaller later in the year. With drought conditions one would expect that the reverse might be true, because of the shallow soils associated with the short-grass vegetative type. Precipitation during the investigation period was 4.4 inches below normal at the Pawhuska station (United States Department of Commerce, 1961).

Only in October, November, and December does the tall-grass association equal the short-grass association in quantity of green materials avail-

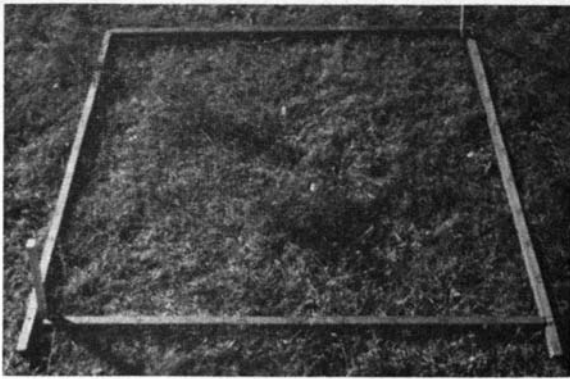


Figure 1. Setting the limits of the plot.

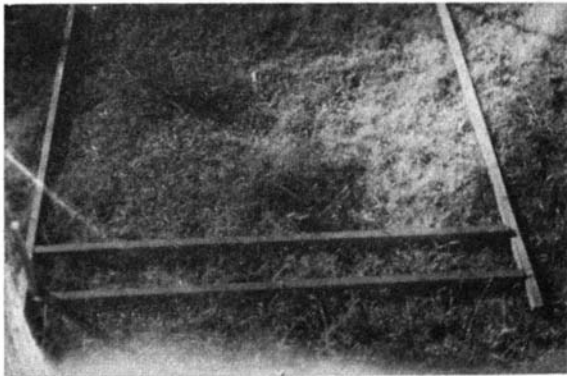


Figure 2. Setting up the first .1 meter subplot.

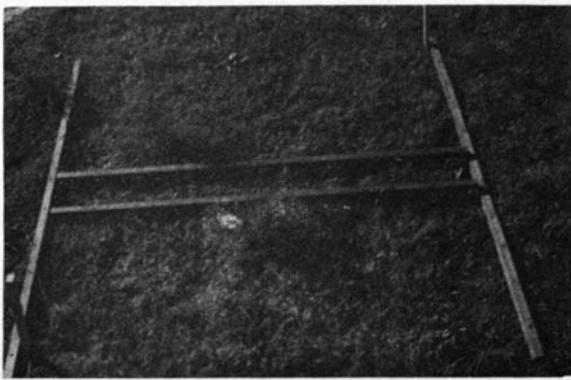


Figure 3. Moving the subplot through the remainder of the plot.

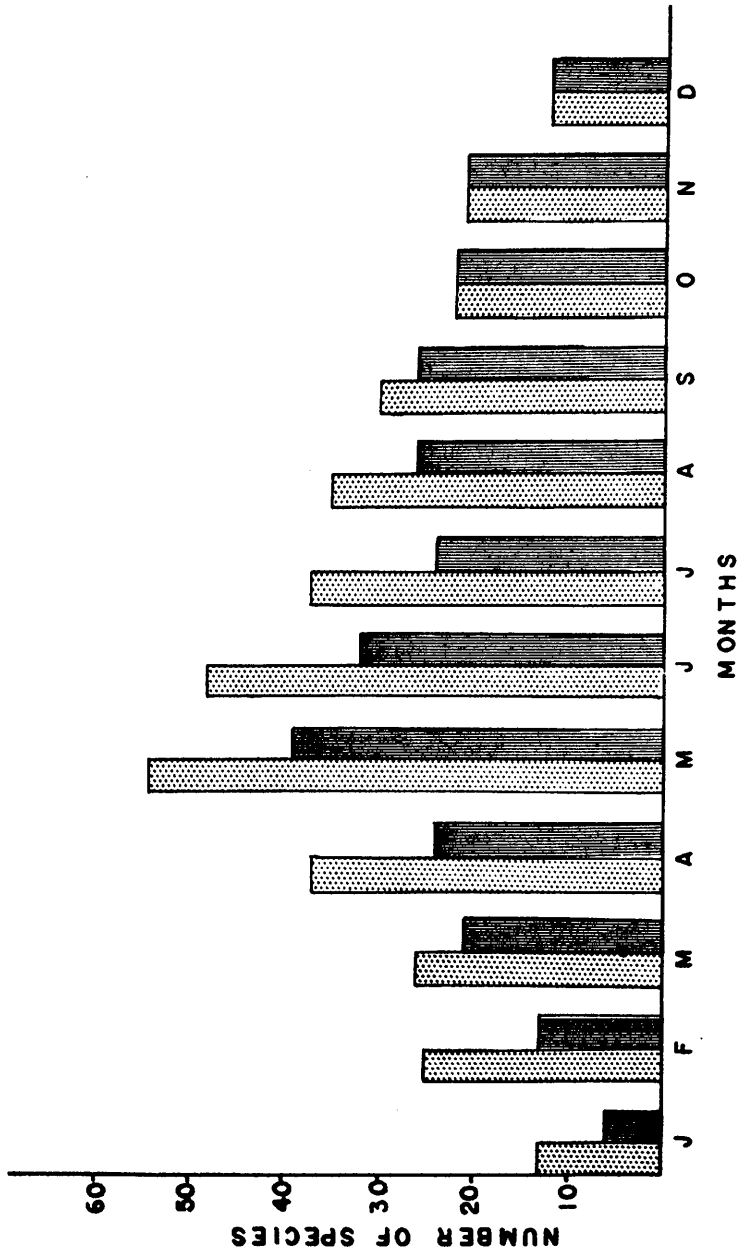


Figure 4. Number of species per month on 10 one-square-meter plots.

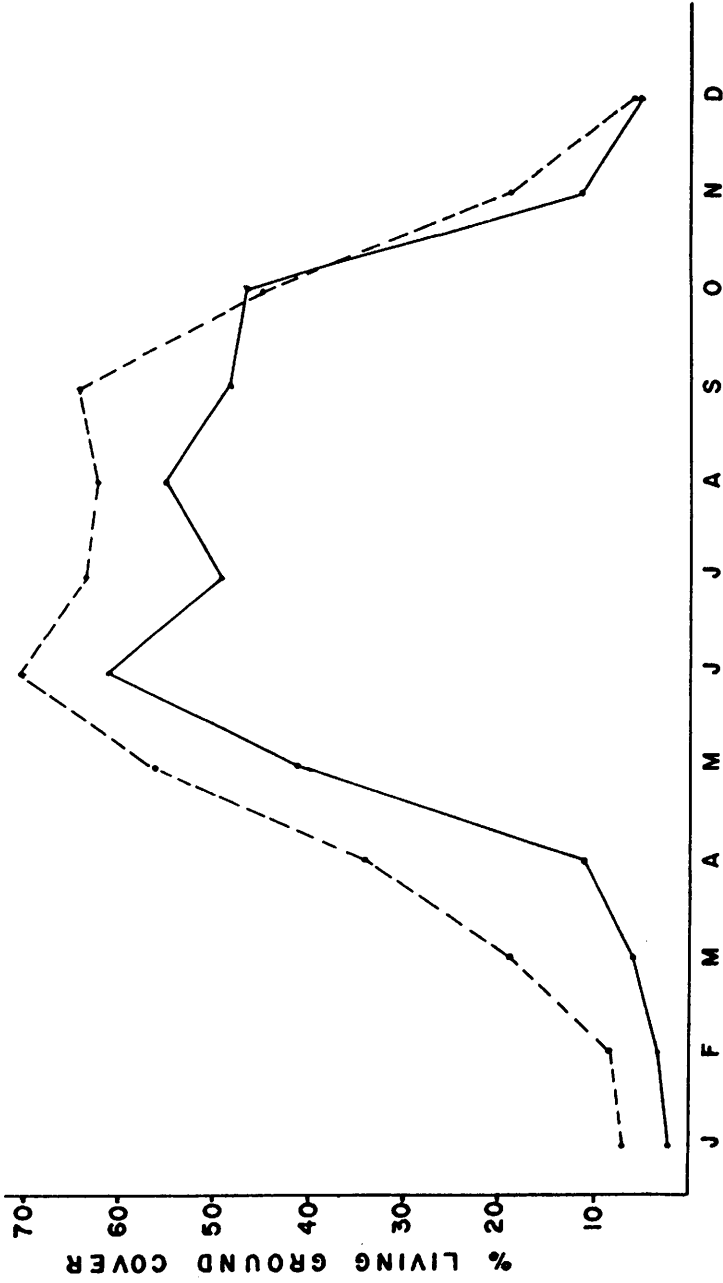


Figure 5. Percent living ground cover on 10 one-square-meter plots.

TABLE I. PHENOLOGY OF THE IMPORTANT PLANTS OF THE TALL-GRASS ASSOCIATION IN OSAGE COUNTY, OKLAHOMA.

Species	Percent total green for age of the various species — arranged according to month.											
	1960						1961					
	Jun.	Jul.*	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
<i>Cyperus</i> Sp.	2.4	T	1.1	0.2	0.4	27.5	53.1	71	53.6	40.5	20.8	8.2
<i>Oxalis stricta</i>	0.1	0.3	0.2	0.2	T	2.1	6.7	3	3.9	4.2	2.5	1.7
<i>Bromus japonicus</i>	2.4	T				3.6	25.1	15	33.6	30.7	18.1	8.6
<i>Citretum undulatum</i>	0.3	0.2				0.5	2.4	7	1.3	2.5	5.0	2.8
<i>Geranium carolinianum</i>	0.1							1	0.6	2.0	1.6	0.7
<i>Juncus interior</i>		1.2	1.1						3.2	9.6	8.2	2.6
<i>Ambrosia peltostachya</i>	7.0	8.6	8.4	10.3	11.1	1.0				3.3	22.6	13.4
<i>Andropogon gerardi</i>	24.4	26.9	21.7	28.8	20.0	0.6				0.4	4.8	17.2
<i>Hypochaeris hirsuta</i>										0.2	2.9	1.1
<i>Panicum scribnerianum</i>	3.1	2.1	2.4	3.0	2.4	7.2					3.0	3.2
<i>Andropogon scoparius</i>	41.6	46.5	52.4	37.1	46.6	46.5					1.0	33.1
<i>Sporobolus asper</i>	0.3	1.7	1.1	2.5	5.6	1.5						1.6
<i>Panicum virgatum</i>	6.2	7.0	5.5	7.0	7.6							2.6
Total area of green forage available in sq. cm./1 sq. meter plot	631.3	499.4*	557.5	477.3	464.5	111.0	25.9	19.8	30.8	55.0	116.1	430.3

*Pasture where half of the plots were located was heavily grazed this month.

TABLE II. PHENOLOGY OF THE IMPORTANT PLANTS OF THE SHORT GRASS ASSOCIATION IN OSAGE COUNTY, OKLAHOMA.

Species	Percent total green forage of the various species — arranged according to month.											
	1960						1961					
	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
<i>Bouteloua gracilis</i>	7.3	12.0	18.2	14.2	20.5	8.2	8.8	24.3	1.8	12.1	1.3	8.8
<i>Cyperus</i> Sp.	6.7	3.6	3.4	2.4	4.3	14.4	34.7	37.3	22.9	14.4	9.2	7.3
<i>Schedonardus paniculatus</i>	1.5	2.3	2.4	1.9	3.2	1.5	2.3	3.8	7.2	7.4	4.9	2.3
<i>Bromus japonicus</i>	5.2	0.9				8.6	35.1	16.5	40.8	30.3	20.7	7.0
<i>Buchloe dactyloides</i>	30.3	35.3	32.4	27.8	20.3	32.7			0.3		6.3	11.2
<i>Juncus interior</i>		3.3							5.2	6.3	15.1	10.2
<i>Hypoxis hirsuta</i>									0.4	3.1	6.9	3.7
<i>Festuca octiflora</i>	0.3								1.4	0.2	T	0.8
<i>Ambrosia psilostachya</i>	18.1	15.3	19.6	20.7	25.2	3.0				9.1	15.1	14.6
<i>Bouteloua curtipendula</i>	3.0	4.6	0.8	2.8	1.6	5.3					2.8	1.7
<i>Andropogon scoparius</i>	0.9	1.5	T	0.1	0.1	0.1					0.3	1.3
<i>Chloris verticillata</i>	0.8	1.2	1.2	2.2	2.0	7.2	5.4	2.2			0.5	1.0
<i>Andropogon gerardi</i>	4.9	3.3	4.4	5.5	6.4	0.1						3.9
<i>Allopecurus carolinianus</i>	0.1											5.1
<i>Gutierrezia dracunculoides</i>		2.5	4.5	6.1	8.4	12.3						3.1
Total area of green forage available in sq. cm./1 sq. meter plot.	701.0	639.0	621.9	640.5	450.8	187.9	53.2	74.0	90.2	192.3	348.5	524.0

able on the surface of the ground. October was the only month in which the percent living cover on the tall-grass plots exceeded that of the short-grass plots. Even here the difference is so small that it does not seem to be of significance.

Tables I and II show the seasonal variations of the principal plant species within the two plant associations. Both tables are made up of the plant species that contributed 80 percent or more to the total green foliage recorded. This is related in each table to the total area in square centimeters of green forage available. The combination of these two numbers gives an idea of the total cover for a species at any given time.

From the tables one can see the importance a plant such as *Bromus japonicus* could have in influencing the movements of the prairie chickens, which graze this plant in the late winter and early spring. During the months of February through May the availability of Japanese brome is greater in the short-grass than in the tall-grass areas. Conversely *Cyperus* sp. in December and January is the major constituent in the tall-grass cover and could influence movements of the birds by its availability.

Plants available in the short-grass association during the critical winter months of January, February and March ranked in the following order: *Bromus japonicus*, *Cyperus* sp., *Bouteloua gracilis*, *Schedonnardus paniculatus* and *Chloris verticillata*. The green plants of the tall-grass association are ranked as follows: *Cyperus* sp., *Bromus japonicus*, *Oxalis stricta*, *Cirsium undulatum*, and *Geranium carolinianum*. Further study of these available plants and correlating this to the food use during these months may bring out other interesting relationships.

The total green forage available (Tables I and II) during these winter months is from 50 to 200 percent greater in the short-grass association. This may have a great influence on the actual index of availability of the plant species in question in these plant associations.

It can be seen then that a factor which could cause variation in the movements of animal species between the two plant communities studied is the short-grass association's ability to green up earlier in the spring. The availability of quantities of green materials influence the birds movements toward this cover type at this time of the year, particularly since this is the time of the year the birds begin their courtship activities and find it necessary to begin utilization of food sources within the grass land areas. Other relationships may be found from further investigation and seasonal plant differences may influence the animal species' choice for use of other habitat features.

Plants unknown to me were verified by comparison with the Adam's Ranch herbarium (Dwyer, 1958). Plant nomenclature follows Waterfall (1960).

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