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Vegetational Composition of Three Missouri Tallgrass Prairies With Reference to Past Management

Mary K. Solecki
John B. Taft
Elizabeth A. Cook
Pamela S. Haverland

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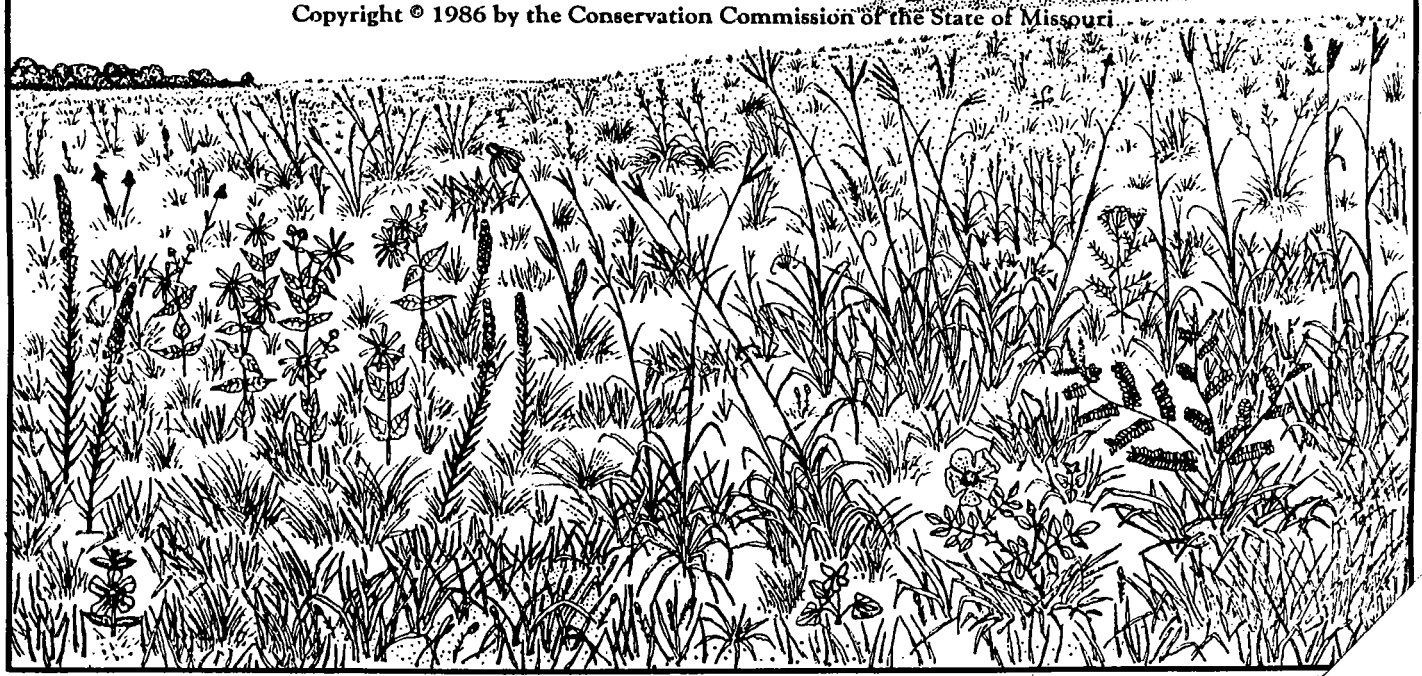

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INTRODUCTION

The vegetational composition of tallgrass prairies in Missouri and management effects on plant composition of these prairies has received limited study, despite the fact that at least 75,000 acres of tallgrass prairie occur in Missouri (Christisen 1972), with over 11,000 acres protected in public ownership. Floristic or vegetational studies have been done at Tucker Prairie (Drew 1947), Wah-Sha-She Prairie (Kelting 1982), and LaPetite Gemme Prairie (Weber et al. 1984), in Missouri. The latter two studies described floristic composition with no quantification of vegetational composition.

Studies regarding the effects of various management techniques upon vegetational composition of Missouri's prairies usually discuss the dominant species and rarely specify uncommon species (Kucera 1956, Kucera and Koelling 1964), even though management may influence uncommon species as much or more than common ones. The effects of burning and grazing on prairie composition in Missouri have been studied, but primarily at one prairie, Tucker Prairie (Kucera 1956, Kucera and Ehrenreich 1962, Kucera et al. 1963, Kucera and Koelling 1964). The vegetational composition of Tucker Prairie may differ somewhat from that of most Missouri prairies, because it occurs on glaciated, loess-derived soils, whereas most Missouri prairies occur on unglaciated, bedrock-derived soils. Although mowing is commonly employed on Missouri's prairies, both publicly and privately owned, comparatively little is known concerning the effects of mowing at various dates and time intervals (Conrad 1954, Gardner et al. 1957, Launchbaugh and Owensby 1978).

Periodic burning, mowing, and, to a lesser extent, grazing are used in managing Missouri's public prairies. This study is the first stage of a long term research project to determine the effects of various management techniques on the vascular plant composition of tallgrass prairies. A primary objective is to

describe, compare, and contrast the vegetational composition of 12 different management units at three tallgrass prairies. This will provide baseline data to be used for comparison with future data gathered at each unit, after different management techniques have been implemented at the units. A second objective is to discuss the vegetational composition of these 12 units in light of past management practices.

DESCRIPTION OF STUDY AREA

OSAGE PRAIRIE

Osage Prairie is located in Sec. 3 and 4, T34N R31W in Vernon Co., Missouri, 6 miles south of Nevada. This 1,467 acre upland prairie lies within the Osage Plains Natural Division (Thom and Wilson 1980) and was acquired jointly by the Missouri Department of Conservation (MDC) and The Nature Conservancy (TNC) beginning in 1959.

The gently rolling topography of this prairie is underlain by Pennsylvanian sandstone and shale of the Burgner and Riverton formations and Krebs subgroup (Anderson 1979). Soils consist of Barco loam interspersed with pockets of Barden silt loam and Coweta fine sandy loam. Sampling sites were restricted to the Barco soil, a moderately deep, well drained loam with medium natural fertility (Preston 1977). Average annual precipitation at Nevada, the nearest reporting station, is 40.7 inches. The average annual temperature is 57°F with an average July temperature of 79°F and an average January temperature of 33°F. Temperatures can range from above 105°F in summer to below -15°F in winter (National Oceanic and Atmospheric Administration 1981).

The south part of Osage Prairie was divided into eight management units (Table 1, Figure 1). Prior to 1984, each unit received varying management. The southwest hay, south-central hay, southeast hay, northeast hay/burn and northwest hay/burn units were in private

Figure 1. Location of management units and sample sites at Osage Prairie. Management unit abbreviations are as follows: NW=northwest hay/burn, NE=northeast hay/burn, SW=southwest hay, SC=south-central hay, SE=southeast hay, W=west graze/hay, C=central graze, and E=east graze. Sample sites are shaded. In the future each unit will receive different management and will have the following name: NW=NW burn, NE=NE burn, SW = annual hay, SC = biennial hay, SE = triennial hay, W = hay/burn, C = moderate graze, and E = light graze unit.

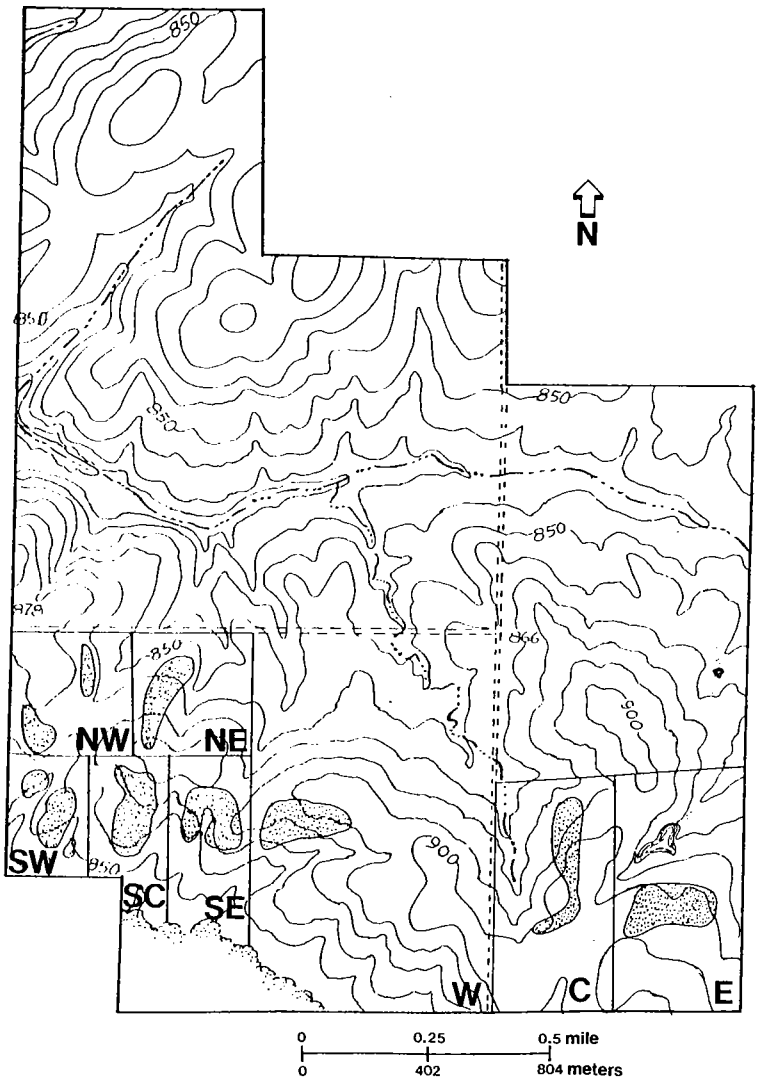


Table 1. Summary of the past and future management of each management unit at Osage Prairie. Abbreviations are as follows: SW=southwest, SC=south-central, SE=southeast, E= east, C=central, W=west, NW=northwest, and NE=northeast. The current and future name of each management unit is given.

	Current Name of Unit							
	SW Hay	SC Hay	SE Hay	E Graze	C Graze	W Graze/ Hay	NW Hay/ Burn	NE Hay/ Burn
past management								
1984	hayed	idle	idle	hayed	hayed	burned	burned	burned
1983	hayed	hayed	hayed	hayed	hayed	idle	idle	idle
1982	hayed	hayed	hayed	grazed	grazed	hayed	hayed	hayed
1981	hayed	hayed	hayed	grazed	grazed	hayed	hayed	hayed
1980	hayed	hayed	hayed	grazed	grazed	idle	hayed	hayed
1979	hayed	hayed	hayed	idle	idle	hayed	hayed	hayed
1978	hayed	hayed	hayed	hayed	hayed	idle	hayed	hayed
1977	hayed	hayed	hayed	grazed	grazed	grazed	hayed	hayed
1976	hayed	hayed	hayed	grazed	grazed	idle	hayed	hayed
1975	hayed	hayed	hayed	idle	idle	grazed	hayed	hayed
1974	hayed	hayed	hayed	grazed	grazed	grazed	hayed	hayed
future management	hay every summer	hay every other summer	hay every third summer	graze lightly in summer or fall; spring burn as needed	graze moderately in summer or fall; spring burn as needed	hay every 2-3 years; spring burn every 3-5 years	spring burn every third year	spring burn every second year
future name of unit	Annual Hay	Biennial Hay	Tri-ennial Hay	Light Graze	Moderate Graze	Hay/Burn	NW Burn	NE Burn

ownership until 1981 and were usually hayed every summer. These units were hayed in July 1982 and 1983, with the exception of the northwest hay/burn and the northeast hay/burn units which remained idle in 1982. In 1984, the northwest and northeast burn units were burned in early April, the southwest hay unit was mowed in July, and the southeast and south-central hay units remained idle. The east and central graze units and the sampled portion of the west graze/hay unit have been grazed at varying intensities and have also been hayed periodically. The east and central graze units were grazed in late summer or early fall of 1974, 1976, 1977, 1980, 1981, and 1982. These units were hayed in summer of 1978, 1983, and 1984. The west graze/hay unit was grazed in summer or fall of 1974, 1975, and 1977 and was hayed in summer of 1979, 1981, and 1982. Prior to acquisition by the Missouri Department of Conservation and The Nature Conservancy, portions of Osage Prairie were summer hayed and others were grazed by cattle. Future management of each unit will follow the outline given in Table 1.

DIAMOND GROVE PRAIRIE

Diamond Grove Prairie, a 515 acre upland prairie, is situated nine miles southeast of Joplin in Sec. 31 and 36, T27N, R32W in Newton County, Missouri, and it lies within the Springfield Plateau of the Ozark Natural Division (Thom and Wilson 1980). Two sites near the east border of Diamond Grove were sampled (Figure 2). The easternmost site was a private hay meadow at the time of this study, but has since been acquired by the Missouri Department of Conservation. The two study sites occur on a gentle, southwest-facing slope and nearly level ridge underlain by Hoberg silt loam and Keeno cherty silt loam soils. These deep, moderately well drained soils contain a massive fragipan and have medium natural fertility (Allgood and Persinger 1979). The Mississippian bedrock contains St. Louis limestone and cherty or non-cherty limestone of the Warsaw and Salem formations (Anderson 1979). Diamond Grove Prairie is the southernmost of the three prairies studied and experiences slightly higher average temperatures than the other two prairies.

Figures 2 and 3. Location of management units and sample sites at Diamond Grove and Paint Brush Prairies. Management unit abbreviations are as follows: E=east, N=north, S=south, and W=west. Sample sites are shaded.

Figure 2. Diamond Grove Prairie

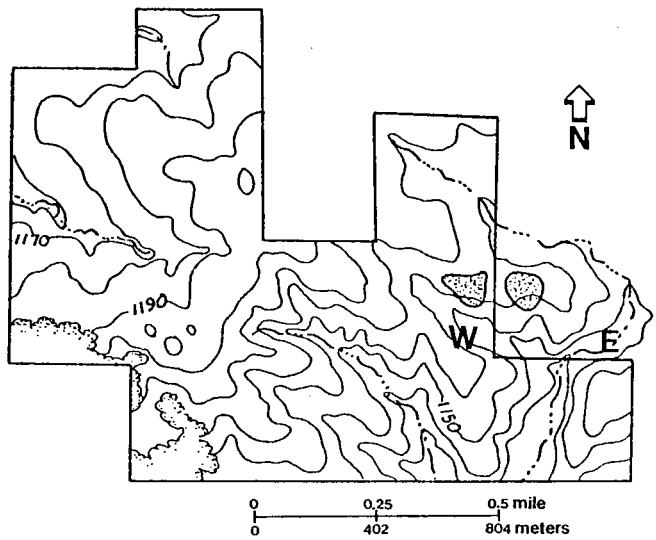
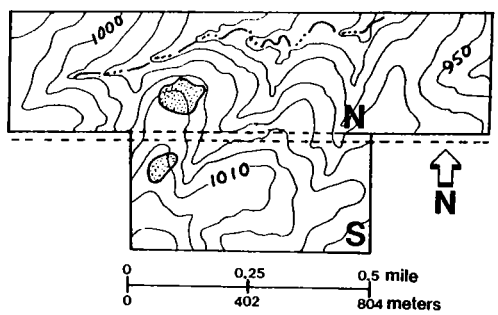


Figure 3. Paint Brush Prairie



The mean annual temperature at Joplin, the closest reporting station is 58°F, with an average July temperature of 80°F and an average January temperature of 34.4°F. Mean annual precipitation is 40.8 inches (National Oceanic and Atmospheric Administration 1981). Diamond Grove Prairie was usually hayed each summer before the Missouri Department of Conservation acquired it in 1981, 1982, and 1985. The west study site was hayed in summer of 1983, as was the east site. The two study sites at this prairie will be managed in the future by rotational summer haying and spring burning.

PAINT BRUSH PRAIRIE

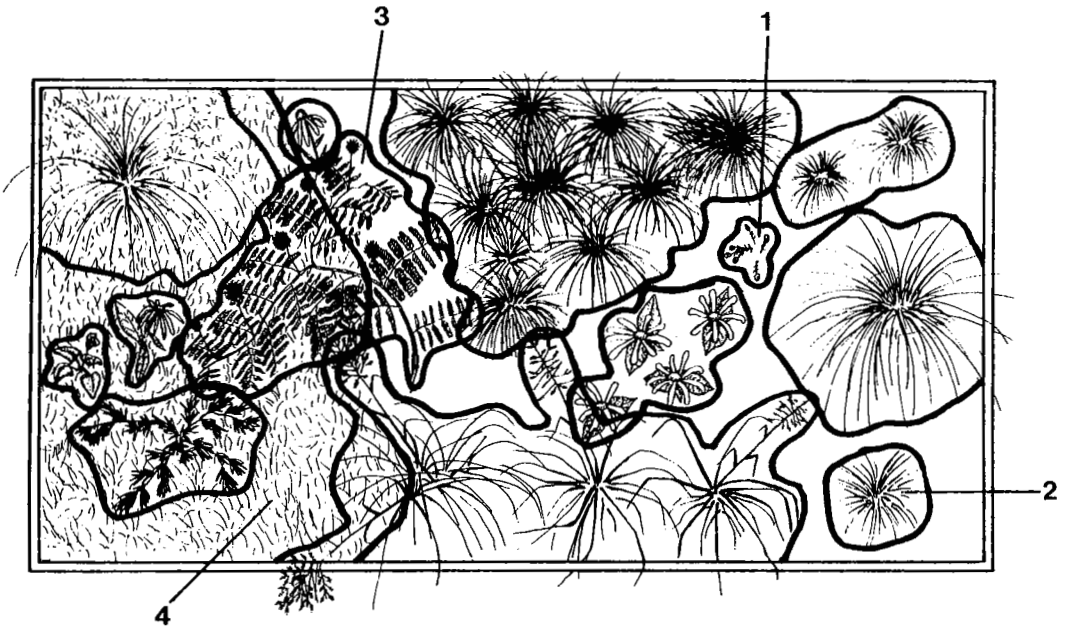
Paint Brush Prairie is a 234 acre prairie located in the Osage Plains Natural Division in Sec. 29 and 32, T44N, R21W in Pettis County, Missouri, approximately nine miles south of Sedalia. This hilly upland prairie has Mississippian and Ordovician bedrock composed of Jefferson City and Cotter dolomite, Burlington limestone, and cherty and dolomitic limestone of the Pierson formation (Anderson 1979). The soils belong to the Gerald-Creldon-Hoberg-Keeno association. These are moderately well drained to somewhat poorly drained, loamy and clayey upland soils with fragipans (Allgood and Persinger 1979). Average annual precipitation at Sedalia is 40.7 inches, the same as at Nevada. The mean July temperature is 79°F and the mean January temperature is 32°F, with a mean annual temperature of 56°F (National Oceanic and Atmospheric Administration 1981). Two sites were studied at Paintbrush Prairie (Figure 3). The north study site was usually hayed each summer prior to its acquisition by the Missouri Department of Conservation in 1978. Since then it has been summer hayed every two or three years. The south site, a privately owned meadow until 1982, was usually hayed every summer. It was also hayed in the summer of 1983 and 1984. Future management of each site will consist of rotational summer haying and spring burning.

METHODS AND MATERIALS

Vegetation at each site was sampled in 1984 with ninety 0.5 m^2 rectangular plots (50x100 cm) placed on midslopes, to upper slopes, or ridgetops at each site. Lower slopes and ravines were not sampled. Disturbed sites, such as mima mounds containing animal holes, were avoided. The eight management units at Osage Prairie were sampled in the spring (April 30 - May 31), summer (July 3 - July 27), and fall (September 11 - October 26), while the two sites each at Diamond Grove Prairie and Paintbrush Prairie were sampled in the summer (June 18-29). Eighty-five plots rather than 90 plots were sampled in spring at the biennial hay unit of Osage Prairie. Plot location was chosen by: 1) looking at the second hand of a wrist watch, 2) walking in the direction the second hand indicated, considering 12:00 as north, and 3) walking the number of paces the second hand indicated, with the number of paces ranging from 1 to 60. The location of the previous plot was the starting point for choosing a new plot. After 45 plots were completed in this manner at a site, the remaining 45 plots were located by considering 12:00 on the wrist watch as south, rather than north. This partially compensated for the sampling bias of walking further distances in a westerly direction (between 30 and 60 paces) and shorter distances in an easterly direction (between 1 and 29 paces) when 12:00 was considered as north.

The canopy cover of each vascular plant species within a plot was recorded using the Daubenmire cover scale (Daubenmire 1959, 1968) with modifications following Bailey and Poulton (1968). Canopy cover is the area, parallel to the ground surface, bounded by a line connecting the extremities of the living parts of a plant's crown (Figure 4) and is expressed as a percent of the plot size (Daubenmire 1959). Canopy coverage was determined for each species occurring within a plot, regardless of where the plant was rooted and regardless of the overlapping of canopies of different species. Since the canopies of different species were

Figure 4. Example of canopy cover estimation. Cover classes shown above are as follows: 1=canopy covers 0-1% of plot size, 2=canopy covers 1-5% of plot size, 3=canopy covers 5-25% of plot size, and 4=canopy covers 25-50% of plot size.



often interconnected or superimposed, the canopy cover percents often total over 100%. The modified Daubenmire cover scale is as follows: class 1, 0-1%; class 2, 1-5%; class 3, 5-25%; class 4, 25-50%; class 5, 50-75%; class 6, 75-95%; and class 7, 95-100%. Cardboard squares representing 1% and 5% of the plot area were used as guides in cover estimation.

Voucher specimens of all plant species collected are deposited with the Missouri Department of Conservation, Jefferson City, Missouri. Taxonomic nomenclature follows Steyermark (1963). Carex abdita and Carex umbellata have similar morphology, with only a slight difference in perigynium structure. Since all specimens of this complex that were collected were identified as C. abdita, it was assumed that all plants of this group encountered during sampling were C. abdita. Some nonreproductive specimens could only be identified to genus, family, or class.

Vegetational data were summarized by calculating the relative frequency and average canopy cover of each plant species sampled at each unit per season. Cover class midpoints were used to calculate average canopy cover. Relative frequency and average canopy cover values for each species sampled in each unit and season were added to calculate an importance value with a maximum value of 200. The composition of each unit was then summarized for the entire growing season by calculating average relative frequency, canopy cover, and importance values from pooled spring, summer, and autumn results.

Vegetational composition between prairie units and seasons was compared to determine if significant differences occurred between units, by calculating analysis of variance and the following tests from relative frequency and canopy cover data using GLM procedures of the Statistical Analysis System (SAS Institute Inc. 1982): F-test, t-test, Tukey's studentized range test, and Duncan's multiple range test (Steel and Torrie 1980). Mean frequency and mean canopy cover of all species sampled in each

unit during each season were used for comparison. These same four tests were calculated to determine if the frequency of 19 common species differed between units at each prairie and also between seasons at each unit of Osage Prairie. Each species selected had to occur in at least 10 of the 12 units sampled for the species to be included. Similarity of vegetational composition between units and seasons was compared by determining Sorenson's similarity index for relative frequency and canopy cover (Mueller-Dombois and Ellenberg 1974). Cluster analysis using Ward's method (CLUSTER procedure) as the hierarchical clustering algorithm (SAS Institute Inc. 1982) was done on Sorenson's similarity indices derived from frequency data to further compare vegetational composition between units at each season.

Diversity indices calculated to analyze the differences in species diversity among the units at each prairie were species richness (S), the Shannon-Weiner index (H'), and Simpson's index (C). Species richness is the number of species occurring within a sample of given size (Whittaker 1975). The Shannon-Weiner index (Shannon and Weaver 1949), a measure of heterogeneity based on information theory, is defined as: $H' = \sum_{i=1}^{s} Pi \log Pi$ where Pi is the relative frequency of each species sampled in a unit expressed in decimal form and S is the species richness. The value of the Shannon-Weiner index is low when only a few species are present in a community and increases as species richness and evenness of distribution increases. In very rich communities (e.g., tropical communities) the diversity increase in H' is damped, since H' asymptotically approaches a maximum of about 5 for many samples (Margalef 1969). Simpson's index measures the probability that two individuals selected randomly from a sample will belong to the same species (Peet 1974). This index, given by: $C = \sum_{i=1}^{s} Pi^2$ with Pi as defined above, measures dominance as the degree of concentration of relative frequencies in one or a few species (Whittaker 1972). The value of Simpson's index increases when most of the individuals sampled belong to only one or a few

species, rather than having a more uniform distribution of individuals among a large number of species.

RESULTS AND DISCUSSION

COMPOSITION - Osage Prairie

Basic compositional data for each species sampled in each unit is presented in Appendices 1 through 6. Relative frequency, average canopy cover, and importance value (IV) for each species sampled at Osage Prairie is given by unit for the entire growing season (averaged for spring, summer, and autumn) in Appendix 1. Importance value, relative frequency, and canopy cover is given by season (spring, summer and autumn) and unit for each species sampled at Osage Prairie in Appendices 2,3, and 4, respectively. Relative frequency, canopy cover, and importance value are given in Appendix 5 for species sampled at Diamond Grove Prairie and in Appendix 6 for species sampled at Paint Brush Prairie. The percent of species composition accounted for by the most important plant families at each management unit of the three prairies sampled is given in Table 2.

Importance values averaged for the entire growing season indicate that *Andropogon gerardii* (IV 74 to 132) and *A. scoparius* (IV 83 to 152) were dominant at every unit of Osage Prairie (Appendix 1). *Sorghastrum nutans* (IV 62 to 123) was also dominant at every unit, with the exception of the northeast hay/burn area. *Andropogon scoparius* had the highest average importance value (152), average relative frequency (98), and average canopy cover (54) of all species studied (Appendix 1) at Osage Prairie, and this occurred in the northeast hay/burn unit.

Table 2. Percent of species composition accounted for by the most important plant families at each management unit of Osage, Diamond Grove, and Paint Brush Prairies. Values given are the percentages of total species sampled at each unit that are accounted for by members of the given plant family. The range of composition value (%) for the 12 units are summarized. Abbreviations of the management units are as follows: SW=southwest, SC=south central, SE=southeast, C=central, E=east, NW=northwest, W=west, E=east, N=north, and S=south. In the future, the units will receive different management and will have the following names: SW hay = annual hay, SC hay = biennial hay, SE hay = triennial hay, C graze = moderate graze, E graze = light graze, NW hay/burn = NW burn, NE hay/burn = NE burn, and W graze/hay = hay/burn.

	OSAGE PRAIRIE								DIAMOND GROVE PRAIRIE		PAINT BRUSH PRAIRIE		
Plant Family	SW Hay	SC Hay	SE Hay	C Graze	E Graze	NW Hay/ Burn	NE Hay/ Burn	W Graze/ Hay	E	W	N	S	Range
Gramineae	20	20	23	20	21	22	20	19	21	20	16	21	16-23
Compositae	20	23	22	18	19	20	21	21	21	20	18	23	18-23
Cyperaceae	9	10	8	6	6	9	8	7	11	7	8	6	6-11
Leguminosae	10	7	8	7	9	10	8	9	8	7	7	7	7-10

A grass (Andropogon gerardii, A. scoparius, or Aristida longespica) was the single most important species each season in the two burn units, the west graze/hay unit and the southeast hay area (Appendix 2). The forb Viola sagittata (IV 97, 100) dominated the remaining two hay units in spring, while Andropogon gerardii (IV 71 to 133) or Sorghastrum nutans (IV 107 to 137) were dominant in summer or fall. The two grazed units were dominanted by Carex meadii (IV 110 to 174), in spring and fall, whereas Andropogon gerardii (IV 117, 141) was the most important summer species. At most units, Viola sagittata was a dominant forb during at least one season, and it was also a ubiquitous forb at Tucker Prairie (Drew 1947), where it had a frequency of 100%. Drew stated that the removal of taller plants as a result of grazing and mowing favored the increase of this diminutive plant. Antennaria neglecta was also very frequent at Tucker Prairie, presumably for the same reason (Drew 1947). It was far less frequent at the three prairies studied here, however, with less than 25% relative frequency at each area sampled. The dominant species and their order of dominance varied somewhat between units, as summarized below.

Southwest Hay Unit. Importance values averaged from all three seasons indicate that Andropogon scoparius (IV 105), Sorghastrum nutans (IV 98), Carex meadii (IV 82), A. virginicus (IV 80), and A. gerardii, were dominant grasses and sedges in the southwest hay unit. Important forbs at this unit were Viola sagittata (IV 99), Aster pilosus (IV 56), and Psoralea psoraleoides (IV 56). Although Andropogon scoparius had the highest importance value (105), Viola sagittata was the most frequent (93%). Andropogon scoparius, Helianthus mollis, and Sorghastrum nutans had the highest canopy covers (26% each).

Seasonal variation in composition at the southwest hay unit is readily apparent from Appendices 2, 3, and 4. Of the 125 species sampled at this unit, 14 species occurred only in spring, 15 species occurred only in summer, 7 species occurred only in fall,

and 37 species were present in all seasons. In each season Andropogon scoparius (IV 89 to 129), Sorghastrum nutans (IV 78 to 110) and Viola sagittata (IV 96 to 103) were among the most important species. Other dominants by season are as follows: spring - Pycnanthemum tenuifolium (IV 89), Carex meadii (IV 85), and Psoralea psoraleoides (IV 80); summer - Andropogon gerardii (IV 133), Agrostis hyemalis (IV 119), Panicum lanuginosum (IV 102), Paspalum sp. (IV 94), and Aster pilosus (IV 91); fall - Carex meadii (IV 97), Andropogon virginicus (IV 95), Aristida longespica (IV 93), A. oligantha (IV 90), and Aster pilosus (IV 75).

South Central Hay Unit. Dominant grasses, based on importance values compiled from all seasons, were Andropogon scoparius (IV 116), Sorghastrum nutans (IV 114), Panicum lanuginosum (IV 96), A. gerardii (IV 85), and A. virginicus (IV 82). Carex meadii (IV 62) was the most important sedge at this unit, while dominant forbs were Viola sagittata (IV 93), Potentilla simplex (IV 65), and Aster pilosus (IV 63). Andropogon scoparius had the highest average importance value (116) and average canopy cover (35%) of the 127 taxa sampled, but Viola sagittata was the most frequent (85%) species. Several forbs had average importance values, canopy covers, or frequencies below 1.

In addition to having high average importance values for the entire growing season, Sorghastrum nutans (IV 71 to 137), Andropogon scoparius (IV 91 to 136), and Andropogon virginicus (IV 72 to 96) were also dominant within each season at the south central hay unit. Other spring dominants at this area were Viola sagittata (IV 97), Carex meadii (IV 87), Agrostis hyemalis (IV 74), Andropogon ternarius (IV 73), and Krigia sp. (IV 70), while other summer dominants were Andropogon gerardii (IV 122), Aristida sp. (IV 118), Panicum lanuginosum (IV 110), Agrostis hyemalis (IV 109), Paspalum sp. (IV 109), Viola sagittata (IV 107), and Rhynchospora globularis (IV 92). Additional dominant species in fall were Panicum lanuginosum (IV 127), Andropogon

gerardii (IV 122), Aristida longespica (IV 106), Aster pilosus (IV 89), and Ruellia humilis. Thirty-six species occurred throughout all seasons. The number of species sampled exclusively in one season are as follows: 16 in spring, 18 in summer, and 14 in fall. The majority of species occurred during two seasons.

Southeast Hay Unit. Dominant grasses at this unit, based on importance values averaged for the three seasons, were Andropogon scoparius (IV 124), Sorghastrum nutans (IV 99), Panicum lanuginosum (IV 82), Andropogon ternarius (IV 79), and Andropogon gerardii (IV 74), while dominant sedges were Carex meadii (IV 66), and Rhynchospora globularis (IV 52). The most important forbs were Viola sagittata (IV 79), Erigeron strigosus (IV 67), and Rudbeckia hirta (IV 67). As with the southwest and south central hay units, Andropogon scoparius was the most important species (IV 124) at the southeast hay unit of the 130 taxa sampled. In contrast with the two other hay areas, Andropogon scoparius was the most frequent species (84%)at this unit rather than Viola sagittata.

The number of species sampled during only one season at the southeast hay unit ranged from 16 to 19. Andropogon scoparius (IV 101 to 154) and Sorghastrum nutans (IV 77 to 113) were dominant grasses each season at this area, while Andropogon gerardii (IV 101, 90) and Andropogon ternarius (IV 89, 99) were also dominant grasses in summer and autumn. Species dominant in both spring and summer were Carex meadii (IV 99, 80) and Viola sagittata (IV 89 each season). Additional dominants during each season are as follows: spring - Agrostis hyemalis (IV 82), Krigia sp. (IV 79), Houstonia minima (IV 74), and Plantago virginica (IV 71); summer - Agrostis hyemalis (IV 105), Rudbeckia hirta (IV 99), Aristida sp. (IV 93), Panicum lanuginosum (IV 85), and Schrankia uncinata (IV 83); and fall - Aristida longespica (IV 125), Panicum lanuginosum (IV 106), Aristida oligantha (IV 98), Andropogon virginicus (IV 94), Rhynchospora

globularis (IV 88), Erigeron strigosus (IV 81), and Aster pilosus (IV 81).

East Graze Unit. Of the 146 taxa sampled at this unit, 12 species were non-native, which included 6 grasses, 5 forbs, and 1 shrub. Dominant sedges and grasses at the east graze unit were Carex meadii (IV 131), Andropogon gerardii (IV 113), Agrostis hyemalis (IV 86), Andropogon scoparius (IV 84), Panicum lanuginosum (IV 78), and Sorghastrum nutans (IV 70). Carex meadii was the most frequent species (93%) and had the greatest canopy cover (38). Viola sagittata (IV 80) was the most important forb at this area, as it was at six other Osage Prairie units. This is the only area sampled in which Solidago gymnospermoides (IV 74) was among the dominant forbs. Other important forbs were Potentilla simplex (IV 59), Pycnanthemum tenuifolium (IV 59), and Helianthus mollis (IV 58).

During each season at the east graze unit, Andropogon gerardii (IV 95 to 141) and Carex meadii (IV 118 to 150) were dominant. Solidago gymnospermoides (IV 87), Agrostis hyemalis (IV 75), Hypoxis hirsuta (IV 74) and Oxalis violacea (IV 70) were also dominant in spring, while additional summer dominants were Agrostis hyemalis (IV 110), Andropogon scoparius (IV 103), Bromus racemosus (IV 97, an introduced grass), Panicum lanuginosum (IV 95), Sorghastrum nutans (IV 92), Polygala sanguinea (IV 90), and Viola sagittata (IV 84). Other important species in autumn were Andropogon scoparius (IV 94), Viola sagittata (IV 87), Panicum lanuginosum (IV 78), Sorghastrum nutans (IV 72), and Agrostis hyemalis (IV 71).

Central Graze Unit. This unit had the highest species richness (152 species sampled) of the eight areas sampled at Osage Prairie and also contained the largest number (13) of introduced species. The greatest number of grasses (30 species) occurred here and at the east graze unit. Dominant grasses and sedges, in decreasing order of average importance, were Carex meadii (IV 106),

Andropogon gerardii (IV 87), Andropogon scoparius (IV 83), Panicum lanuginosum (IV 79), and Agrostis hyemalis (IV 62). Viola sagittata and Potentilla simplex were the only forbs with importance values above 50. The shrub, Rubus sp. was more important here (IV 53) than at any other Osage Prairie unit.

At the central graze unit, Carex meadii (IV 95 to 174) and Andropogon scoparius (IV 72 to 90) were dominant in spring, summer, and fall. Spring dominants also included Potentilla simplex (IV 77), Viola sagittata (IV 75), and Ranunculus fascicularis (IV 74), with other summer dominants including Andropogon gerardii (IV 117), Bromus racemosus (IV 106), Panicum lanuginosum (IV 103), Ptilimnium nuttallii (IV 100), Carex meadii (IV 95), and Agrostis hyemalis (IV 92). Additional fall dominants were Viola sagittata (IV 95), Andropogon gerardii (IV 88), Panicum lanuginosum (IV 80), Potentilla simplex (IV 74), Leptoloma cognatum (IV 73), and Sorghastrum nutans (IV 72).

West Graze/Hay Unit. Grasses and sedges with the highest average importance values for the entire year at the west graze/hay unit were Andropogon scoparius (IV 140), Andropogon gerardii (IV 122), Panicum lanuginosum (IV 116), Sorghastrum nutans (IV 96), Carex meadii (IV 74), and Setaria geniculata (IV 72). In addition to being the most important species at this unit, Andropogon scoparius was also the most frequent (92%) and had the highest average canopy cover (54). Dominant forbs were Pycnanthemum tenuifolium (IV 80), Ruellia humilis (IV 80), Viola sagittata (IV 80), and Potentilla simplex (IV 76). Rosa carolina (IV 84) was more important at this unit than at any other studied. A total of 140 species were sampled during the year.

Species dominant during each season at the west graze/hay unit were Andropogon scoparius (IV 132 to 150), Andropogon gerardii (IV 102 to 134), Panicum lanuginosum (IV 101 to 124), and Sorghastrum nutans (IV 88 to 102). In spring, additional dominants were Carex meadii (IV 109), Potentilla simplex (IV 51 to

91), Sorghastrum nutans (IV 88), and Viola sagittata (IV 84), while other summer dominants included Aristida sp. (IV 109), Polygala sanguinea (IV 93), Pycnanthemum tenuifolium (IV 92), and Setaria geniculata (IV 91). Leptoloma cognatum (IV 99), Setaria geniculata (IV 92), Aristida longespica (IV 90), and Aristida purpurascens (IV 86) were dominant in autumn.

Northwest Hay/Burn Unit. The dominant grasses and sedges and their order of dominance was the same at the northwest hay/burn unit as at the south central hay unit, except Andropogon virginicus was not among the dominants here. Viola sagittata and Ruellia humilis were the only forbs with average importance values of 60 or more. One hundred and eleven species were sampled here, which was less than at any other Osage Prairie unit.

The most important species in spring, summer, and fall at the northwest hay/burn unit included Andropogon scoparius (114 to 161), Sorghastrum nutans (IV 87 to 122), Panicum lanuginosum (IV 82 to 114), Andropogon gerardii (IV 87 to 105), and Viola sagittata (IV 77 to 85). In addition to these, Oxalis violacea (IV 83), Carex meadii (IV 77), and Psoralea psoraleoides (IV 74) were spring dominants, while additional summer dominants were Aristida sp. (IV 102), Psoralea psoraleoides (IV 82), and Rudbeckia hirta (IV 81). Aristida longespica (IV 87), Aristida purpurascens (IV 73), Carex meadii (IV 70), and Oxalis dillenii (IV 70) were dominant in autumn also.

Northeast Hay/Burn Unit. Dominant grasses and sedges, based on importance values from all three seasons, were Andropogon scoparius (IV 152), Andropogon gerardii (IV 132), Sorghastrum nutans (IV 123), Panicum lanuginosum (IV 113), and Carex meadii (IV 96), with the most important forbs including Viola sagittata (IV 83), Aster pilosus (IV 67), and Psoralea psoraleoides (IV 65). One hundred and twenty species were sampled here during the year.

Each of the grasses and sedges listed above as dominants in the northeast hay/burn unit were also dominant within each season. Psoralea psoraleoides (IV 105), Oxalis violacea (IV 97), and Viola sagittata (IV 93) were dominant spring forbs, and Rudbeckia hirta (IV 93), Psoralea psoraleoides (IV 89), and Viola sagittata (IV 88) were dominant summer forbs. Additional species dominant in autumn were Aster pilosus (IV 80), Viola sagittata (IV 79), Oxalis dillenii (IV 78), and Aristida purpurascens (IV 75).

Vegetation and Past Management Relationships. Species importances at Osage Prairie varied with past management practices. Carex meadii, Cerastium vulgatum, Solidago gymnospermoides, Vernonia baldwinii, and Vernonia sp. reached their highest importance values at the two grazed units (central and east graze units). On the other hand, the lowest importance values for Amorpha canescens, Andropogon ternarius, Andropogon virginicus, Aristida longespica, Fimbristylis caroliniana, Psoralea psoralioides, Rhynchospora globularis, Rudbeckia hirta, Schrankia uncinata, Scleria triglomerata, and Sorghastrum nutans occurred at the two grazed units. At the three unburned hay units, Leptoloma cognatum had its lowest importance values, while Andropogon virginicus, Erigeron strigosus, and Houstonia minima had their highest importance values. Since the two hay/burn units have a long history of annual mowing and have been burned only once in the recent past, any comments on species composition in relation to burning at these units would probably be spurious.

Our findings partially agree with Kucera's (1956) list of species that increased or decreased with grazing on Tucker Prairie. Species Kucera listed as absent or less frequent on grazed prairie, which were also absent or less frequent on grazed portions of Osage Prairie include: Amorpha canescens, Asclepias hirtella, Euphorbia corollata, and Gentiana puberulenta. Plants that were more frequent under grazing at Tucker Prairie and that

showed the same tendency at Osage Prairie are Cerastium vulgatum and Myosotis virginica. The study area at Tucker Prairie was heavily grazed and compositional changes were probably more pronounced than those at the comparatively lightly grazed units of Osage Prairie.

Diamond Grove Prairie

Several dominant species at the two Diamond Grove Prairie units differed markedly from those at Osage Prairie (Appendix 5). Unlike Osage Prairie, Sporobolus heterolepis (IV 144, 91) was a dominant grass and Marshallia caespitosa (IV 64, 68) was a dominant forb at both Diamond Grove Prairie areas. In addition, Polygala sanguinea was a relatively important forb at the west unit (IV 71), while Lobelia spicata was relatively important at the east unit (IV 71). Other grasses dominant at both units of Diamond Grove were Andropogon scoparius (IV 138, 144), Andropogon gerardii (IV 108, 139), and Sorghastrum nutans (IV 85, 102). The east unit was the only one of the 12 units studied in which Panicum virgatum was a relatively important grass (IV 93). In addition to the forbs previously mentioned, Psoralea psoraleoides (IV 67, 85) was among the most important forbs at both areas, while Erigeron strigosus (IV 63) was relatively important only at the east unit. The most important member of Cyperaceae was Carex meadii (IV 82) at the west unit and Fimbristylis caroliniana (IV 67) at the east unit.

Paint Brush Prairie

As with Diamond Grove Prairie, Sporobolus heterolepis (IV 83, 161) and Andropogon scoparius (IV 85, 98) are among the dominant grasses at both units of Paintbrush Prairie (Appendix 6). Other dominant grasses were Panicum lanuginosum (IV 75) at the north unit and Andropogon virginicus (IV 95), Paspalum sp. (IV 80) and Agrostis hyemalis (IV 74) at the south area. At both sites Carex meadii (IV 62, 118) was the most important sedge and Rosa carolina (IV 95, 99) was a relatively important shrub.

In addition to being a dominant grass at the annually hayed south unit, Andropogon virginicus had its greatest frequency on areas of Osage Prairie and Diamond Grove Prairie that had been annually hayed. This agrees with Irving et al. (1980) finding that Andropogon virginicus was dominant or most frequent on annually disturbed prairies (hayed and burned every year) in eastern Arkansas.

Dominant forbs differed between the two sites at Paint Brush Prairie, with the exception of Crotonopsis elliptica, the only forb dominant at both sites. Coreopsis palmata and Euphorbia corollata were dominant forbs at the north unit, while Plantago aristata, Oenothera linifolia, Ruellia humilis, Viola sagittata, and Potentilla simplex were dominant at the south unit.

COMPARISON OF MANAGEMENT UNITS - Similarity and Classification

Comparison of Sorenson's similarity indices (Table 3, Appendix 8) calculated for each unit and season, where applicable, indicates that, in general, Osage Prairie units which receive the same type of management treatments are most alike. Thus, within a given season, the hayed units most closely resembled each other, the grazed units were most similar, and the hay/burn units had the greatest resemblance to each other. The west graze/hay unit in spring and summer was most similar to the northeast hay/burn unit in the corresponding season.

The two units at Diamond Grove were most similar to each other (similarity index = 78), as were the two units at Paint Brush Prairie (similarity index = 69). This is not surprising since the geology, soils, and topography of Diamond Grove, Paint Brush, and Osage Prairie all differ, and one would expect two parts of a given prairie to be more similar than two areas at geographically isolated prairies with different physical characteristics. The Diamond Grove-east, Diamond Grove-west, and Paint Brush-south

	OSAGE - SPRING								OSAGE - SUMMER								OSAGE - FALL											
	SW Hay	SC Hay	SE Hay	C Graze	E Graze	NW Hay/Burn	NE Hay/Burn	W Graze/Hay	SW Hay	SC Hay	SE Hay	C Graze	E Graze	NW Hay/Burn	NE Hay/Burn	W. Graze/Hay	SW Hay	SC Hay	SE Hay	C Graze	E Graze	NW Hay/Burn	NE Hay/Burn	W Graze/Hay	Diamond Grove-E	Diamond Grove-W	Paintbrush-N	Paintbrush-S
OSAGE - SPRING																												
SW Hay																												
SC Hay	84																											
SE Hay	72	77																										
C Graze	60		60																									
E Graze				75																								
NW Hay/Burn	64	65	66																									
NE Hay/Burn						77																						
W Graze/Hay					56	67	70																					
OSAGE - SUMMER																												
SW Hay																												
SC Hay									83																			
SE Hay									79	75																		
C Graze																												
E Graze					55							73																
NW Hay/Burn									74	71	73																	
NE Hay/Burn							66		70					81														
W Graze/Hay					56							58	62	72	69													
OSAGE - FALL																												
SW Hay																												
SC Hay																	68											
SE Hay																	71	81										
C Graze																	62											
E Graze												56	61							78								
NW Hay/Burn																	69			58								
NE Hay/Burn															71							78						
W Graze/Hay																71		66	67			69	70					
Diamond Grove-E									59		60														78			
Diamond Grove-W											61			62												51		
Paintbrush-N														48													69	
Paintbrush-S									54	52																		

Table 3. Sorenson similarity index values for 8 management units at Osage Prairie sampled in spring, summer, and fall, and for 2 units at each Diamond Grove and Paintbrush Prairies sampled only in summer. Only the three highest index values are given for each unit. All index values are shown in Appendix 2. Management unit abbreviations are as follows: SW=southwest, SC=south central, SE=southeast, C=central, E=east, NW=northwest, NE=northeast, W=west, N=north, and S=south. In the future, each unit will receive different management and will be named as outlined in Table 1.

areas, which usually have been mowed annually and were sampled only in summer, were second and/or third most similar to the hay units at Osage Prairie sampled in summer. Thus, units which received a given management (e.g., annual haying) generally bore more resemblance to units receiving the same management treatment than to units receiving a different type of management, even though the units may occur at disjunct prairies with marked differences in soils and substrates. An exception was the Paint Brush Prairie-north area which had a similarity index above 50 with only one other area, Paint Brush Prairie-south. The north and south units at Paint Brush occur on similar soils with similar topography and geology. However, the north unit has been hayed or burned every 2 to 3 years while the south unit has been annually hayed. The north unit is the only area that did not have a similarity value above 50 with at least two other units. Comparison of summer similarity indices for all three prairies (Appendix 8) indicates that the eight management units at Osage Prairie were least similar with one or both of the Paint Brush Prairie management units.

To determine if vegetational composition varied significantly with past management at Osage Prairie, an analysis of variance was used to compare the mean frequency of all species sampled at the eight management units. The mean frequency of all species sampled within a season did not differ significantly ($p=0.05$) between the eight Osage Prairie management units. However, when mean canopy cover was compared, significant differences did occur. Using Duncan's multiple range test, significant differences were indicated between units in spring and autumn, but not in summer (Table 4). The mean cover differences between units in spring and fall are not clearly related to past management.

Further determination of differences in vegetational composition associated with past management units at Osage Prairie was made by comparing the mean frequency of 19 common species using

Table 4. Comparison of seasonal differences between Osage Prairie management units based on mean canopy cover of all species sampled. Duncan's multiple range test (SAS Institute Inc. 1982) was used for comparisons. Units with the same letter within a season are not statistically different (alpha=0.05). In summer, no units were significantly different. In the future, each unit will receive different management and will be named according to the outline in Table 1.

	OSAGE PRAIRIE MANAGEMENT UNIT							
Season	SW Hay	SC Hay	SE Hay	C Graze	E Graze	NE Hay/ Burn	W Graze/ Hay	NW Hay/ Burn
Spring	B,C	C	B,C	B,C	B	A	A	B,C
Fall	C	A	A,B	C	C	B	A,B	B

analysis of variance, and where significant differences were indicated a further break down using Duncan's multiple range test was applied (Table 5). Each of the 19 species showed significant differences in mean frequency between at least three of the management units. The frequency of Andropogon scoparius at the central and east graze units was significantly lower than at all other units. This is the only clear instance where the abundance of a species was related to a specific management practice.

The two units at Diamond Grove Prairie did not have significantly different mean frequencies or mean canopy covers. This was expected since both areas were annually hayed for many years prior to this study. The same 19 species tested for frequency differences at Osage Prairie were also tested for differences in mean frequency at Diamond Grove Prairie. Most of the species (11) showed no significant differences in mean frequency between the two units (Table 6). Two of the five grasses tested were significantly less frequent in the east unit (Andropogon gerardii, Andropogon virginicus), while one grass (Panicum lanuginosum) was significantly more frequent in the west unit. Only three of the 11 forbs tested showed significant differences. Erigeron strigosus, Potentilla simplex, and Rudbeckia hirta were significantly more frequent in the east than the west unit.

At Paint Brush Prairie, the overall composition of the two management units, as measured by mean frequency and mean canopy cover, did not differ significantly. However, 16 of the 19 species tested showed significant differences in mean frequency between the two units. Of these 16 species, 11 were significantly more frequent in the south unit than in the north unit. Differences in past management at the two units probably affected the frequency of certain species. On visual inspection, the south unit appears less productive with a greater abundance of disturbance adapted species, giving the impression that the south unit has been hayed too frequently or too late in the year. Haying date has been shown to affect species composition and

Table 5. Comparison of seasons and units for 19 common species at Osage Prairie based on frequency. Duncan's multiple range test (SAS Institute Inc. 1982) was used for comparisons. Seasons or management units with the same letter or number are not significantly different (alpha=0.05). Comparisons are only valid between seasons and units for a given species. Comparisons between species are not valid. For example the frequency of Rudbeckia hirta was significantly different in each season (indicated by a different number in spring, summer and fall). The frequency of Rudbeckia hirta differed significantly between the SE hay, NE hay/burn, C graze, and E graze units (indicated by A,B,D, and E), but did not differ significantly between the SW hay, SC hay, W graze/hay, and NW hay/burn units (indicated by C). Seasons are abbreviated as follows: SP=spring, SU=summer, FA=fall. The future management and name of each unit are given in Table 1.

	SEASON			OSAGE PRAIRIE MANAGEMENT UNIT							
Species	SP	SU	FA	SW Hay	SC Hay	SE Hay	C Graze	E Graze	NE Hay/ Burn	W Graze/ Hay	NW Hay/ Burn
Amorpha canescens	1	2	3	B,C	C,D,E	A	D,E	F	C,D	E,F	B
Andropogon gerardii	1	2	3	D	C,D	D	C	B	A	B	C
Andropogon scoparius	2	1	1	B	B	B	C	C	A	A	A
Andropogon virginicus	1	1	1	A	A	B	C	D	C	C	C
Antennaria neglecta	1	2	1	A,B	A	C,D	C,D	D	A	B,C	A,B
Carex meadii	1	2	3	C	F	E,F	B	A	B	D,E	D
Coreopsis grandiflora	1	2	3	B,C	C	A	B	D	B	D	D
Erigeron strigosus	1	1	2	C	B	A	E	F	E	D	E
Helenium flexuosum	2	1	2	B	B,C	A	C	D	D	D	D
Helianthus mollis	1	1	1	B,C	C,D	D,E	C,D,E	A	E	C,D	A,B
Panicum lanuginosum	1	2	3	C	B	C	C	C	A	A	A
Potentilla simplex	1	1	1	D	B,C	D	A,B	C	E	A	E
Pycnanthemum tenuifolium	1	1	1	C	C	C	C	B	C	A	C
Rosa carolina	1	1	1	D	E	B	D	E	C,D	A	B,C
Rudbeckia hirta	1	2	3	C	C	A	D	E	B	C	C
Ruellia humilis	1	2	3	C	B	C	D	B,C	B,C	A	B
Scleria triglomerata	1	2	1	C,D	A	B	D	D	B,C	A	B,C
Sorghastrum nutans	1	2	2	B	A,B	B,C	E	D	A	C	B
Viola sagittata	1	1	1	A	B	D	D	D	B,C	C,D	B,C,D

Table 6. Comparison of management units at Diamond Grove and Paint Brush Prairie for 19 common species, based on frequency. Duncan's multiple range test (SAS Institute Inc. 1982) was used for comparisons. Units with the same number (1 or 2) or letter (A or B) are not significantly different (alpha= 0.05). Relative frequency values for each species are given in parentheses.

	Diamond Grove Prairie		Paint Brush Prairie	
Species	West Unit	East Unit	North Unit	South Unit
Amorpha canescens	1 (3)	1 (4)	A (10)	B (1)
Andropogon gerardii	1 (76)	2 (93)	A (32)	A (27)
Andropogon scoparius	1 (94)	1 (96)	A (58)	B (76)
Andropogon virginicus	1 (49)	2 (73)	A (24)	B (77)
Antennaria neglecta	1 (11)	1 (3)	A (9)	B (23)
Carex meadii	1 (67)	2 (40)	A (50)	B (98)
Coreopsis grandiflora	1 (44)	1 (53)	A (14)	B (47)
Erigeron strigosus	1 (38)	2 (56)	A (10)	B (37)
Helenium flexuosum	1 (10)	1 (16)	A (0)	B (4)
Helianthus mollis	1 (16)	1 (23)	A (46)	B (0)
Panicum lanuginosum	1 (59)	2 (43)	A (67)	B (50)
Potentilla simplex	1 (27)	2 (47)	A (34)	B (50)
Pycnanthemum tenuifolium	1 (7)	1 (1)	A (51)	B (33)
Rosa carolina	1 (54)	2 (70)	A (84)	A (83)
Rudbeckia hirta	1 (31)	2 (59)	A (3)	A (3)
Ruellia humilis	1 (62)	1 (49)	A (62)	B (80)
Scleria triglomerata	1 (21)	1 (13)	A (22)	B (10)
Sorghastrum nutans	1 (58)	1 (69)	A (8)	B (24)
Viola sagittata	1 (53)	1 (50)	A (58)	B (81)

productivity (Hazell 1965, Launchbaugh and Owensby 1978, Hover and Bragg 1981).

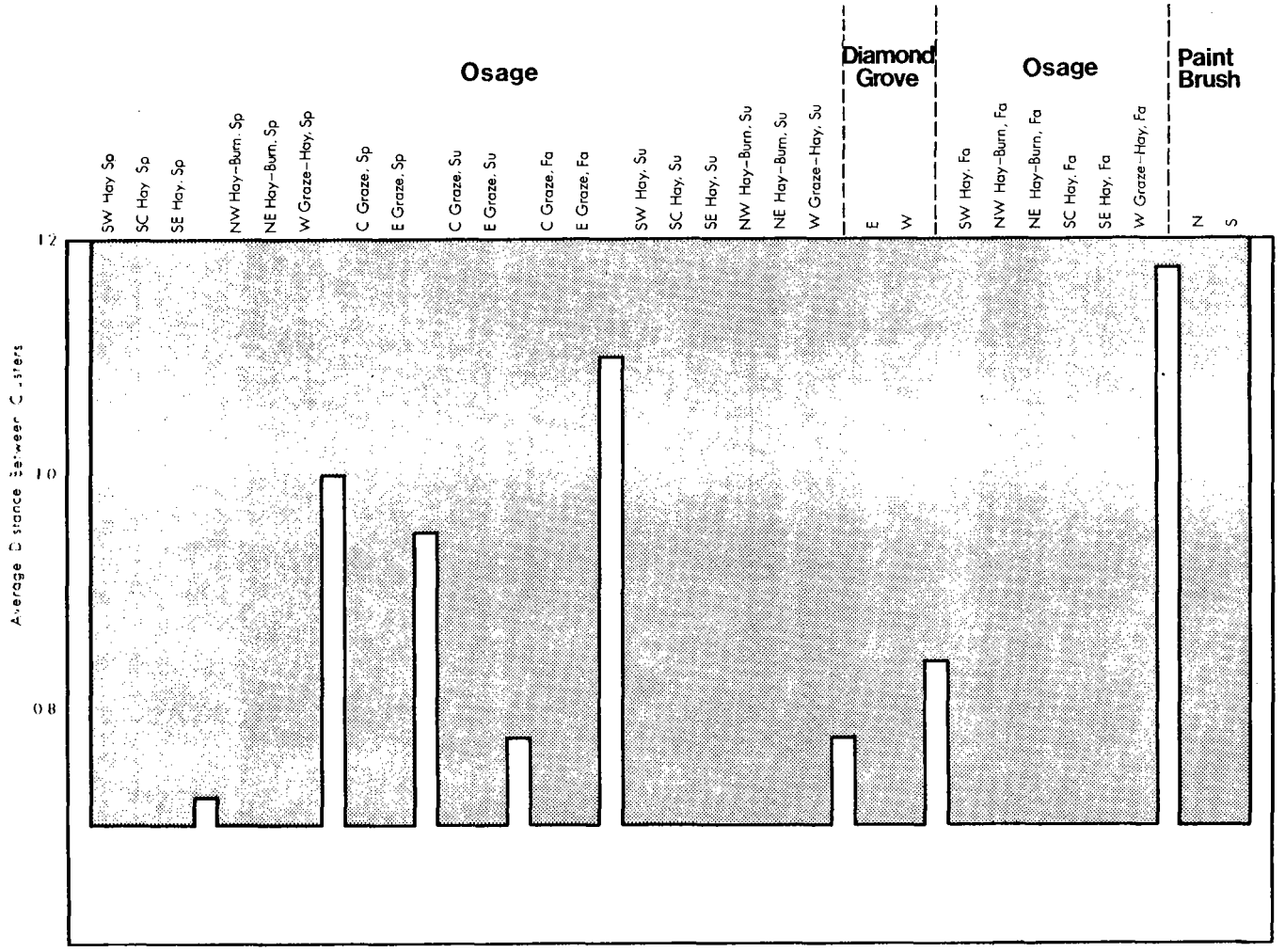
Further comparison between prairie units made with cluster analysis indicates the importance of management treatment and season. Cluster analysis using Sorenson's similarity indices derived from frequency data initially clustered the two Paint Brush Prairie units as a group dissimilar from the units at Osage and Diamond Grove Prairie (Figure 5). This directly resulted from the low similarity values between the Paint Brush Prairie units and all other units. Subsequent divisions indicated that the east and central graze units were similar to each other across all seasons and later grouped the two units by season (i.e., east and central graze units in spring distinct from east and central graze units in summer or fall). The remaining six units at Osage Prairie were similar within each season. These six units have a history of haying, although two units had been recently burned and another was intermittently grazed. Thus, Osage Prairie units with similar (but not necessarily identical) management were similar within a season, but less similar from one season to another.

The two Diamond Grove Prairie units were initially grouped with summer and fall units at Osage Prairie in which haying was a significant part of management. These two units were later recognized as a distinct group. This indicates that hayed prairies or units at separate locations may be vegetationally similar, but that other environmental factors may cause vegetational composition to differ between hayed prairies (e.g. hayed Osage units are similar to hayed Diamond Grove units, but not hayed Paint Brush unit).

Seasonal Variation

Considerable seasonal variation was apparent at Osage Prairie, as there was relatively little similarity between seasons at a given

Figure 5. Cluster analysis (Ward's method, SAS Institute Inc. 1982) of management units at Osage, Diamond Grove, and Paint Brush Prairies using Sorenson's similarity indices obtained from frequency data. Management units that are most similar are grouped together. Shaded areas represent the management units designated above the area, and the unshaded, vertical bars represent divisions between the groups (e.g. the SW Hay, SC Hay and SE Hay units sampled in spring are a group of similar units distinct from the adjacent group containing the NW Hay-Burn, NE Hay-Burn, and W Graze-Hay units). Management unit and season abbreviations are as follows: SW=southwest, SC=south central, SE=southeast, NW=northwest, NE=northeast, W=west, C=central, E=east, N=north, S=south, SP=spring, SU=summer, and FA=fall. The future management and future name of each unit at Osage Prairie are given in Table 1.



unit (Appendix 8). For example, the spring vegetation at the various units was usually most similar to the spring vegetation at the other units, rather than the summer or fall vegetation at the given unit. When considering the three highest similarity values for each unit (Table 3), it is apparent that relatively high similarity values (between 55 and 71) occurred between adjacent seasons (spring and summer, or summer and fall), but not between disjunct seasons (spring and autumn). The results of cluster analysis, discussed earlier, further substantiates this observation.

Since seasonal variation at Osage Prairie was apparent from comparing similarity indices, the next question is whether the differences in vegetational composition between the three seasons are significant. To answer this, the mean frequencies of all species sampled in each season were tested using analysis of variance and no significant differences between seasons were found ($p=0.05$) for any units except the northeast hay-burn unit. At this unit, the mean frequencies of all species sampled in spring and fall are significantly different based on Duncan's multiple range test, while those in spring and summer or summer and fall are not different. However, seasonal differences in mean canopy cover for all species at a given unit were usually significant. Only the northeast hay/burn unit showed no significant difference in mean canopy cover between the three seasons. Seasonal differences in canopy cover were not surprising since the canopy of most grasses, sedges and forbs varies with growth stage within a year. Likewise, the similarity in frequency between seasons is not surprising since many species were present vegetatively (basal leaves or rosettes) from May through October, even though they were not flowering or fruiting.

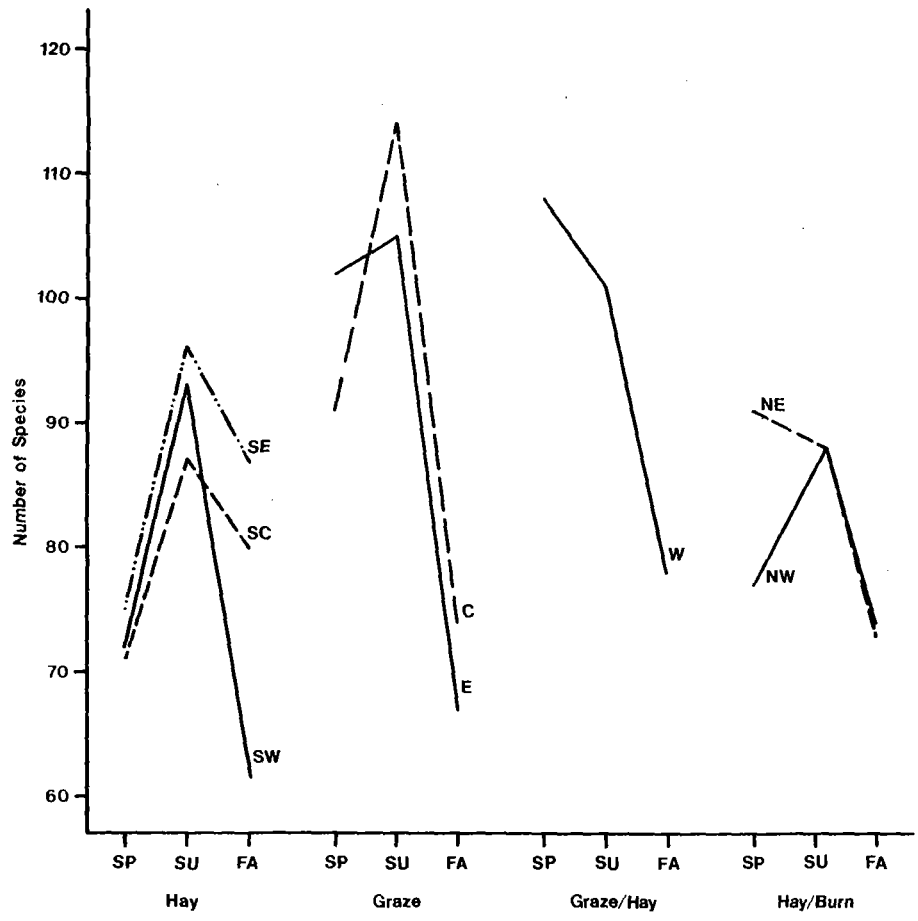
Because little difference occurred in overall mean frequency from one season to the next, the frequency of 19 common species was compared between seasons at Osage Prairie to determine if the frequency of individual species differed with season. Fourteen

of the 19 species (73%) had significant differences between at least two seasons (Table 5). Seven species showed significant differences for all three seasons, while seven others differed for only two seasons.

Diversity

Species richness differed between prairie units and seasons. At Osage Prairie, grazed areas sampled in spring and summer tended to have the highest species richness (Figure 6, Appendix 9). This may be due partially to the relatively high number of introduced species present at the grazed areas as opposed to the hayed or burned areas. At each previously grazed unit 4.3 to 8.6% of total species sampled were introduced, while 0.8% to 2.7% of total species sampled at non-grazed units were introduced. The high species richness of grazed areas in this study contradicts Eyster-Smith's (1984) finding that grazing reduced species richness in a study of 77 tallgrass prairie remnants, but substantiates Kelting's (1954) finding that species richness was higher in a grazed Oklahoma prairie (64 species sampled) than on a nearby ungrazed prairie (36 species sampled). Kelting attributed the increased species richness to an increase in habitat types caused by grazing. Grazing at the Osage Prairie units, which was relatively light and only occurred intermittently, probably opened the ground for invasion by some Eurasian plants but may not have been severe enough to eliminate a noticeable number of native prairie species. This may have resulted in a relatively high species richness, including native and non-native components. Increased species richness brought about by an increase in introduced plant species is not particularly desirable when trying to maintain a high quality prairie. Relatively low species richness occurred in autumn at the three units that were hayed in July, one and a half to two months prior to fall sampling. This included two grazed units. In spring, the three hayed units had lower richness than the hayed/burned or grazed areas (Figure 6).

Figure 6. Species richness of eight management units at Osage Prairie for each season. Abbreviations are as follows: SE=southeast hay unit, SC=south central hay unit, SW=southwest hay unit, C=central graze unit, E=east graze unit, W=west graze/hay unit, NE=northeast hay/burn unit, NW=northwest hay/burn unit, SP=spring, SU=summer, and FA=fall. The future management and future name of each unit are given in Table 1.



Although the total number of species encountered during a season was highest at two grazed units, this says nothing about the frequency or evenness of distribution of species at grazed versus nongrazed units. The Shannon-Weiner index takes the frequency of each species at a unit into account and measures both the evenness, or equitability, of species distributions and the species richness at a unit. Shannon-Weiner index values (Appendix 9) were highest at the central (4.08 in summer) and east (3.98 in summer) graze units, indicating that these units had the greatest equitability of species distribution. The southeast hay unit also had a high Shannon Weiner index (3.97 in summer) however, and it was extremely close to that of the east graze unit. Since the equitability values of these three units were close, the average number of species per plot was calculated for these three units to estimate the evenness of species distributions. The average species richness in a $0.5m^2$ plot sampled in summer was very similar for the three units, with 21.2 species/plot at the east graze unit, 21.1 species/plot at the central graze unit, and 21.1 species/plot at the southeast hay unit.

Species richness showed seasonal variation within a given unit at Osage Prairie. The greatest average species richness at Osage Prairie (97 species/unit) occurred in summer, while the lowest average richness (74 species/unit) occurred in autumn. Contrary to these findings, a study of grazed and ungrazed Oklahoma prairie (Kelting 1954) concluded that the greatest number of species occurred in spring, rather than summer or fall. Many of the species encountered in that study were early flowering annuals, which were very uncommon at Osage Prairie.

The concentration of dominance (as measured by Simpson's index) ranged from 0.21 to 0.36 and varied little between prairie units, indicating that dominance was shared among many species at all areas sampled (Appendix 9). As with species richness, the value

Figure 7. Dominance concentration, as measured by Simpson's index, of eight management units at Osage Prairie for each season. Abbreviations are as follows: SE=southeast hay unit, SC=south central hay unit, SW=southwest hay unit, C=central graze unit, E=east graze unit, W=west graze/hay unit, NE=northeast hay/burn unit, NW=northwest hay/burn unit, SP=spring, SU=summer, and FA=fall. The future management and future name of each management unit are given in Table 1.

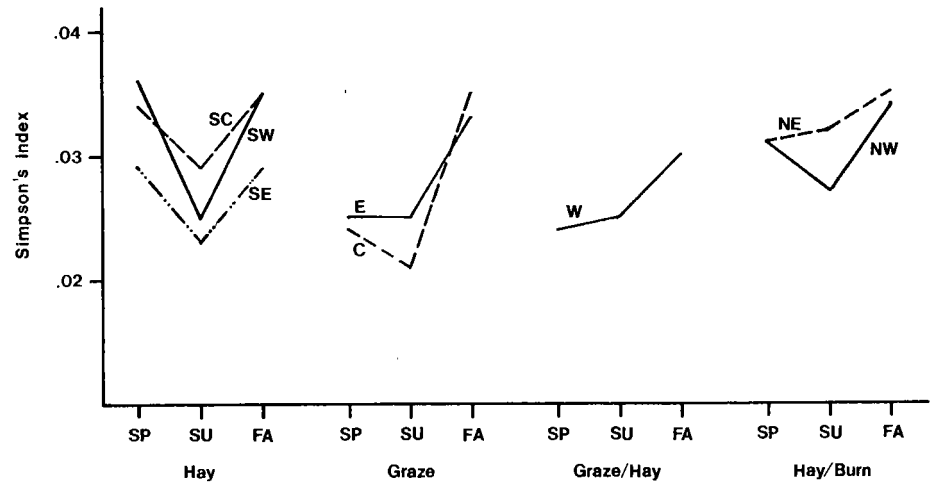
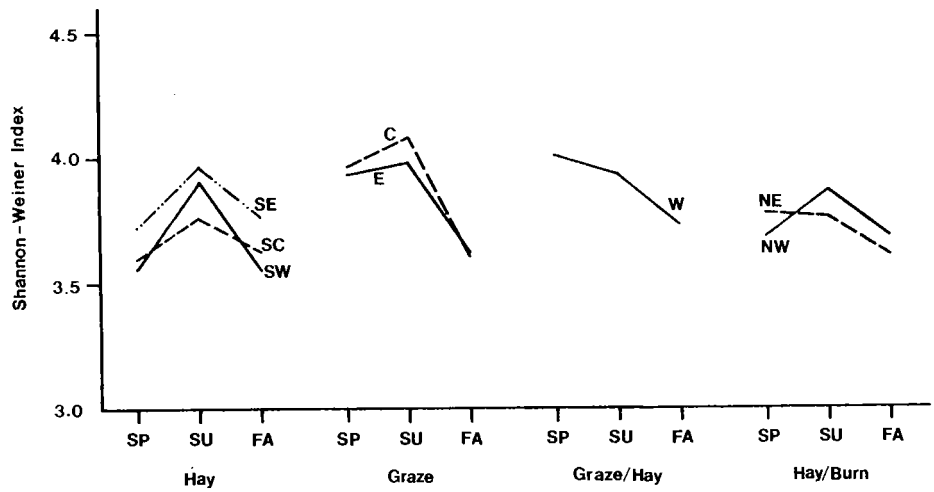


Figure 8. Equitability, as measured by Shannon-Weiner index, of eight management units at Osage Prairie for each season. Abbreviations are as follows: SE=southeast hay unit, SC=south central hay unit, SW=southwest hay unit, C=central graze unit, E=east graze unit, W=west graze/hay unit, NE=northeast hay/burn unit, NW=northwest hay/burn unit, SP=spring, SU=summer, and FA=fall. The future management and future name of each management unit are given in Table 1.



of Simpson's index varied with season. The lowest concentration of dominance occurred in summer at most units sampled at Osage Prairie, with greater dominance concentration in spring and autumn (Figure 7). Exceptions to this occurred at the NE burn unit and W graze/hay unit, where dominance concentration was lowest in spring, increased in summer, and then again in fall. The highest value of Simpson's index occurred at the SW hay unit in spring, while the lowest value occurred at the C graze unit in summer. Concentration of dominance at the eight Osage Prairie units varied the greatest in fall. In spring, hayed and hayed/burned areas had higher dominance concentration than grazed areas. However, in summer and fall the value of Simpson's index was similar among units with differing management regimes.

Concentration of dominance was lower at these prairies than at 77 tallgrass prairie remnants studied in Arkansas, Kansas, Missouri, and Oklahoma (Eyster-Smith 1984). Eyster-Smith obtained Simpson's index values ranging from .086 to .392 (after necessary mathematical transformations) for 77 prairie remnants, including values of .132 at Diamond Grove Prairie and .093 at Paint Brush Prairie. The lower concentration of dominance found in this study may be due to the much larger sample size which included approximately 50 to 80 more taxa than Eyster-Smith's study.

In this study, dominance concentration is inversely related to species richness. This agrees with McNaughton's (1968) conclusion that dominance and diversity (species richness) were inversely correlated in California grasslands. However, Whittaker (1965) reported the inverse correlation between dominance and diversity was a weak one.

Equitability, as measured with the Shannon-Weiner index, was generally highest during the summer at a given unit (Figure 8). A comparison of seasonal variation within each unit shows that equitability and dominance concentration varied inversely (Figures 7, 8), as should be expected (Peet 1974). The greatest

equitability occurred at Diamond Grove Prairie's west unit and the central graze unit of Osage Prairie in summer (Appendix 9). These two areas also had the greatest species richness of those studied. In contrast, the lowest equitability occurred at the southwest and south central hay units of Osage Prairie, sampled in spring and summer.

SUMMARY

1. Baseline data on vegetational composition (relative frequency, average canopy cover, and importance value) are given for each species sampled at 12 management units in three different prairies. Compositional data are given on a seasonal basis (spring, summer, and fall) for the eight management units studied at Osage Prairie. These data are given for summer only at two management units of Diamond Grove and Paint Brush Prairies.

2. Andropogon gerardii and Andropogon scoparius were dominant grasses at every unit of Osage Prairie, while Sorghastrum nutans was dominant at seven of the eight Osage Prairie management units. Viola sagittata was a dominant forb at most units of Osage Prairie during at least one season. Diamond Grove and Paint Brush Prairies differed from Osage Prairie in that Sporobolus heterolepis was among the dominant grasses at these two prairies, but not at Osage Prairie. Marshallia caespitosa was among the dominant forbs at Diamond Grove Prairie, but was absent from the other two prairies. The percentage of species composition accounted for by the four most important plant families at the 12 units sampled fell within the following ranges: Compositae - 18 to 23%, Gramineae - 16 to 23%, Cyperaceae - 6 to 11% and Leguminosae - 7 to 10%.

3. The importance value of several species at Osage Prairie varied with past management. Carex meadii, Cerastium

vulgatum, Solidago gymnospermoides, Vernonia baldwinii, and Vernonia sp. had their highest importance values at two units of Osage Prairie that were grazed, rather than units which were primarily hayed or hayed and burned. On the contrary, lowest importance values for Amorpha canescens, Andropogon ternarius, Andropogon virginicus, Aristida longspica, Fimbristylis caroliniana, Psoralea psoralioides, Rhynchospora globularis, Rudbeckia hirta, Schrankia uncinata, Scleria triglomerata, and Sorghastrum nutans occurred at the two grazed units. Andropogon virginicus, Erigeron strigosus, and Houstonia minima reached their highest importance values at the three unburned, annually hayed units, while Leptoloma cognatum had its lowest importance value at these three units.

4. Species absent or less frequent on grazed areas of Osage Prairie that were also listed by Kucera (1956) as absent or less frequent on a grazed part of a northeast Missouri prairie include Amorpha canescens, Asclepias hirtella, Euphorbia corollata, and Gentiana puberulenta. Plants that were more frequent under grazing at both Osage Prairie and the prairie studied by Kucera were Cerastium vulgatum and Myosotis virginica.

5. Andropogon virginicus was most frequent on areas of Osage, Diamond Grove, and Paint Brush Prairies that had been annually hayed.

6. To determine if species frequencies were significantly different from past management, an analysis of variance was done using the frequency of 19 common species at each unit of the three prairies. For those species showing a significant difference in units, a Duncan's multiple range test was used to further determine which were different. At Osage Prairie, these 19 species showed significant differences in mean frequency between at least three of the units. Most of the

differences in frequency were not clearly related to specific management practices however. An exception was Andropogon scoparius which was significantly less frequent at two primarily grazed units of Osage Prairie than at units receiving other types of management. At Diamond Grove Prairie, two areas that were both annually hayed for many years showed no significant differences in 11 of the 19 common species tested. At Paint Brush Prairie, 11 of the 19 species tested were significantly more frequent in a management unit that was annually hayed than in a unit that was hayed every two or three years. Five of the 19 species were significantly less frequent in the annually hayed unit as opposed to the biennially or triennially hayed unit. On the whole, the frequency of most species tested differed significantly on units that had received different management treatments.

7. In general, Osage Prairie management units that received the same type of past management had the highest similarity indices. In a given season, the hayed units were most similar, grazed units were most similar, and hayed/burned units were most similar. An exception was that the west graze/hay unit sampled in spring and summer was most similar to the northeast hay/burn unit in the corresponding season.

8. The highest species richness (total number of species sampled in a unit during a season) at Osage Prairie occurred in two grazed areas (sampled in summer). This may be attributed partially to the relatively high percentage of introduced species at the grazed units (4.3 to 8.6% of species sampled were introduced) as opposed to the hayed or hayed and burned units (0.8 to 2.7% of species sampled were introduced). Values for the Shannon-Weiner index, a heterogeneity index which takes into account both species richness and the evenness of a species distribution (species frequency), were also highest at these two grazed units (4.08 at the central

graze unit and 3.98 at the east graze unit in summer). The Shannon-Weiner index value for the southeast hay unit was also high (3.97 in summer) and very close to that of the east graze unit.

9. Seasonal variation in vegetational composition was apparent since the frequency of 19 common species often differed significantly with season at Osage Prairie. Fourteen of the 19 species tested had significant differences in mean frequency between at least two of the three seasons studied. Additionally, the most important species at each unit of the three prairies often varied with season.

10. Seasonal variation was also apparent from diversity indices calculated for Osage Prairie. The greatest average species richness (97 species per unit) occurred in summer, and the lowest average species richness (74 species per unit) occurred in autumn. The lowest concentration of dominance (Simpson's index) occurred in summer at most units of Osage prairie, with greater dominance concentration in spring and fall.

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Appendix 1. Average relative frequency, average canopy cover, and average importance value of each species sampled at 8 management units of Osage Prairie. Values are averages of spring, summer, and fall data. Species belonging to major families are indicated as: C=Compositae, G=Graminae, L=Leguminosae, and S=Cyperaceae (sedge family). An * denotes an introduced species not native to Missouri (Steyermark 1963). Abbreviations of management units are: SW=southwest, SC=south central, SE=southeast, C=central, E=graze, NW=northwest, NE=northeast, and W=west. The future management and future name of each management unit are given in Table 1.

OSAGE PRAIRIE

Species	family	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
		relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value
Acalypha gracilens					1	0.3	1.3				10	1	11	14	1	15	0.3	1	1.3	3	1	4	27	1	28
Achillea millefolium*	C	1	2	3				0.3	5	5.3	10	8	18	3	4	7							5	2	7
Agropyron repens*	G										0.3	1	1.3												
Agrostis elliottiana	G	0.3	1	1.3										0.3	1	1.3				1	5	6			
Agrostis hyemalis	G	53	15	68	49	18	67	49	13	62	49	13	62	72	14	86	25	9	34	36	11	47	28	10	38
Agrostis stolonifera	G				1	1	2	1	5	6	1	2	3	4	4	8				0.3	21	21.3	0.3	5	5.3
Allium sp.		0.3	1	1.3							0.3	0.3	0.6												
Alopecurus carolinianus	G													1	2	3									
Ambrosia artemisiifolia	C	5	2	7				1	1	2	9	1	10	9	2	11	1	1	2	1	2	3	3	2	5
Ambrosia bidentata	C										1	0.3	1.3	4	3	7									
Ambrosia coronopifolia	C	0.3	1	1.3	1	0.3	1.3				0.3	0.3	0.6	1	4	5									
Amorpha canescens	L	14	4	18	10	10	20	31	9	40	6	5	11	0.3	1	1.3	17	6	23	11	11	22	5	11	16
Andropogon gerardii	G	51	24	75	54	31	85	48	26	74	59	28	87	83	30	113	73	26	99	93	39	132	83	39	122
Andropogon saccharoides	G	0.3	0.3	0.6																					
Andropogon scoparius	G	79	26	105	81	35	116	84	40	124	65	18	83	64	20	84	97	47	144	98	54	152	92	48	140
Andropogon ternarius	G	23	24	47	33	25	58	40	39	79	2	3	5	0.3	1	1.3	24	18	42	20	20	40	16	16	32
Andropogon virginicus	G	67	13	80	64	18	82	51	17	68	18	10	28	7	6	13	28	10	38	18	14	32	21	15	36
Anemone caroliniana					1	0.3	1.3	1	0.3	1.3				1	0.3	1.3	2	1	3	0.3	0.3	0.6	1	1	2
Antennaria neglecta	C	15	1	16	20	3	23	8	1	9	5	2	7	5	3	8	16	1	17	18	1	19	11	1	12
Apocynum cannabinum					2	1	3	2	2	4				1	3	4	4	1	5	2	1	3	0.3	0.3	0.6
Aristida dichotoma	G				2	8	10													1	3	4			
Aristida longespica	G	24	7	31	23	12	35	30	12	42	2	2	4	4	5	9	21	8	29	18	6	24	18	12	30
Aristida oligantha	G	22	8	30	16	9	25	24	8	32	9	3	12	7	4	11	8	3	11	6	4	24	14	5	19
Aristida purpurascens	G	8	5	13	1	14	15	8	9	17				1	3	4	32	13	45	36	18	54	38	19	57
Aristida sp.	G	20	8	28	26	19	45	19	13	32	3	3	6	4	4	8	22	12	34	14	9	23	23	13	36

(continued on next page)

Appendix 1. Continued

OSAGE PRAIRIE

Species	family	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
		relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value
Asclepias amplexicaulis		0.3	5	5.3				1	2	3										0.3	1	1.3	0.3	0.3	0.6
Asclepias hirtella		2	5	7	2	8	10										1	19	20	1	17	18			
Asclepias stenophylla																				0.3	5	5.3			
Asclepias verticillata		0.3	1	1.3																1	0.3	1.3			
Asclepias viridiflora																				0.3	1	1.3			
Asclepias viridis		3	1	4	1	2	3	2	2	4	0.3	1	1.3	0.3	1	1.3	3	3	6	3	3	6			
Asclepias sp.		1	1	2	0.3	1	1.3													1	0.3	1.3			
Aster azureus	C																			0.3	5	5.3			
Aster ericoides	C	10	4	14	1	22	23	0.3	1	1.3	7	6	13	1	2	3	6	3	9	0.3	1	1.3			
Aster linariifolius	C				0.3	13	13.3																		
Aster patens	C	9	2	11	3	3	6	26	4	30							43	7	50	6	5	11	1	4	5
Aster pilosus	C	52	4	56	54	9	63	41	5	46	11	4	15	22	5	27	27	3	30	61	6	67	23	4	27
Aster sp.	C							1	1	2	14	11	25												
Astragalus sp.	L	1	1	2	1	1	2	3	1	4				0.3	1	1.3									
Baptisia leucantha	L													0.3	5	5.3									
Baptisia leucophaea	L	1	6	7	3	7	10	7	8	15	4	5	9	3	4	7	8	9	17	8	9	17	1	8	9
Bidens polylepis	C				1	3	4	0.3	0.3	0.6				0.3	1	1.3									
Bromus racemosus*	G										34	11	45	42	12	54									
Bromus sp.*	G										0.3	1	1.3										0.3	21	21.3
Buchnera americana								0.3	1	1.3							2	1	3	1	3	4			
Cacalia tuberosa	C				1	6	7				0.3	1	1.3				0.3	1	1.3						
Calopogon tuberosus					0.3	0.3	0.6																		
Camassia scilloides																				1	4	5			
Cardamine parviflora		0.3	0.3	0.6				0.3	5	5.3	4	3	7	7	1	8				0.3	0.3	0.6	1	0.3	1.3
Carex abdita	S	16	8	24	8	5	13	25	7	32	20	12	32	8	10	18	20	8	28	14	11	25	22	14	36
Carex bushii	S	4	6	10	10	8	18	4	8	12	15	10	25	25	8	33	9	9	18	8	6	14	19	12	31

Appendix 1. Continued

OSAGE PRAIRIE

Species	family	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
		relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value
Carex meadii	S	71	11	82	48	14	62	50	16	66	80	26	106	93	38	131	59	12	71	78	18	96	58	16	74
Carex sp.	S							2	6	8							0.3	1	1.3	0.3	1	1.3	3	11	14
Castilleja coccinea		13	2	15	21	2	23	17	2	19							5	1	6	3	6	9	1	1	2
Ceanothus americanus																	0.3	1	1.3						
Centunculus minimus					0.3	0.3	0.6				0.3	0.3	0.6	1	0.3	1.3									
Cerastium vulgatum*		0.3	0.3	0.6				0.3	0.3	0.6	20	1	21	17	1	18							1	0.3	1.3
Chrysopsis pilosa	C	0.3	0.3	0.6				0.3	0.3	0.6													0.3	0.3	0.6
Cicuta maculata											0.3	1	1.3												
Cirsium altissimum	C										2	2	4	3	1	4							8	4	12
Cirsium discolor	C				0.3	0.3	0.6	0.3	0.3	0.6	0.3	1	1.3	1	4	5							1	1	2
Cirsium sp.	C	0.3	0.3	0.6				1	1	2	1	1	2	1	2	3	1	0.3	1.3	1	0.3	1.3	3	1	4
Claytonia virginica								0.3	5	5.3	10	1	11	21	1	22				0.3	0.3	0.6	0.3	1	1.3
Comandra richardsiana		0.3	0.3	0.6	4	2	6	10	3	13	5	4	9	0.3	1	1.3							10	8	18
Coreopsis grandiflora	C	18	3	21	13	4	17	27	5	32	20	10	30	4	4	8	5	2	7	19	4	23	7	1	8
Coreopsis palmata	C				1	3	4																		
Cornus drummondi														0.3	1	1.3									
Crotalaria sagittalis	L	14	0.3	14.3	13	1	14	5	0.3	5.3	12	1	13	18	1	19	6	0.3	6.3	2	0.3	2.3	12	0.3	12.3
Croton glandulosus											7	0.3	7.3	0.3	0.3	0.6									
Croton monanthogynus											0.3	0.3	0.6	0.3	1	1.3							1	1	2
Crotonopsis elliptica								0.3	1	1.3	0.3	1	1.3	4	5	9							6	6	12
Cyperus sp.	S																						0.3	1	1.3
Danthonia spicata	G										0.3	0.3	0.6												
Delphinium virescens																							0.3	5	5.3
Desmodium canadense	L	0.3	13	13.3																					
Desmodium sessilifolium	L																						0.3	5	5.3

Appendix 1. Continued

OSAGE PRAIRIE

Species	family	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
		relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value
Diodia teres								0.3	0.3	0.6	6	1	7	2	0.3	2.3							2	14	16
Dodecatheon meadia		4	1	5				1	1	2	0.3	1	1.3	0.3	5	5.3	10	2	12	6	1	7			
Draba brachycarpa														0.3	0.3	0.6									
Echinacea pallida	C	2	1	3	0.3	1	1.3	1	11	12							9	5	14	13	6	19	2	9	11
Eleocharis obtusa	S										0.3	1	1.3							0.3	0.3	0.6			
Eleocharis tenuis	S	1	11	12	6	16	22	1	13	14	12	12	24	22	10	32	3	31	34	4	31	35	9	31	40
Eleocharis sp.	S	0.3	13	13.3							2	8	10				1	25	26	3	46	49	2	16	18
Elymus canadensis	G							1	0.3	1.3													0.3	5	5.3
Elymus virginicus	G										0.3	5	5.3												
Eragrostis spectabilis	G	19	6	25	9	8	17	17	9	26	3	5	8	2	10	12	14	7	21	16	10	26	17	10	27
Erigeron annuus	C													0.3	5	5.3									
Erigeron canadensis	C	0.3	0.3	0.6	1	1	2	0.3	0.3	0.6	1	11	12				1	0.3	1.3	1	1	2	1	0.3	1.3
Erigeron strigosus	C	44	3	47	52	4	56	62	5	67	22	5	27	11	5	16	26	1	27	26	3	29	36	1	37
Eryngium yuccifolium		1	3	4				0.3	5	5.3	0.3	1	1.3	0.3	1	1.3	0.3	1	1.3	0.3	5	5.3	1	5	6
Erythronium albidum		1	0.3	1.3							1	0.3	1.3				1	1	2	1	0.3	1.3			
Eupatorium perfoliatum	C										3	2	5	2	5	7				0.3	5	5.3	5	7	12
Eupatorium serotinum	C										0.3	5	5.3												
Euphorbia corollata		12	5	17	11	9	20	12	8	20	1	1	2				25	10	35	8	9	17	2	1	3
Festuca octoflora		7	2	9	6	2	8	2	0.3	2.3	16	2	18	21	2	23	0.3	0.3	0.6	0.3	0.3	0.6	2	1	3
Festuca elatior*	G										2	15	17	3	14	17									
Fimbristylis caroliniana	S	11	3	14	19	5	24	12	3	15	1	0.3	1.3	1	2	3	15	6	21	17	5	22	15	6	21
Galium obtusum														0.3	5	5.3									
Gentiana puberulenta		0.3	0.3	0.6				2	4	6							3	5	8	2	11	13			
Geranium carolinianum		0.3	1	1.3							3	1	4	7	1	8									

Appendix 1. Continued

OSAGE PRAIRIE

Species	family	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
		relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value
Gerardia fasciculata		0.3	0.3	0.6	0.3	1	1.3				0.3	1	1.3												
Gnaphalium purpureum	C	6	0.3	6.3	3	0.3	3.3	4	0.3	4.3							0.3	0.3	0.6				1	0.3	1.3
Helenium flexuosum	C	13	4	17	10	3	13	22	3	25	6	3	9	4	3	7	1	14	15	3	1	4	4	8	12
Helianthus mollis	C	18	26	44	15	22	37	9	24	33	12	15	27	25	33	58	23	30	53	6	21	27	13	25	38
Hieracium longipilum	C	1	1	2				2	4	6							0.3	0.3	0.6	1	1	2	1	2	3
Houstonia minima		17	1	18	52	1	53	24	1	25	3	0.3	3.3	3	0.3	3.3				1	3	4	1	0.3	1.3
Hypericum drummondii		5	1	6	3	1	4	2	1	3	1	1	2	3	1	4				1	1	2	1	1	2
Hypericum punctatum											0.3	0.3	0.6				0.3	0.3	0.6	1	1	2			
Hypoxis hirsuta		1	1	2	3	1	4	6	1	7	11	1	12	22	2	24	14	2	16	27	2	29	13	2	15
Isoetes butleri														0.3	1	1.3									
Juncus brachycarpus											3	10	13	13	3	16							5	11	16
Juncus dudleyi																							0.3	5	5.3
Juncus interior											1	1	2	10	4	14							0.3	1	1.3
Juncus marginatus					0.3	5	5.3				1	1	2	2	1	3	0.3	1	1.3				2	2	4
Juniperus virginiana								0.3	1	1.3				0.3	5	5.3									
Koeleria cristata	G	1	6	7	3	18	21	4	3	7	0.3	5	5.3	0.3	0.3	0.6	0.3	5	5.3	2	8	10	0.3	1	1.3
Krigia dandelion	C													11	4	15				6	3	9	17	4	21
Krigia occidentalis	C				1	1	2																		
Krigia virginica	C										0.3	1	1.3	1	0.3	1.3									
Krigia sp.	C	22	2	24	22	1	23	24	2	26	21	3	24	31	3	34	12	1	13	9	2	11	8	2	10
Lactuca canadensis											2	2	4	0.3	1	1.3									
Lepidium virginicum		0.3	0.3	0.6	1	0.3	1.3	1	1	2	4	1	5	1	0.3	1.3	0.3	1	1.3						
Leptoloma cognatum	G	12	6	18	6	6	12	11	5	16	33	7	40	18	7	25	16	9	25	28	5	33	48	10	58
Lespedeza capitata	L	0.3	0.3	0.6				0.3	21	21.3				0.3	1	1.3	1	1	2	1	1	2			
Lespedeza striata*	L	0.3	0.3	0.6	0.3	0.3	0.6	0.3	0.3	0.6	20	1	21	20	1	21							1	1	2

Appendix 1. Continued

OSAGE PRAIRIE

Species	family	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
		relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value
Lespedeza virginica	L	1	1	2				2	1	3	0.3	0.3	0.6	4	1	5	8	5	13	8	3	11	4	1	5
Lespedeza striata/Trifolium*	L										7	1	8	4	1	5									
Liatris aspera	C																0.3	5	5.3	0.3	5	5.3			
Liatris pycnostachya	C	1	14	15	5	14	19	1	13	14				3	7	10	0.3	5	5.3				4	10	14
Linaria canadensis																							0.3	0.3	0.6
Linum medium		9	1	10	3	5	8	4	2	6	1	2	3	7	0.3	7.3	2	0.3	2.3	3	1	4	7	1	8
Linum sulcatum								4	3	7							1	1	2	13	1	14			
Lithospermum incisum					1	1	2	2	2	4													0.3	1	1.3
Lobelia spicata		4	1	5	1	1	2	0.3	1	1.3	1	1	2	0.3	0.3	0.6	0.3	0.3	0.6	2	1	3	4	1	5
Ludwigia alternifolia											0.3	0.3	0.6												
Luzula bulbosa		2	2	4	1	1	2	2	4	6	6	3	9	5	2	7							2	1	3
Monarda fistulosa																							0.3	5	5.3
Myosotis virginica					1	0.3	1.3	0.3	0.3	0.6	6	1	7	11	1	12							0.3	0.3	0.6
Nothoscordum bivalve		14	2	16	13	3	16	20	3	23	20	4	24	21	3	24	14	1	15	14	1	15	1	1	2
Oenothera linifolia		16	1	17	6	0.3	6.3	7	1	8	4	1	5	0.3	1	1.3	3	0.3	3.3	2	0.3	2.3	1	1	2
Oxalis dillenii		30	1	31	25	1	26	20	2	22	30	1	31	27	2	29	36	3	39	44	1	45	48	1	49
Oxalis violacea		15	1	16	13	1	14	19	1	20	16	2	18	22	2	24	27	2	29	45	3	48	24	2	26
Panicum lanuginosum	G	64	7	71	78	18	96	68	14	82	70	9	79	69	9	78	87	16	103	91	22	113	93	23	116
Panicum linearifolium	G																			1	5	6			
Panicum oligosanthes	G	0.3	1	1.3	1	6	7	10	5	15	5	4	9	3	3	6	12	11	23	24	11	35	7	14	21
Panicum scoparium	G				0.3	1	1.3	0.3	5	5.3	18	10	28	13	15	28	0.3	5	5.3				32	20	52
Panicum sphaerocarpon	G	5	1	6	4	1	5	21	2	23	3	1	4				6	3	9	5	2	7	5	4	9
Panicum virgatum	G	5	19	24	2	15	17	7	25	32	4	20	24				4	23	27	1	6	7	7	29	36
Panicum sp.	G	17	3	20	6	2	8	3	2	5	2	2	4	1	0.3	1.3	7	3	10	5	4	9	1	5	6
Paspalum ciliatifolium	G	15	7	22	26	10	36	23	5	28	21	8	29	15	8	23	14	4	18	8	5	13	40	5	45

Appendix 1. Continued

OSAGE PRAIRIE

Species	family	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
		relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value
Paspalum laeve	G	12	2	14	9	7	16	11	5	16	17	12	29	9	8	17	1	3	4	1	3	4	3	5	8
Paspalum sp.	G	30	7	37	30	6	36	23	7	30	3	2	5	3	5	8	1	1	2				7	1	8
Pedicularis canadensis		0.3	1	1.3	2	7	9	14	12	26	2	15	17	6	23	29				4	8	12	3	18	21
Penstemon digitalis		7	3	10	5	2	7	14	3	17	3	1	4	2	2	4	3	1	4	10	2	12	3	2	5
Penstemon spp.		4	1	5	5	1	6	10	1	11	1	1	2				3	0.3	3.3	6	1	7	2	1	3
Petalostemon candidum	L																						1	14	15
Phleum pratense*	G										1	5	6	1	8	9									
Phlox pilosa								0.3	1	1.3															
Physalis heterophylla								1	1	2	0.3	1	1.3												
Physalis pumila											0.3	0.3	0.6												
Physalis virginiana																	1	1	2				1	3	4
Physostegia angustifolia		1	3	4	2	3	5	0.3	1	1.3	4	2	6	5	1	6				0.3	1	1.3	3	1	4
Plantago aristata		7	5	12	1	1	2	1	1	2	18	5	23	3	2	5				0.3	0.3	0.6			
Plantago lanceolata*											1	3	4												
Plantago virginica		9	1	10	18	2	20	23	1	24	8	1	9	4	1	5	15	1	16	4	0.3	4.3	12	0.3	12.3
Poa compressa*	G										5	6	11	9	8	17							0.3	1	1.3
Poa pratensis*	G										19	9	28	25	6	31									
Poa sp.*	G										11	2	13	14	2	16									
Polygala incarnata		1	4	5																					
Polygala sanguinea		29	1	30	30	1	31	26	1	27	24	1	25	29	1	30	25	0.3	25.3	26	1	27	30	1	31
Polygala verticillata																				0.3	0.3	0.6			
Polytaenia nuttallii		1	1	2	1	1	2	1	1	2	1	1	2	1	1	2	3	2	5	17	2	19	1	1	2
Potentilla recta*					0.3	5	5.3							0.3	1	1.3	1	1	2						
Potentilla simplex		38	6	44	56	9	65	37	7	44	63	9	72	54	5	59	23	3	26	22	2	24	68	8	76
Prenanthes aspera	C										0.3	1	1.3	1	0.3	1.3							0.3	5	5.3

Appendix 1. Continued

OSAGE PRAIRIE

Species	family	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
		relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value
Prunella vulgaris														1	0.3	1.3									
Psoralea psoralioides	L	52	4	56	48	3	51	30	3	33	17	3	20	11	8	19	45	8	53	56	9	65	36	4	40
Ptilimnium nuttallii								1	6	7	39	8	47	35	9	44							1	1	2
Pycnanthemum tenuifolium		32	8	40	32	8	40	28	10	38	27	6	33	49	10	59	34	10	44	24	9	33	67	13	80
Pyrrhopappus carolinianus	C													2	1	3									
Ranunculus fascicularis		3	1	4	5	6	11	10	1	11	3	2	5	2	1	3	3	1	4	3	0.3	3.3	3	0.3	3.3
Rhus copallina																	0.3	0.3	0.6						
Rhynchospora globularis	S	12	6	18	41	13	54	37	15	52	0.3	5	5.3	2	3	5	5	5	10	7	9	16	13	6	19
Rhynchospora harveyi	S	0.3	0.3	0.6	1	1	2	1	3	4							1	2	3				2	4	6
Rhynchospora sp.	S	36	7	43	15	11	26	12	5	17	8	1	9	4	1	5	19	8	27	13	8	21	14	9	23
Rosa carolina		28	6	34	19	7	26	44	9	53	28	14	42	19	10	29	38	10	48	33	11	44	67	17	84
Rosa multiflora*											0.3	5	5.3	0.3	1	1.3	0.3	0.3	0.6	0.3	1	1.3	0.3	5	5.3
Rubus enslenii														0.3	5	5.8									
Rubus flagellaris		2	8	10	1	7	8	1	26	27							12	22	34				4	34	38
Rubus orarius											0.3	21	21.3	0.3	5	5.3									
Rubus sp.		2	9	11	1	6	7	2	11	13	41	12	53	34	13	47	3	27	30	0.3	5	5.3	7	18	25
Rudbeckia hirta	C	44	2	46	41	3	44	61	6	67	31	3	34	16	4	20	40	3	43	53	2	55	39	1	40
Ruellia humilis		45	2	47	53	3	56	44	3	47	19	2	21	51	4	55	57	3	60	52	4	56	75	5	80
Rumex acetosella											41	4	45	26	7	33							0.3	1	1.3
Salvia azurea					1	5	6	1	5	6							4	7	11				0.3	1	1.3
Schrankia uncinata	L	20	5	25	16	4	20	39	9	48	8	3	11	3	4	7	32	7	39	36	4	40	53	14	67
Scirpus koilolepis	S													0.3	1	1.3									
Scleria ciliata	S	10	4	14	9	8	17	17	8	25	0.3	1	1.3	0.3	5	5.3	6	5	11	1	5	6	4	4	8
Scleria pauciflora	S	6	4	10	3	5	8	2	3	5							2	4	6						
Scleria triglomerata	S	7	7	14	19	14	33	14	13	27	2	2	4	2	9	11	10	8	18	10	13	23	23	20	43

Appendix 1. Continued

OSAGE PRAIRIE

Species	family	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
		relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value
Scleria sp.		3	3	6	4	4	8	4	9	13	3	2	5	2	3	5	2	1	3	2	3	5	9	9	18
Scutellaria parvula		1	1	2	5	6	11				4	1	5	11	1	12	2	1	3	3	0.3	3.3	1	0.3	1.3
Setaria geniculata	G	7	5	12	15	12	27	27	10	37	2	1	3	6	6	12	12	17	29	18	17	35	57	15	72
Silene antirrhina											0.3	5	5.3												
Silphium integrifolium	C				0.3	0.3	0.6				0.3	0.3	0.6	2	7	9							0.3	0.3	0.6
Sisyrinchium campestre		2	1	3	1	1	2				1	1	2	0.3	0.3	0.6				0.3	1	1.3	1	1	2
Solanum carolinense											9	1	10	1	1	2				0.3	1	1.3			
Solidago gymnospermoides	C				1	1	2	17	11	28	27	11	38	57	17	74	13	3	16	4	7	11	16	12	28
Solidago missouriensis	C	3	1	4	2	4	6	6	4	10	0.3	1	1.3	2	7	9	6	18	24	11	9	20	5	10	15
Solidago nemoralis	C	6	3	9	1	0.3	1.3	6	3	9	11	8	19	2	6	8	3	1	4	3	2	5	31	6	37
Solidago rigida	C	2	1	3	1	1	2	0.3	0.3	0.6	0.3	1	1.3							2	2	4	1	3	4
Solidago speciosa	C																						0.3	1	1.3
Solidago sp.	C													1	25	26									
Sorghastrum nutans	G	72	26	98	78	36	114	70	29	99	41	21	62	49	21	70	77	32	109	84	39	123	64	32	96
Specularia perfoliata					1	0.3	1.3	5	0.3	5.3	1	1	2							1	0.3	1.3	0.3	1	1.3
Spiranthes cernua		1	0.3	1.3							0.3	0.3	0.6	1	0.3	1.3									
Spiranthes vernalis								0.3	0.3	0.6													0.3	0.3	0.6
Sporobolus asper	G	1	5	6													0.3	5	5.3	1	3	4			
Sporobolus heterolepis	G										0.3	13	13.3										0.3	13	13.3
Strophostyles leiosperma	L				6	1	7	4	1	5	4	0.3	4.3	30	2	32	1	0.3	1.3	1	1	2	28	1	29
Stylosanthes biflora	L	16	1	17	14	1	15	22	1	23	11	1	12	7	1	8	22	1	23	15	3	18	27	2	29
Tephrosia virginiana	L																1	5	6	3	14	17	0.3	5	5.3
Tradescantia ohiensis					0.3	13	13.3																0.3	5	5.3
Tragia betonicifolia		4	1	5	1	0.3	1.3	3	1	4	3	1	4				14	3	17	9	2	11	6	3	9
Tridens flavus	G				1	8	9	1	10	11				0.3	21	21.3							2	12	14

Appendix 1. Concluded

OSAGE PRAIRIE

Species	family	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
		relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value	relative frequency	average canopy cover	importance value
Tridens strictus	G							0.3	5	5.3				0.3	5	5.3	0.3	1	1.3						
Trifolium campestre*	L										17	0.3	17.3	17	1	18	0.3	1	1.3						
Valerianella radiata											0.3	0.3	0.6	0.3	1	1.3									
Verbesina helianthoides	C				0.3	5	5.3																0.3	5	5.3
Vernonia baldwini	C	1	1	2	1	1	2	0.3	5	5.3	9	17	26	11	2	13	2	0.3	2.3				6	5	11
Vernonia crinita	C										0.3	1	1.3							0.3	0.3	0.6			
Vernonia missurica	C				4	5	9	0.3	5	5.3							1	1	2	1	8	9	8	2	10
Vernonia sp.	C	3	11	14	4	5	9	1	1	2	37	7	44	45	10	55	7	5	12	7	9	16	32	10	42
Viola kitaibeliana*											0.3	1	1.3	1	5	6									
Viola pedata								5	4	9															
Viola sagittata		93	6	99	85	8	93	73	6	79	73	7	80	73	7	80	80	3	83	82	5	87	78	2	80
Compositae		0.3	5	5.3							1	5	6	1	3	4							0.3	5	5.3
Cyperaceae		1	3	4	1	1	2										1	9	10	1	3	4	4	3	7
Gramineae											3	4	7	5	3	8	0.3	0.3	0.6	1	1	2	2	3	5
Orchidaceae		0.3	0.3	0.6				0.3	0.3	0.6	0.3	0.3	0.6	0.3	1	1.3	0.3	0.3	0.6				0.3	0.3	0.6
unknown monocot					0.3	0.3	0.6																		
unknown dicot					1	1	2							0.3	1	1.3	0.3	1	1.3						

Appendix 2. Importance value (relative frequency + canopy cover) of each species sampled at 8 management units of Osage Prairie, given by season as follows: SP=spring, SU=summer, and FA=fall. Abbreviations of management unit names are: SW=southwest, SC=south central, SE=southeast, C=central, E=east, NW=northwest, NE=northeast, and W=west. The future management and future name of each unit are given in Table 1.

OSAGE PRAIRIE - IMPORTANCE VALUES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Acalypha gracilens					3						31	2		41	2		4			4	8	14	29	42
Achillea millefolium	4	3	2					16		19	25	10	5	11	4							12	3	6
Agropyron repens											4													
Agrostis elliottiana		4											4						17					
Agrostis hyemalis	53	119	34	74	109	16	82	105		54	92	39	75	110	71	38	53	12	80	59		73	41	
Agrostis stolonifera					4			18	2		10			23						64		16		
Allium sp.	4									2														
Alopecurus carolinianus													4		4									
Ambrosia artemisiifolia		21					2		2	10	20		13	18		2	4		3	4	2	6	4	4
Ambrosia bidentata											4		7	13										
Ambrosia coronopifolia			5	3								2		5	10									
Amorpha canescens	4	41	9	18	22	19	45	58	18	6	18	11		4		28	27	13	12	35	31	16	17	15
Andropogon gerardii	21	133	71	11	122	122	30	101	90	56	117	88	95	141	103	87	105	104	127	143	125	129	134	102
Andropogon saccharoides		2																						
Andropogon scoparius	89	129	98	91	136	122	101	154	115	72	88	90	57	103	94	114	159	161	134	158	165	132	139	150
Andropogon ternarius	44	46	52	73	79	22	49	89	99	16			4			63	35	28	73	26	21	69	18	11
Andropogon virginicus	72	73	95	72	96	78	48	62	94	18	45	21	11	16	12	31	38	46	26	31	38	34	46	29
Anemone caroliniana				3			3						4			2		5	2			4		
Antennaria neglecta	22	9	18	26	18	18	13	9	5	11	8	3	10	9	5	17	10	25	21	12	25	9	12	14
Apocynum cannabinum				5		3		13					4	10		6	9		2	4	2		2	
Aristida dichotoma						30															11			
Aristida longespica			93			106			125			14			26			87			71			90
Aristida oligantha			90			74			98			36			33			34		4	28			53
Aristida purpurascens	2		36		17	28		22	29					10	4	11	50	73	34	52	75	22	62	86
Aristida sp.		84			118	17		93	4		16			25			102			71			109	
Asclepias amplexicaulis		16						5	4												4		2	
Asclepias hirtella		10	10		13	16										4	40	16	16	22	17			
Asclepias stenophylla																				16				
Asclepias verticillata		4																		4				
Asclepias viridiflora																				4				
Asclepias viridis		13			9			11			4			4		4	15		17	6				
Asclepias sp.		7			4														4					
Aster azureus																			16					

Appendix 2. (Continued)

OSAGE PRAIRIE - IMPORTANCE VALUES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Aster ericoides		26	16		64	3			4		16	25		10			10	17			4			
Aster linariifolius						39																		
Aster patens	5	23	5	7		12	24	47	19							44	55	51	5	15	13	10	4	
Aster pilosus	3	91	75	11	87	89		59	81	4	23	16		39	40		52	36	35	86	80	29	32	21
Aster sp.							2	2		10	66													
Astragalus sp.		5	2		4	3		8	4					4										
Baptisia leucantha														16										
Baptisia leucophaea	4	16			17	13	21	15	11	5	21		10	11		22	26	4	22	9	18	16	13	
Bidens polylepis					10				2					4										
Bromus racemosus											106	28	30	97	37									
Bromus sp.											5											64		
Buchnera americana								4								2	8			13				
Cacalia tuberosa				5	16					4						4								
Calopogon tuberosus					2																			
Camassia scilloides																			14					
Cardamine parviflora	2						16			20			23						2			4		
Carex abdita	30	21	21	27	14		56	41		35	34	27	21	19	14	19	22	44	29	23	23	57	21	31
Carex bushii	12	16		14	22	19	14	17	5	36	25	14	42	41	16	15	19		18	7	19	46	35	13
Carex meadii	85	65	97	87	75	24	99	80	19	174	95	110	124	118	150	77	65	70	112	94	73	103	69	48
Carex sp.								23								4			4			16	26	
Castilleja coccinea	11	23	12	5	35	28	4	25	27								8	8	16	5	4		2	2
Ceanothus americanus																4								
Centunculus minimus					2						2			3										
Cerastium vulgatum	2						2			53	9		41	13								4		
Chrysopsis pilosa			2						2															2
Cicuta maculata										4														
Cirsium altissimum										5	4	4	4	3	5							22	4	10
Cirsium discolor						16	2			4			15											8
Cirsium sp.		2						6			4	2		9		3			3				13	
Claytonia virginica							16			33			64						2			4		
Comandra richardsiana	2			15		4	6	6	26	9	14	4		4								17	16	13
Coreopsis grandiflora	25	36		11	28	12	45	47	2	25	52	3	4	13	7	6	15		15	29	24	13	8	4
Coreopsis palmata					11																			
Cornus drummondi															4									
Crotalaria sagittalis		43			39	4		15			38			55	2		19			7			37	

Appendix 2. (Continued)

OSAGE PRAIRIE - IMPORTANCE VALUES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Croton glandulosus											21			2										
Croton monathogynus											2		4									4	4	
Crotonopsis elliptica									4		4		11	7	9								22	13
Cyperus sp.																							4	
Danthonia spicata										2														
Delphinium virescens																						16		
Desmodium canadense		39																						
Desmodium sessilifolium																							16	
Diodia teres									2		21			7									28	21
Dodecatheon meadia	16						4		2	4			16			35			20					
Draba brachycarpa													2											
Echinacea pallida		8				1	4	16	17							13	13	15	16	21	20	13		21
Eleocharis obtusa											4										2			
Eleocharis tenuis	37			32	35		41			44	26		65	30		30	73		52	54		79	41	
Eleocharis sp.	39									26		4					78		86	59		40	16	
Elymus canadensis								3															16	
Elymus virginicus											16													
Eragrostis spectabilis		27	46		19	32	11	26	43		4	22		21	16		24	39	16	13	50	22	26	42
Erigeron annuus													16											
Erigeron canadensis		2			4	2		2			33	4					4			2	2		3	
Erigeron strigosus	65	44	33	47	51	68	47	71	81	19	48	14	13	23	13	7	14	59	13	18	55	39	13	59
Eryngium yuccifolium		10							16	4				4				4	16			2	16	
Erythronium albidum	3									4						4			3					
Eupatorium perfoliatum										9	4		9	11						76		21	15	
Eupatorium serotinum											16													
Euphorbia corollata	15	33	4	16	23	21	19	25	16	2	2					46	49	11	22	16	13	10		
Festuca octoflora		27			25			8			56			69			2			2			8	
Festuca elatior											11	39	16	12	21									
Fimbristylis caroliniana		44			51	21		30	17		4			10		13	42	6	27	29	9	23	24	15
Galium obtusum										16														
Gentiana puberulenta	2							4	14							6	10	9	4	18	16			
Geranium carolinianum	4									9		3	13	2	10									

Appendix 2. (Continued)

OSAGE PRAIRIE - IMPORTANCE VALUES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Gerardia fasciculata			2			4					4													
Gnaphalium purpureum		20			9			12									2						5	
Helenium flexuosum	5	28	17	9	22	8	21	41	13	4	19	2	8	11	2	41	4		2	7	2	24	10	2
Helianthus mollis	55	55	21	30	49	33	30	50	18	38	19	24	51	62	60	50	61	49	46	21	12	46	30	39
Hieracium longipilum		5					4	10	4									2		4		4		5
Houstonia minima	51	3		55			74			11			11						14			3		
Hypericum drummondii		9	7		5	7	2	4	5	2		2		4	10						4		2	3
Hypericum punctatum												2						2	2		2			
Hypoxis hirsuta	6			12			20			36			74			46			89			46		
Isoetes butleri													4											
Juncus brachycarpus										29	11		14	35								23	9	16
Juncus dudleyi																						16		
Juncus interior											5		14	29								4		
Juncus marginatus					16						5			9			4						8	4
Juniperus virginiana								4					16											
Koeleria cristata		21		40		16		19			16			2		16			16	10	4		4	
Krigia dandelion													45						27			64		
Krigia occidentalis				5																				
Krigia virginica										4			3											
Krigia sp.	70		2	70			79			64		7	44		58	41			35			31		
Lactuca canadensis										7	2	4	4											
Lepidium virginicum	2			3			6			12	3		4					2						
Leptoloma cognatum		19	36		17	18		18	31		46	73		24	52		34	39		29	71		73	99
Lespedeza capitata		2							64					4			2	4	4					
Lespedeza striata			2		2			2			49	13		39	22								2	4
Lespedeza virginica								4	5			2		2	11	4	22	11	11	9	11	7	6	4
Lespedeza striata/Trifolium										24			14											
Liatris aspera																	16				16			
Liatris pycnostachya	16	28		5	34	19	16		24				10	20		16						14	16	11
Linaria canadensis																						2		
Linum medium		31			15	15		14	4		9			22			8			5	7		22	
Linum sulcatum								20									5			28	13			
Lithospermum incisum				5			6	5														4		
Lobelia spicata	4	8	4	3	3			4			2	2	2			2			4	3		12	3	

Appendix 2. (Continued)

OSAGE PRAIRIE - IMPORTANCE VALUES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Ludwigia alternifolia											2													
Luzula bulbosa	14			5			18			24		3	18		2							9		
Monarda fistulosa																							16	
Myosotis virginica				3			2			21			36									2		
Nothoscordum bivalve	45		2	48			69			63		9	64		9	45			46			16		
Oenothera linifolia		50			20			23			13			4			11			7		2	4	
Oxalis dillenii	30	22	43	41	12	27	27	13	25	31	9	53	19	9	57	9	33	70	20	38	78	34	40	74
Oxalis violacea	33	2	14	42			54		7	52		2	70			83		3	97		47	67		12
Panicum lanuginosum	48	102	66	52	110	127	56	85	106	55	103	80	61	95	78	82	112	114	94	121	124	101	124	123
Panicum linearifolium																					19			
Panicum oligosanthes			4		4	6	19	14	12	27			19			21	24	24	29	31	44	19	18	26
Panicum scoparium					4			16			41	41	18	43	25			16				49	56	50
Panicum sphaerocarpon		19			8	6		52	18		12						16	9		15	8		15	13
Panicum virgatum	12	41	19	17		33	25	48	22	22	48					6	49	28	11		10	28	50	30
Panicum sp.	32	6	20	22	4		17			4	4	4			3	5	6	19	21	8		18		
Paspalum ciliatifolium		19	46	14	17	77	4		80	28	44	15	14	44	12		42	13	5	22	13		59	76
Paspalum laeve			43			47			49		45	42		31	20			10		11			14	12
Paspalum sp.	12	94	6		109		6	82	4		11	4	16		8			5				25		
Pedicularis canadensis	4			10	13	4	31	28	18	17	16	17	28	40	18				18	18		37	21	4
Penstemon digitalis	6	4	19	17	4	9	26	9	14	7		5	2	4	5		6	8		20	17		10	7
Penstemon spp.		14			18			32			4					9			20			9		
Petalostemon candidum																						39		4
Phleum pratense											18			26										
Phlox pilosa							4																	
Physalis pumila												2												
Physalis heterophylla							4					4												
Physalis virginiana																	5					11		
Physostegia angustifolia		10		8	4	4			4	4	13		7	11					4			10	2	
Plantago aristata		34			6			7			67			17						2				
Plantago lanceolata											12													
Plantago virginica	28	2		60			71			26			14			48			14			38		
Poa compressa										13	15	4	23	27									4	
Poa pratensis										47	35		54	37										
Poa sp.												39			48									
Polygala incarnata		16																						

Appendix 2. (Continued)

OSAGE PRAIRIE - IMPORTANCE VALUES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Polygala sanguinea	2	88			89	5		78	4		73			90	2		75			80			93	
Polygala verticillata																				2				
Polytaenia nuttallii	4			5			4	3		6			6			14	2		55	2		3	4	
Potentilla recta					16								4			5								
Potentilla simplex	43	50	37	42	77	76	30	46	58	77	65	74	59	61	58	30	19	28	25	30	17	91	86	51
Prenanthes aspera										4					3							16		
Prunella vulgaris															4									
Psoralea psoralioides	80	88		62	90		42	57		32	30		21	35		74	82		105	89		72	49	
Ptilimnium nuttallii							4	16		40	100		32	79									5	
Pycnanthemum tenuifolium	89	44	21	47	30	45	29	38	48	35	30	32	57	65	56	47	48	35	32	41	27	84	91	66
Pyrrhopappus carolinianus														11										
Ranunculus fascicularis	12			15	16		33			74		2	10			11		2	10			11		
Rhus copallina																	2							
Rhynchospora globularis		54			92	71		67	88		16			16			28			21	26		31	28
Rhynchospora harveyi		2				4		13								4	4						13	4
Rhynchospora sp.	56	16	57	43	21	16	26	10	16	7		20	5		11	42	25	14	19	24	20	24	28	19
Rosa carolina	29	32	41	34	29	16	47	58	54	44	47	35	23	25	38	50	60	36	40	47	46	83	84	84
Rosa multiflora										16			4				2		4			16		
Rubus enslenii													16											
Rubus flagellaris		30			21	4		64	16								41	37					70	45
Rubus orarius											64			16										
Rubus sp.	16	16		5		16	17	16	5	45	58	56	49	59	37	11	30	52	16			35	28	16
Rudbeckia hirta	8	64	67	15	59	60	38	99	64	12	59	31	5	26	31		81	48	26	93	48	30	51	38
Ruellia humilis	32	79	45	15	75	80	18	50	71	16	41	5	55	83	27	69	68	43	60	53	53	84	75	81
Rumex acetosella										25	59	52	36	22	40								4	
Salvia azurea				17					16								16	27				4		
Schrankia uncinata		73	2	5	46	10	14	83	47		33			17	2	30	61	28	31	44	47	65	69	65
Scirpus koilolepis													4											
Scleria ciliata		42		5	27	19		51	25		4			16	4		28			18			21	4
Scleria pauciflora		19			11	11		14									19							
Scleria triglomerata	4	27	10	8	53	39	17	35	29		9	5	16	16		17	33	5	23	41	4	32	50	45
Scleria sp.	4	4	11	5	11	9		18	21		4	12		16				8		10	14	16	21	19
Scutellaria parvula	2	2	3	7	8	16				7	7		17	17		3	5		10			3		
Setaria geniculata		37			44	38		65	45		11		19	17		14	51	23	23	55	26	33	91	92

Appendix 2. (Continued)

OSAGE PRAIRIE - IMPORTANCE VALUES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Silene antirrhina											16													
Silphium integrifolium					2						2			14	13								2	
Sisyrinchium campestre	9	2		7						6				2					4			6		
Solanum carolinense											30			6	2					4				
Solidago gymnospermoides				5			38	23	23	54	38	21	87	82	53	35		13	16	41	17	36	22	28
Solidago missouriensis	2	4			4	16		19	10		4			28		41	17	14	11	24	25	4	24	16
Solidago nemoralis	9	10	9			4	4	11	11	11	32	15	2	18	2		4	9		5	10	32	48	31
Solidago rigida		9				5			2		4								4	4	2		10	
Solidago speciosa																						4		
Solidago sp.													39	39										
Sorghastrum nutans	78	110	107	71	137	136	77	113	106	47	67	72	47	92	72	87	116	122	123	121	124	88	102	99
Specularia perfoliata				3			15			3	3								3			4		
Spiranthes cernua			3									2			4									
Spiranthes vernalis								2															2	
Sporobolus asper			19															16	11					
Sporobolus heterolepis											39											39		
Strophostyles leiosperma					9	12		3	10		13			81	14		5			4	4		59	30
Stylosanthes biflora		47	2		26	19		46	25		34	4		19	5	19	34	17	21	20	14	44	34	7
Tephrosia virginiana														19					16	29	4		16	
Tradescantia ohiensis						39																16		
Tragia betonicifolia		7	7			5			12		9	2				4	36	12	8	16	9	2	9	9
Tridens flavus					26			17	16					64								28		14
Tridens strictus									16				16			4								
Trifolium campestre											53		24	30		4								
Valerianella radiata										2				4										
Verbesina helianthoides						16																		16
Vernonia baldwini	2		4	5			16			29	39	10	37					7						33
Vernonia crinita										4											2			
Vernonia missurica						27			16							4		3			26			30
Vernonia sp.	4	28	11	5	21			7		36	52	43	29	73	63	9	22	5	23	25		52	76	
Viola kitaibeliana										4			2	16										
Viola pedata							19	5	2															
Viola sagittata	100	96	103	97	107	74	89	89	58	75	69	95	69	84	87	77	85	85	93	88	79	84	76	80

Appendix 2. (Concluded)

OSAGE PRAIRIE - IMPORTANCE VALUES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Compositae	16									17			11									16		
Cyperaceae	11			5												14		16	11			21		
Gramineae										17	4		23				2			5		16		
Orchidaceae	2						2			2			4			2						2		
unknown monocot					2																			
unknown dicot				4									4				4							

Appendix 3. Relative frequency of each species sampled at 8 management units of Osage Prairie given by season: SP=spring, SU=summer, and FA=fall. Management unit names are abbreviated as follows: SW=southwest, SC=south central, SE=southeast, C=central, E=east, NW=northwest, NE=northeast, and W=west. The future management and future name of each unit are given in Table 1.

OSAGE PRAIRIE - RELATIVE FREQUENCIES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Acalypha gracilens					2						30	1		40	1		1			3	7	13	28	41
Achillea millefolium	1	2	1					1		8	18	3	2	6	1							9	2	3
Agropyron repens											1													
Agrostis elliottiana		1											1						2					
Agrostis hyemalis	39	90	31	62	83	1	69	79		42	69	36	61	87	68	28	36	11	61	46		57	28	
Agrostis stolonifera					2			3	1		4			12						1		1		
Allium sp.	1									1														
Alopecurus carolinianus													1		1									
Ambrosia artemisiifolia		14					1		1	9	17		12	14		1	1		2	1	1	4	2	3
Ambrosia bidentata											3		6	6										
Ambrosia coronopifolia			3	2								1		2	2									
Amorpha canescens	1	33	8	14	7	8	40	42	11	3	7	9		1		23	20	7	6	10	18	8	2	4
Andropogon gerardii	11	90	51	4	77	81	23	67	53	43	70	63	78	92	80	72	76	71	91	97	90	89	88	72
Andropogon saccharoides		1																						
Andropogon scoparius	71	88	79	66	91	86	80	97	74	58	63	74	47	70	76	97	97	98	96	98	100	84	92	100
Andropogon ternarius	27	12	31	52	38	10	24	43	52	6			1			51	11	11	50	3	6	44	3	2
Andropogon virginicus	66	53	81	65	71	56	41	42	71	13	29	11	8	4	8	27	22	36	18	16	20	17	29	17
Anemone caroliniana				2			2						3			1		4	1			2		
Antennaria neglecta	20	8	17	25	17	17	12	8	4	6	7	2	6	4	4	16	9	24	20	11	24	8	11	13
Apocynum cannabinum				4		2		7					2	2		4	8		1	3	1		1	
Aristida dichotoma						6															2			
Aristida longespica			73			70			89			7			12			64			53			53
Aristida oligantha			66			47			73			26			21			24		1	18			43
Aristida purpurascens	1		23		2	2		11	14					3	1	2	33	60	17	38	53	9	42	63
Aristida sp.		61			76	2		56	1		8			12			67			43			69	
Asclepias amplexicaulis		1						2	1												1		1	
Asclepias hirtella		3	2		4	1										1	2	1	1	2	2			
Asclepias stenophylla																				1				
Asclepias verticillata		1																		3				
Asclepias viridiflora																				1				
Asclepias viridis		10			4			6			1			1		1	8		7	3				
Asclepias sp.		4			1														3					
Aster azureus																			1					

Appendix 3. (Continued)

OSAGE PRAIRIE - RELATIVE FREQUENCIES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Aster ericoides		17	14			1			1		1	21		3			6	11			1			
Aster linariifolius						1																		
Aster patens	4	18	4	6		4	22	42	14							42	43	44	4	4	10	2	1	
Aster pilosus	2	81	73	4	78	79		50	74	1	17	14		28	37		46	34	31	81	71	22	28	19
Aster sp.							1	1		4	38													
Astragalus sp.		2	1		1	2		6	3					1										
Baptisia leucantha														1										
Baptisia leucophaea	1	1			2	6	9	7	6	2	9		3	7		13	10	1	10	4	9	1	3	
Bidens polylepis					2				1					1										
Bromus racemosus											89	13	17	81	29									
Bromus sp.											1											1		
Buchnera americana								1								1	6			3				
Cacalia tuberosa				2	1					1						1								
Calopogon tuberosus					1																			
Camassia scilloides																			3					
Cardamine parviflora	1						1			12			21						1			3		
Carex abdita	24	9	16	22	3		47	28		24	19	18	10	4	10	16	7	37	22	8	12	42	6	18
Carex bushii	7	4		6	14	10	8	2	2	23	14	8	33	30	13	10	6	11	4	4		33	22	4
Carex meadii	73	52	88	72	60	13	73	66	12	78	79	83	87	98	94	64	51	61	83	81	71	76	57	40
Carex sp.								6								1			1			1	8	
Castilleja coccinea	6	22	11	2	34	27	1	24	26								7	7	1	4	3		1	1
Ceanothus americanus																1								
Centunculus minimus					1						1			2										
Cerastium vulgatum	1						1			51	8		39	12								3		
Chrysopsis pilosa			1						1															1
Cicuta maculata										1														
Cirsium altissimum										2	3	2	2	2	4							19	2	2
Cirsium discolor						1	1			1			4											4
Cirsium sp.		1						4			1	1		3		2			2				10	
Claytonia virginica							1			30			62						1			1		
Comandra richardsiana	1			11		1	4	4	21	4	8	2		1								11	9	11
Coreopsis grandiflora	21	32		9	19	10	42	37	1	20	39	2	1	6	6	4	10		11	23	23	11	7	3
Coreopsis palmata					2																			
Cornus drummondi															1									
Crotalaria sagittalis		42			37	3		14			36			53	1		18			6			36	

Appendix 3. (Continued)

OSAGE PRAIRIE - RELATIVE FREQUENCIES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Croton glandulosus											20			1										
Croton monathogynus											1		1									2	2	
Crotonopsis elliptica									1		1		2	6	3								12	6
Cyperus sp.																							1	
Danthonia spicata										1														
Delphinium virescens																						1		
Desmodium canadense		1																						
Desmodium sessilifolium																							1	
Diodia teres									1		17			6									4	2
Dodecatheon meadia	12						1		1	1			1			30			17					
Draba brachycarpa													1											
Echinacea pallida		6				1	1	1	2							9	7	11	10	12	16	3		4
Eleocharis obtusa											1										1			
Eleocharis tenuis	3			12	6		2			27	8		50	16		7	3		8	4		18	9	
Eleocharis sp.	1									6		1					4		1	7		6	1	
Elymus canadensis								2															1	
Elymus virginicus											1													
Eragrostis spectabilis		18	38		9	19	2	17	33		1	9		3	4		14	29	1	9	38	9	11	30
Erigeron annuus													1											
Erigeron canadensis		1			2	1		1			3	1					3			1	1		2	
Erigeron strigosus	64	37	32	45	44	66	43	64	78	14	39	13	6	16	12	6	13	58	11	13	54	37	12	58
Eryngium yuccifolium		2							1	1				1				1	1			1	1	
Erythronium albidum	2									3						2			2					
Eupatorium perfoliatum										7	1		3	2						1		8	7	
Eupatorium serotinum											1													
Euphorbia corollata	14	21	2	13	9	10	17	14	6	1	1					39	29	8	13	7	3	6		
Festuca octoflora		22			18			7			49			64			1			1			6	
Festuca elatior											2	4	1	4	3									
Fimbristylis caroliniana		34			41	17		23	14		3			4		10	31	3	24	20	6	17	16	11
Galium obtusum													1											
Gentiana puberulenta	1							2	3							4	2	4	1	3	1			
Geranium carolinianum	1									7		2	11	1	9									

Appendix 3. (Continued)

OSAGE PRAIRIE - RELATIVE FREQUENCIES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Gerardia fasciculata			1			1					1													
Gnaphalium purpureum		19			8			11									1						4	
Helenium flexuosum	3	19	16	7	17	7	19	36	12	3	13	1	3	8	1	2	2		1	6	1	6	6	1
Helianthus mollis	22	21	10	7	26	13	4	14	9	17	4	14	21	21	32	21	21	28	10	3	4	9	14	7
Hieracium longipilum		2					1	3	1									1		2		1		2
Houstonia minima	49	2		52			71			10			10						4			2		
Hypericum drummondii		8	6		3	6	1	2	4	1		1		3	9						2		1	2
Hypericum punctatum												1						1	1		1			
Hypoxis hirsuta	3			9			17			32			67			41			82			39		
Isoetes butleri													1											
Juncus brachycarpus										8	2		10	30								10	4	1
Juncus dudleyi																						1		
Juncus interior											3		8	22								1		
Juncus marginatus					1						2			7			1						6	1
Juniperus virginiana								1					1											
Koeleria cristata		3		2		1		11			1			1		1			1	3	1		1	
Krigia dandelion													34						17			51		
Krigia occidentalis				2																				
Krigia virginica										1			2											
Krigia sp.	64		1	67			73			57		6	36		57	37			28			24		
Lactuca canadensis										4	1	1	1											
Lepidium virginicum	1			2			4			11	2		3					1						
Leptoloma cognatum		11	26		8	9		10	24		39	60		14	40		21	26		21	63		60	83
Lespedeza capitata		1							1					1			1	1	2					
Lespedeza striata			1		1			1			48	11		38	21								1	2
Lespedeza virginica		3						3	4			1		1	10	3	12	8	7	8	8	6	4	3
Lespedeza striata/Trifolium										22			11											
Liatris aspera																	1				1			
Liatris pycnostachya	1	2		2	8	6	1		3				2	7		1						3	6	2
Linaria canadensis																						1		
Linum medium		28			14	1		10	2		3			21			7			2	6		20	
Linum sulcatum								12									3			27	12			
Lithospermum incisum				2			3	2														1		
Lobelia spicata	3	7	3	2	2			1			1	1	1			1			3	2		11	2	

Appendix 3. (Continued)

OSAGE PRAIRIE - RELATIVE FREQUENCIES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Ludwigia alternifolia											1													
Luzula bulbosa	7			2			7			17		2	14		1							7		
Monarda fistulosa																							1	
Myosotis virginica				2			1			18			34									1		
Nothoscordum bivalve	41		1	40			59			51		8	56		7	42			43			13		
Oenothera linifolia		47			19			21			11			1			10			6		1	2	
Oxalis dillenii	28	21	42	39	11	26	24	12	24	29	8	52	16	8	56	8	32	69	19	37	77	33	39	73
Oxalis violacea	31	1	13	39			51		6	47		1	66			79		2	88		46	61		11
Panicum lanuginosum	43	88	62	45	90	100	49	71	84	50	89	72	52	83	73	74	93	93	80	98	94	88	99	93
Panicum linearifolium																					4			
Panicum oligosanthes			1		1	3	14	8	8	16			10			11	14	11	20	18	34	10	8	3
Panicum scoparium					1			1			29	24	7	20	13			1				30	33	33
Panicum sphaerocarpon		16			7	4		47	16		9						9	8		12	4		8	8
Panicum virgatum	7	3	6	2		3	9	10	2	7	4					3	6	4	2		2	11	3	7
Panicum sp.	27	4	19	18	1		10			1	1	3			2	2	4	14	13	3		3		
Paspalum ciliatifolium		4	41	11	2	64	1		69	19	32	11	7	31	8		32	10	2	13	9		51	70
Paspalum laeve			37			27			34		18	32		10	16			2		2			3	7
Paspalum sp.	8	79	4		90		3	66	1		7	3	1		7			3				21		
Pedicularis canadensis	1			2	4	1	12	16	13	2	1	2	2	6	9				4	7		4	3	1
Penstemon digitalis	3	1	17	15	1	7	22	7	12	4		4	1	1	4		4	6		16	14		4	6
Penstemon spp.		12			14			29			2					8			18			7		
Petalostemon candidum																						1		1
Phleum pratense											3			3										
Phlox pilosa							1																	
Physalis pumila												1												
Physalis heterophylla							2					1												
Physalis virginiana																	2					2		
Physostegia angustifolia		2		5	1	1			1	2	9		6	10					1			8	1	
Plantago aristata		20			3			4			53			10						1				
Plantago lanceolata											4													
Plantago virginica	26	1		55			67			23			12			46			13			37		
Poa compressa										4	10	1	9	17									1	
Poa pratensis										28	28		43	31										
Poa sp.												32			42									
Polygala incarnata		3																						

Appendix 3. (Continued)

OSAGE PRAIRIE - RELATIVE FREQUENCIES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Polygala sanguinea	1	87			87	4		76	3		71			87	1		74			78			90	
Polygala verticillata																				1				
Polytaenia nuttallii	2			2			1	2		3			3			8	1		51	1		2	1	
Potentilla recta					1								1			2								
Potentilla simplex	39	38	36	38	64	66	27	37	48	70	48	72	53	53	57	27	16	26	22	27	16	77	79	49
Prenanthes aspera										1					2							1		
Prunella vulgaris															3									
Psoralea psoralioides	77	79		59	84		40	49		29	22		14	19		64	70		87	80		64	44	
Ptilimnium nuttallii							1	1		34	83		28	77									2	
Pycnanthemum tenuifolium	48	30	19	41	24	32	20	27	36	26	24	30	44	53	50	37	36	28	24	32	17	68	76	58
Pyrrhopappus carolinianus														7										
Ranunculus fascicularis	9			13	1		30			7		1	7			9		1	9			10		
Rhus copallina																	1							
Phynchospora globularis		37			71	53		39	71		1			6			14			9	11		22	18
Rhynchospora harveyi		1				2		4								1	2						4	1
Rhynchospora sp.	52	4	53	39	3	4	23	4	9	4		19	3		9	37	10	11	13	16	11	12	19	12
Rosa carolina	20	26	37	27	19	11	39	46	47	28	27	30	14	12	30	39	48	28	28	34	38	62	66	73
Rosa multiflora										1			1				1		1			1		
Rubus enslenii													1											
Rubus flagellaris		7			3	1		1	1								2	11					2	11
Rubus orarius											1			1										
Rubus sp.	4	1		2		1	2	1	2	33	41	49	38	42	27	7	3	2	1			14	11	1
Rudbeckia hirta	7	61	64	14	52	58	34	98	62	10	53	30	2	19	28		77	43	24	89	47	29	50	37
Ruellia humilis	18	74	44	14	69	77	16	46	69	14	39	4	53	73	26	67	63	42	58	46	51	79	68	78
Rumex acetosella										20	57	46	26	19	32							1		
Salvia azurea				2					2								1	10				1		
Schrankia uncinata		60	1	2	39	7	12	64	40		23			7	1	26	50	21	28	38	43	50	54	54
Scirpus koilolepis													1											
Scleria ciliata		30		2	14	11		37	14		1			1			17	1		3			11	1
Scleria pauciflora		6			6	2		6									6							
Scleria triglomerata	3	10	8	5	30	22	10	13	20		4	3	1	4		14	14	3	12	17	1	16	24	28
Scleria sp.	2	1	6	4	2	7		3	9		1	9		6				6		2	3	9	8	11
Scutellaria parvula	1	1	2	6	7	1				6	6		16	16		2	4		9			2		
Setaria geniculata		21			23	22		50	30		7		8	11		7	22	8	12	27	14	27	68	77

Appendix 3. (Continued)

OSAGE PRAIRIE - RELATIVE FREQUENCIES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Silene antirrhina											1													
Silphium integrifolium					1						1			3	3								1	
Sisyrinchium campestre	6	1		4						4				1					1			4		
Solanum carolinense											28			3	1					1				
Solidago gymnospermoides				2			30	11	9	38	24	19	64	59	47	31		8	9	2	2	18	12	19
Solidago missouriensis	1	2			1	6		10	8		1			6		2	8	8	2	16	16	1	13	1
Solidago nemoralis	3	8	8			3	1	7	9	6	18	10	1	4	1		3	6		3	6	26	40	26
Solidago rigida		6				2			1		1								1	3	1		2	
Solidago speciosa																						1		
Solidago sp.													1	1										
Sorghastrum nutans	60	73	83	54	87	94	63	78	69	36	36	51	34	57	57	70	78	82	86	82	84	58	68	67
Specularia perfoliata				2			14			2	1								2			1		
Spiranthes cernua			2									1			3									
Spiranthes vernalis								1															1	
Sporobolus asper			4															1	2					
Sporobolus heterolepis											1											1		
Strophostyles leiosperma					8	11		2	9		12			77	13		4			1	3		56	29
Stylosanthes biflora		46	1		24	18		43	24		31	3		16	4	18	32	16	20	13	13	43	31	6
Tephrosia virginiana																	4		1	6	1		1	
Tradescantia ohiensis						1																1		
Tragia betonicifolia		6	6			4			9		8	1				1	31	11	7	13	8	1	8	8
Tridens flavus					3			2	1					1								2		3
Tridens strictus									1				1			1								
Trifolium campestre											52		22	29		1								
Valerianella radiata										1			1											
Verbesina helianthoides						1																		1
Vernonia baldwini	1		1	2			1			24	1	2	32					6						19
Vernonia crinita										1											1			
Vernonia missurica						12			1							1		2			3			23
Vernonia sp.	2	2	6	2	10			4		30	41	39	18	58	58	3	14	4	8	14		36	61	
Viola kitaibeliana										1			1	1										
Viola pedata							10	4	1															
Viola sagittata	91	91	98	89	93	73	80	82	57	66	64	89	63	77	79	74	80	84	84	84	78	80	74	79

Appendix 3. (Concluded)

OSAGE PRAIRIE - RELATIVE FREQUENCIES

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Compositae	1									2			2									1		
Cyperaceae	2			2												3		1	2			11		
Gramineae										8	1		14				1			2		7		
Orchidaceae	1						1			1			1			1						1		
unknown monocot					1																			
unknown dicot				2									1				1							

Appendix 4. Average canopy cover of each plant species sampled at 8 management units of Osage Prairie presented by season: SP=spring, SU=summer, and FA=fall. Management units are abbreviated as follows: SW=southwest, SC=south central, SE=southeast, C=central, E=east, NW=northwest, NE=northeast, and W=west. The future management and future name of each unit are given in Table 1.

OSAGE PRAIRIE - CANOPY COVER

	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
Species	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Acalypha gracilens					1						1	1		1	1		3			1	1	1	1	1
Achillea millefolium	3	1	1					15		11	7	7	3	5	3							3	1	3
Agropyron repens											3													
Agrostis elliottiana		3											3						15					
Agrostis hyemalis	14	29	3	12	26	15	13	26		12	23	3	14	23	4	10	17	1	19	13		16	13	
Agrostis stolonifera					2			15	1		6			11						63		15		
Allium sp.	3									1														
Alopecurus carolinianus													3		3									
Ambrosia artemisiifolia		7					1		1	1	3		1	4		1	3		1	3	1	2	2	1
Ambrosia bidentata											1		1	7										
Ambrosia coronopifolia			2	1								1		3	8									
Amorpha canescens	3	8	1	4	15	11	5	16	7	3	11	2		3		5	7	6	6	15	13	8	15	11
Andropogon gerardii	10	43	20	7	45	41	7	34	37	13	47	25	17	49	23	15	29	33	36	46	35	40	46	30
Andropogon saccharoides		1																						
Andropogon scoparius	18	41	19	25	45	36	21	57	41	14	25	16	10	33	18	17	62	63	38	60	65	48	47	50
Andropogon ternarius	17	34	21	21	41	12	25	46	47	10			3			12	24	17	23	23	15	25	15	9
Andropogon virginicus	6	20	14	7	25	22	7	20	23	5	16	10	3	12	4	4	16	10	8	15	18	17	17	12
Anemone caroliniana				1			1						1			1		1	1			2		
Antennaria neglecta	2	1	1	1	1	1	1	1	1	5	1	1	4	5	1	1	1	1	1	1	1	1	1	1
Apocynum cannabinum				1		1		6					2	8		2	1		1	1	1		1	
Aristida dichotoma						24															9			
Aristida longespica			20			36			36			7			14			23			18			37
Aristida oligantha			24			27			25			10			12			10		3	10			16
Aristida purpurascens	1		13		15	26		11	15					7	3	9	17	13	17	14	22	13	20	23
Aristida sp.		23			42	15		37	3		8			13			35			28			40	
Asclepias amplexicaulis		15						3	3												3		1	
Asclepias hirtella		7	8		9	15										3	38	15	15	20	15			
Asclepias stenophylla																				15				
Asclepias verticillata		3																		1				
Asclepias viridiflora																				3				
Asclepias viridis		3			5			5			3			3		3	7		10	3				
Asclepias sp.		3			3														1					
Aster azureus																			15					

Appendix 4. (Continued)

OSAGE PRAIRIE - CANOPY COVER

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Aster ericoides		9	2		63	2			3		15	4		7			4	6			3			
Aster linariifolius						38																		
Aster patens	1	5	1	1		8	2	5	5							2	12	7	1	11	3	8	3	
Aster pilosus	1	10	2	7	9	10		9	7	3	6	2		11	3		6	2	4	5	9	7	4	2
Aster sp.							1	1		6	28													
Astragalus sp.		3	1		3	1		2	1					3										
Baptisia leucantha														15										
Baptisia leucophaea	3	15			15	7	12	8	5	3	12		7	4		9	16	3	12	5	9	15	10	
Bidens polylepis					8				1					3										
Bromus racemosus											17	15	13	16	8									
Bromus sp.											3											63		
Buchnera americana								3								1	2			10				
Cacalia tuberosa				3	15					3						3								
Calopogon tuberosus					1																			
Camassia scilloides																			11					
Cardamine parviflora	1						15			8			2						1			1		
Carex abdita	6	12	5	5	11		9	13		11	15	9	11	15	4	3	15	7	7	15	11	15	15	13
Carex bushii	5	12		8	8	9	6	15	3	13	11	6	9	11	3	5	13	8	14	3		13	13	9
Carex meadii	12	13	9	15	15	11	26	14	7	36	16	27	37	20	56	13	14	9	29	13	12	27	12	8
Carex sp.								17								3			3			15	18	
Castilleja coccinea	5	1	1	3	[illegible]	1	3	1	1								1	1	15	1	1		1	1
Ceanothus americanus																3								
Centunculus minimus					1						1			1										
Cerastium vulgatum	1						1			2	1		2	1								1		
Chrysopsis pilosa			1						1															1
Cicuta maculata										3														
Cirsium altissimum										3	1	2	2	1	1							3	2	8
Cirsium discolor						15	1			3			11											4
Cirsium sp.		1						2			3	1		6		1			1				3	
Claytonia virginica							15			3			2						1			3		
Comandra richardsiana	1			4		3	2	2	5	5	6	2		3								6	7	2
Coreopsis grandiflora	4	4		2	9	2	3	10	1	15	13	1	3	7	1	2	5		4	6	1	2	1	1
Coreopsis palmata					9																			
Cornus drummondi															3									
Crotalaria sagittalis		1			2	1		1			2			2	1		1			1			1	

Appendix 4. (Continued)

OSAGE PRAIRIE - CANOPY COVER

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Croton glandulosus											1			1										
Croton monathogynus											1		3									2	2	
Crotonopsis elliptica									3		3		9	1	6								10	7
Cyperus sp.																							3	
Danthonia spicata										1														
Delphinium virescens																						15		
Desmodium canadense		38																						
Desmodium sessilifolium																							15	
Diodia teres									1		4			1									24	19
Dodecatheon meadia	4						3		1	3			15			5			3					
Draba brachycarpa													1											
Echinacea pallida		2				3	3	15	15							4	6	4	6	9	4	10		17
Eleocharis obtusa											3										1			
Eleocharis tenuis	34			20	29		39			17	18		15	14		23	70		44	50		61	32	
Eleocharis sp.	38									20		3					74		85	52		34	15	
Elymus canadensis								1															15	
Elymus virginicus											15													
Eragrostis spectabilis		9	8		10	13	9	9	10		3	13		18	12		10	10	15	4	12	13	15	12
Erigeron annuus													15											
Erigeron canadensis		1			2	1		1			30	3					1			1	1		1	
Erigeron strigosus	1	7	1	2	7	2	4	7	3	5	9	1	7	7	1	1	1	1	2	5	1	2	1	1
Eryngium yuccifolium		8							15	3				3				3	15			1	15	
Erythronium albidum	1									1						2			1					
Eupatorium perfoliatum										2	3		6	9						15		13	8	
Eupatorium serotinum											15													
Euphorbia corollata	1	12	2	3	14	11	2	11	10	1	1					7	20	3	9	9	10	4		
Festuca octoflora		5			7			1			7			5			1			1			2	
Festuca elatior											9	35	15	8	18									
Fimbristylis caroliniana		10			10	4		7	3		1			6		3	11	3	3	9	3	6	8	4
Galium obtusum													15											
Gentiana puberulenta	1							2	11							2	8	5	3	15	15			
Geranium carolinianum	3									2		1	2	1	1									

Appendix 4. (Continued)

OSAGE PRAIRIE - CANOPY COVER

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Gerardia fasciculata			1			3						3												
Gnaphalium purpureum		1			1			1									1						1	
Helenium flexuosum	2	9	1	2	5	1	2	7	1	1	6	1	5	3	1	39	2		1	1	1	18	4	1
Helianthus mollis	33	34	11	23	23	20	26	36	9	21	15	10	30	41	28	29	40	21	36	18	8	37	16	22
Hieracium longipilum		3					3	7	3									1		2		3		3
Houstonia minima	2	1		3			3			1			1						10			1		
Hypericum drummondii		1	1		2	1	1	2	1	1		1		1	1						2		1	1
Hypericum punctatum												1						1	1		1			
Hypoxis hirsuta	3			3			3			4			7			5			7			7		
Isoetes butleri													3											
Juncus brachycarpus										21	9		4	5								13	5	15
Juncus dudleyi																						15		
Juncus interior											2		6	7								3		
Juncus marginatus					15						3			2			3						2	3
Juniperus virginiana								3					15											
Koeleria cristata		18		38		15		8			15			1		15			15	7	3		3	
Krigia dandelion													11						10			13		
Krigia occidentalis				3																				
Krigia virginica										3			1											
Krigia sp.	6		1	3			6			7		1	8		1	4			7			7		
Lactuca canadensis										3	1	3	3											
Lepidium virginicum	1			1			2			1	1		1					1						
Leptoloma cognatum		8	10		9	9		8	7		7	13		10	12		13	13		8	8		13	16
Lespedeza capitata		1							63					3			1	3	2					
Lespedeza striata			1		1			1			1	2		1	1								1	2
Lespedeza virginica		2						1	1			1		1	1	1	10	3	4	1	3	1	2	1
Lespedeza striata/Trifolium										2			3											
Liatris aspera																15					15			
Liatris pycnostachya	15	26		3	26	13	15		23				8	13		15						11	10	9
Linaria canadensis																						1		
Linum medium		3			1	15		4	2		6			1			1			3	1		2	
Linum sulcatum								8									2			1	1			
Lithospermum incisum				3			3	3														3		
Lobelia spicata	1	1	1	1	1			3			1	1	1			1			1	1		1	1	

Appendix 4. (Continued)

OSAGE PRAIRIE - CANOPY COVER

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Ludwigia alternifolia											1													
Luzula bulbosa	7			3			11			7		1	4		1							2		
Monarda fistulosa																							15	
Myosotis virginica				1			1			3			2									1		
Northoscordum bivalve	4		1	8			10			12		1	8		2	3			3			3		
Oenothera linifolia		3			1			2			2			3			1			1		1	2	
Oxalis dillenii	2	1	1	2	1	1	3	1	1	2	1	1	3	1	1	1	1	1	1	1	1	1	1	1
Oxalis violacea	2	1	1	3			3		1	5		1	4			4		1	9		1	6		1
Panicum lanuginosum	5	13	4	7	20	27	7	14	22	5	14	8	9	12	5	8	19	21	14	23	30	13	25	30
Panicum linearifolium																					15			
Panicum oligosanthes			3		3	3	5	6	4	11			9			10	10	13	9	13	10	9	10	23
Panicum scoparium					3			15			12	17	11	23	12			15				19	23	17
Panicum sphaerocarpon		3			1	2		5	2		3						7	1		3	4		7	5
Panicum virgatum	5	38	13	15		30	16	38	20	15	44					3	43	24	9		8	17	47	23
Panicum sp.	5	2	1	4	3		7			3	3	1			1	3	2	5	8	5		15		
Paspalum ciliatifolium		15	5	3	15	13	3		11	9	12	4	7	13	4		10	3	3	9	4		8	6
Paspalum laeve			6			20			15		27	10		21	4			8		9			11	5
Paspalum sp.	4	15	2		19		3	16	3		4	1	15		1			2				4		
Pedicularis canadensis	3			8	9	3	19	12	5	15	15	15	26	34	9				14	11		33	18	3
Penstemon digitalis	3	3	2	2	3	2	4	2	2	3		1	1	3	1		2	2		4	3		6	1
Penstemon sp.		2			4			3			2					1			2			2		
Petalostemon candidum																						38		3
Phleum pratense											15			23										
Phlox pilosa							3																	
Physalis pumila												1												
Physalis heterophylla							2					3												
Physalis virginiana																	3					9		
Physostegia angustifolia		8		3	3	3			3	2	4		1	1					3			2	1	
Plantago aristata		14			3			3			14			7						1				
Plantago lanceolata											8													
Plantago virginica	2	1		5			4			3			2			2			1			1		
Poa compressa										9	5	3	14	10									3	
Poa pratensis										19	7		11	6										
Poa sp.												7			6									
Polygala incarnata		13																						

Appendix 4. (Continued)

OSAGE PRAIRIE - CANOPY COVER

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Polygala sanguinea	1	1			2	1		2	1		2			3	1		1			2			3	
Polygala verticillata																				1				
Polytaenia nuttallii	2			3			3	1		3			3			6	1		4	1		1	3	
Potentilla recta					15								3			3								
Potentilla simplex	4	12	1	4	13	10	3	9	10	7	17	2	6	8	1	3	3	2	3	3	1	14	7	2
Prenanthes aspera										3					1							15		
Prunella vulgaris															1									
Psoralea psoralioides	3	9		3	6		2	8		3	7		7	16		10	12		18	9		8	5	
Ptilimnium nuttallii							3	15		6	17		4	22									3	
Pycnanthemum tenuifolium	7	14	2	6	6	13	7	11	12	9	6	2	13	12	6	10	12	7	8	9	10	16	15	8
Pyrrhopappus carolinianus														4										
Ranunculus fascicularis	3			2	15		3			4		1	3			2		1	1			1		
Rhus copallina																	1							
Rhynchospora globularis		17			21	18		28	17		15			10			14			12	15		9	10
Rhynchospora harveyi		1				2		9								3	2						9	3
Rhynchospora sp.	4	12	4	4	18	12	3	6	7	3		1	2		2	5	15	3	6	8	9	12	9	7
Rosa carolina	9	6	4	7	10	5	8	12	7	16	20	5	9	13	8	11	12	8	12	13	8	21	18	11
Rosa multiflora										15			3				1		3			15		
Rubus enslenii													15											
Rubus flagellaris		23			18	3		63	15								39	26					68	34
Rubus orarius											63			15										
Rubus sp.	12	15		3		15	15	15	3	12	17	7	11	17	10	4	27	50	15			21	17	15
Rudbeckia hirta	1	3	3	1	7	2	4	11	2	2	6	1	3	7	3		4	5	2	4	1	1	1	1
Ruellia humilis	1	5	1	1	6	3	2	4	2	2	2	1	2	10	1	2	5	1	2	7	2	5	7	3
Rumex acetosella										5	2	6	10	3	8							3		
Salvia azurea				15					15								15	7				3		
Schrankia uncinata		13	1	3	7	3	2	19	7		10			10	1	4	11	7	3	6	4	15	15	11
Scirpus koilolepis													3											
Scleria ciliata		12		3	13	8		14	11		3			15			11	3		15			10	3
Scleria pauciflora		13			5	9		8									13							
Scleria triglomerata	1	17	2	3	23	17	7	22	9		5	2	15	12		3	19	2	11	24	3	16	26	17
Scleria sp.	2	3	5	1	9	2		15	12		3	3		10				2		8	11	7	13	8
Scutellaria parvula	1	1	1	1	1	15				1	1		1	1		1	1		1			1		
Setaria geniculata		16			21	16		15	15		4		11	6		7	29	15	11	28	12	6	23	15

Appendix 4. (Continued)

OSAGE PRAIRIE - CANOPY COVER

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Silene antirrhina											15													
Silphium integrifolium					1						1			11	10								1	
Sisyrinchium campestre	3	1		3						2				1					3			2		
Solanum carolinense											2			3	1					3				
Solidago gymnospermoides				3			8	12	14	16	14	2	23	23	6	4		5	7	39	15	18	10	9
Solidago missouriensis	1	2			3	10		9	2		3			22		39	9	6	9	8	9	3	11	15
Solidago nemoralis	6	2	1			1	3	4	2	5	14	5	1	14	1		1	3		2	4	6	8	5
Solidago rigida		3				3			1		3								3	1	1		8	
Solidago speciosa																						3		
Solidago sp.													38	38										
Sorghastrum nutans	18	37	24	17	50	42	14	35	37	11	31	21	13	35	15	17	38	40	37	39	40	30	34	32
Specularia perfoliata				1			1			1	2								1			3		
Spiranthes cernua			1									1			1									
Spiranthes vernalis								1															1	
Sporobolus asper			15															15	9					
Sporobolus heterolepis											38											38		
Strophostyles leiosperma					1	1		1	1		1			4	1		1			3	1		3	1
Stylosanthes biflora		1	1		2	1		3	1		3	1		3	1	1	2	1	1	7	1	1	3	1
Tephrosia virginiana																	15		15	23	3		15	
Tradescantia ohiensis						38																15		
Tragia betonicifolia		1	1			1			3		1	1				3	5	1	1	3	1	1	1	1
Tridens flavus					23			15	15					63								26		11
Tridens strictus									15				15			3								
Trifolium campestre											1		2	1		3								
Valerianella radiata										1				3										
Verbesina helianthoides						15																		15
Vernonia baldwini	1		3	3			15			5	38	8	5					1						14
Vernonia crinita										3											1			
Vernonia missurica						15			15							3		1			23			7
Vernonia sp.	2	26	4	3	11			3		6	11	4	11	15	5	6	8	1	15	11		16	15	
Viola kitaibeliana										3			1	15										
Viola pedata							9	1	1															
Viola sagittata	9	5	5	8	14	1	9	7	1	9	5	6	6	7	8	3	5	1	9	4	1	4	2	1

Appendix 4. (Concluded)

OSAGE PRAIRIE - CANOPY COVER

Species	SW Hay			SC Hay			SE Hay			C Graze			E Graze			NW Hay/ Burn			NE Hay/ Burn			W Graze/ Hay		
	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA	SP	SU	FA
Compositae	15									15			9									15		
Cyperaceae	9			3												11		15	9			10		
Gramineae										9	3		9				1			3		9		
Orchidaceae	1						1			1			3			1						1		
unknown monocot					1																			
unknown dicot				2									3				3							

Appendix 5. Relative frequency, canopy cover and importance values of each plant species sampled at the west and east units of Diamond Grove Prairie. An * indicates an introduced plant not native to Missouri's presettlement flora (Steyermark 1963). Major plant families are indicated as: C=Compositae, G=Gramineae, L=Leguminosae, S=Cyperaceae.

		DIAMOND GROVE PRAIRIE					
		Relative Frequency		Canopy Cover		Importance Value	
Species	Family	West Unit	East Unit	West Unit	East Unit	West Unit	East Unit
Agrostis elliottiana	G	1		3		4	
Agrostis hyemalis	G	47	57	30	26	77	83
Ambrosia artemisiifolia	C	1	1	1	1	2	2
Amorpha canescens	L	3	4	7	9	10	13
Andropogon gerardii	G	76	93	32	46	108	139
Andropogon saccharoides	G	7		15		22	
Andropogon scoparius	G	94	96	44	48	138	144
Andropogon virginicus	G	49	73	17	26	66	99
Andropogon sp.	G	1		15		16	
Antennaria neglecta	C	11	3	2	1	13	4
Aristida purpurascens	G	2	3	15	10	17	13
Aristida sp.	G	9	7	27	11	36	18
Asclepias hirtella		1		15		16	
Asclepias stenophylla			1		1		2
Asclepias viridis			1		3		4
Aster azureus	C	1	4	3	6	4	10
Aster pilosus	C	34	16	4	3	38	19
Aster sp.	C	17	13	10	4	27	17
Astragalus sp.	L	2	7	15	2	17	9
Baptisia leucantha	L	1		3		4	
Baptisia leucophaea	L	11	10	13	8	24	18
Bromus racemosus*	G	10	7	5	15	15	22
Callirhoe digitata		7	3	4	7	11	10
Carex abdita	S		13		13		26
Carex bushii	S	22	20	14	18	36	38
Carex meadii	S	67	40	15	12	82	52
Castilleja coccinea		1		1		2	
Ceanothus americanus		2		26		28	
Centunculus minimus		1		1		2	
Claytonia virginica			1		3		4
Comandra richardsiana		8	7	1	1	9	8
Coreopsis grandiflora	C	44	53	7	6	51	59
Coreopsis palmata	C	11		6		17	
Crotonopsis elliptica		17	6	1	1	18	7
Delphinium sp.		4		3		7	
Dodecatheon meadia		3		7		10	
Echinacea pallida	C	14	9	13	9	27	18
Eleocharis tenuis	S	6	6	10	10	16	16
Eleocharis sp.		4	1	12	38	16	39
Elymus canadensis	G	4	2	11	9	15	11
Eragrostis spectabilis	G	4	12	15	15	19	27
Erigeron annuus	C	1		1		2	
Erigeron strigosus	C	38	56	6	7	44	63
Eryngium yuccifolium		1	1	15	15	16	16
Euphorbia corallata		23	33	5	3	28	36
Festuca octoflora	G	20	27	8	4	28	31
Fimbristylis caroliniana	S	42	54	11	13	53	67
Gentiana puberulenta		6	2	12	3	18	5
Gnaphalium purpureum	C		1		1		2

Appendix 5. (Continued)

DIAMOND GROVE PRAIRIE

Species	Family	Relative Frequency		Canopy Cover		Importance Value	
		West Unit	East Unit	West Unit	East Unit	West Unit	East Unit
Habenaria lacera			1		1		2
Helenium flexuosum	C	10	16	2	2	12	18
Helianthus mollis	C	16	23	13	15	29	38
Hieracium longipilum	C	1	1	15	15	16	16
Houstonia minima		19	4	1	1	20	5
Hypoxis hirsuta		3	4	3	3	6	7
Juncus brachycarpus			1		15		16
Juncus interior			2		9		11
Koeleria cristata	G	18	22	7	15	25	37
Krigia sp.	C	4	1	1	1	5	2
Lespedeza virginica	L		3		6		9
Liatris aspera	C	2		9		11	
Liatris pycnostachya	C	11	20	13	13	24	33
Linum sulcatum		6	1	2	1	8	2
Lobelia spicata		53	66	5	5	58	71
Luzula bulbosa			12		3		15
Marshallia caespitosa	C	54	49	10	19	64	68
Myosotis virginica		1		1		2	
Oenothera linifolia		37	4	3	1	40	5
Oxalis dillenii		26	20	1	1	27	21
Oxalis violacea		10		1		11	
Panicum lanuginosum	G	59	43	10	6	69	49
Panicum linearifolium	G		3		6		9
Panicum oligosanthes	G	16	2	13	9	29	11
Panicum sphaerocarpon	G	38	76	10	10	48	86
Panicum virgatum	G	46	58	31	35	77	93
Panicum sp.	G	1		15		16	
Paspalum ciliatifolium	G	27	12	7	6	34	18
Paspalum sp.			14		7		21
Pedicularis canadensis		27	23	12	15	39	38
Penstemon digitalis		2	9	3	4	5	13
Penstemon sp.		17	23	3	5	20	28
Phleum pratense*	G		1		3		4
Physalis virginiana		2	1	2	38	4	39
Physostegia angustifolia		29	29	4	2	33	31
Plantago lanceolata*		1		1		2	
Plantago virginica		14	7	9	7	23	14
Poa compressa*	G	1	3	3	3	4	6
Poa pratensis*	G		1		3		4
Polygala sanguinea		68	32	3	1	71	33
Polygala verticillata		19	4	1	1	20	5
Potentilla recta		1	1	1	3	2	4
Potentilla simplex		27	47	9	12	36	59
Prenanthes aspera	C		1		1		2
Prunella vulgarus		1		3		4	
Psoralea psoralioides	L	70	60	15	7	85	67
Pycnanthemum tenuifolium		7	1	8	15	15	16

Appendix 5. (Concluded)

DIAMOND GROVE PRAIRIE

Species	Family	Relative Frequency		Canopy Cover		Importance Value	
		West Unit	East Unit	West Unit	East Unit	West Unit	East Unit
Rhynchospora globularis	S	4	4	9	8	13	12
Rhynchospora sp.		1		15		16	
Rosa carolina		54	70	8	11	62	81
Rubus enslenii		1		38		39	
Rubus flagellaris			6		24		30
Rubus sp.		2	3	9	10	11	13
Rudbeckia hirta	C	31	59	2	4	33	63
Ruellia humilis		62	49	6	3	68	52
Salvia azurea		11		10		21	
Schrankia uncinata	L	40	46	19	11	59	57
Scleria ciliata	S	18	4	11	15	29	19
Scleria pauciflora	S	3	1	15	3	18	4
Scleria triglomerata	S	21	13	17	13	38	26
Scleria sp.		4	7	8	11	12	18
Scutellaria parvula		1		15		16	
Setaria geniculata	G	2		3		5	
Silphium integrifolium	C	1	1	15	1	16	2
Solanum carolinense			1		1		2
Solidago gymnospermoides	C	1		15		16	
Solidago missouriensis	C	11	3	13	7	24	10
Solidago rigida	C		1		1		2
Sorghastrum nutans	G	58	69	27	33	85	102
Specularia biflora		1	1	1	1	2	2
Specularia perfoliata		1	6	1	1	2	7
Spermolepis inermis			2		1		3
Sphenopholis obtusata	G	2	2	3	9	5	11
Sporobolus heterolepis	G	89	39	55	52	144	91
Stylosanthes biflora	L	24	21	5	3	29	24
Tephrosia virginiana	L	8	16	25	14	33	30
Trifolium campestre*	L		7		9		16
Valerianella radiata		17	22	2	1	19	23
Verbesina helianthoides	C	1	4	15	6	16	10
Vernonia sp.	C		1		3		4
Viola pedatifida		1	2	1	8	2	10
Viola sagittata		53	50	6	3	59	53
Cyperaceae			12		13		25

Appendix 6. Relative frequency, average canopy cover, and importance value of each plant species sampled at the north and south management units of Paint Brush Prairie. Major plant families are abbreviated as: C=Compositae, G=Gramineae, L=Leguminosae and S=Cyperaceae. An * denotes an introduced plant not native to Missouri (Steyermark 1963).

PAINT BRUSH PRAIRIE

Species	Family	Relative Frequency		Canopy Cover		Importance Value	
		North Unit	South Unit	North Unit	South Unit	North Unit	South Unit
Acalypha gracilens		24	10	1	1	25	11
Achillea millefolium*	C		1		1		2
Agrostis elliottiana	G	2	2	2	3	4	5
Agrostis hyemalis	G	32	59	26	15	58	74
Agrostis stolonifera	G	2	16	26	3	28	19
Ambrosia artemisiifolia	C	3	1	1	1	4	2
Amorpha canescens	L	10	1	15	15	25	16
Andropogon gerardii	G	32	27	23	14	55	41
Andropogon scoparius	G	58	76	27	22	85	98
Andropogon virginicus	G	24	77	12	18	36	95
Antennaria neglecta	C	9	23	1	2	10	25
Aristida sp.	G	40	13	10	5	50	18
Asclepias hirtella		1		3		4	
Asclepias stenophylla		1		3		4	
Asclepias viridiflora			2		3		5
Aster azureus	C		1		1		2
Aster ericoides	C		1		15		16
Aster sp.	C	1	1	3	3	4	4
Astragalus sp.	L	6		2		8	
Baptisia leucophaea	L	33	56	10	22	43	78
Carex bushii	S	3	10	7	8	10	18
Carex meadii	S	50	98	12	20	62	118
Carex sp.	S	1		3		4	
Centunculus minimus		7	16	1	1	8	17
Cerastium vulgatum*		1		3		4	
Comandra richardsiana		33	34	2	10	35	44
Coreopsis grandiflora	C	14	47	5	6	19	53
Coreopsis palmata	C	83	1	9	15	92	16
Crotalaria sagittalis	L	11	34	1	1	12	35
Croton monanthogynus		3		1		4	
Crotonopsis elliptica		93	97	6	9	99	106
Danthonia spicata	G	41	29	16	27	57	56
Diodia teres		44	47	5	14	49	61
Dodecatheon meadia		2	4	1	2	3	6
Echinacea pallida	C	20	30	6	9	26	39
Eleocharis tenuis	S	46	53	20	31	66	84
Eleocharis sp.	S	13	6	15	10	28	16
Eragrostis spectabilis	G		18		12		30
Erigeron strigosus	C	10	37	3	5	13	42
Eryngium yuccifolium		11	2	7	8	18	10
Euphorbia corollata		78	67	5	9	83	76
Festuca octoflora	G	4	2	20	1	24	3
Festuca elatior*	G		1		15		16
Fimbristylis caroliniana	S	4	23	8	10	12	33
Gentiana puberulenta		3		1		4	
Helenium flexuosum	C		4		2		6
Helianthus mollis	C	46		24		70	

Appendix 6. (Continued)

Species	Family	PAINT BRUSH PRAIRIE Relative Frequency North Unit	Relative Frequency South Unit	Canopy Cover North Unit	Canopy Cover South Unit	Importance Value North Unit	Importance Value South Unit
Hieracium longipilum	C		4		5		9
Houstonia minima		11	10	1	1	12	11
Hypoxis hirsuta		1		3		4	
Juncus brachycarpus			1		3		4
Juncus marginatus			1		3		4
Juniperus virginiana		1	6	1	1	2	7
Krigia dandelion	C	1		15		16	
Krigia sp.	C		2		1		3
Lepidium virginicum		1		1		2	
Leptoloma cognatum	G	23	34	5	5	28	39
Lespedeza virginica	L		2		8		10
Liatris pycnostachya	C	9	3	11	23	20	26
Liatris squarrosa	C	1		3		4	
Linum medium		2	20	2	1	4	21
Linum sulcatum			4		5		9
Lobelia spicata			1		1		2
Myosotis virginica		2		1		3	
Oenothera linifolia		64	81	8	9	72	90
Oxalis dillenii		12	14	1	1	13	15
Oxalis violacea		9	4	1	1	10	5
Panicum lanuginosum	G	67	50	8	7	75	57
Panicum oligosanthes	G		6		5		11
Panicum scoparium	G		1		3		4
Panicum sphaerocarpon	G	22	8	3	4	25	12
Panicum virgatum	G	3		30		33	
Panicum sp.			41		16		57
Paspalum ciliatifolium	G		2		2		4
Paspalum sp.		24	72	4	8	28	80
Penstemon digitalis		2	1	9	3	11	4
Penstemon pallidus		7	9	2	1	9	10
Penstemon sp.		3		3		6	
Phleum pratense*	G	1		3		4	
Physalis pumila		1		3		4	
Plantago aristata		17	78	9	28	26	106
Plantago virginica			3		1		4
Poa compressa*	G		11		15		26
Polygala incarnata			1		1		2
Polygala sanguinea		58	76	1	1	59	77
Polytaenia nuttallii		1	1	1	3	2	4
Potentilla simplex		34	50	8	30	42	80
Prunus americana		1		1		2	
Psoralea psoralioides	L	1	7	15	3	16	10
Pycnanthemum tenuifolium		51	33	10	9	61	42
Phynchospora globularis	S	1		15		16	
Rosa carolina		84	83	15	12	99	95
Rubus enslenii		1		3		4	
Rubus flagellaris		10	1	17	3	27	4
Rubus sp.		1		15		16	

Appendix 6. (Concluded)

Species	Family	PAINT BRUSH PRAIRIE					
		Relative Frequency		Canopy Cover		Importance Value	
		North Unit	South Unit	North Unit	South Unit	North Unit	South Unit
Rudbeckia hirta	C	3	3	1	1	4	4
Ruellia humilis		62	80	4	10	66	90
Schrankia uncinata	L	27	12	7	16	34	28
Scleria triglomerata	S	22	10	27	24	49	34
Scutellaria parvula		12	1	1	1	13	2
Senecio sp.	C	6	8	5	3	11	11
Serinia oppositifolia	C	2	2	1	8	3	10
Setaria geniculata	G	10	16	12	10	22	26
Silphium integrifolium	C	1		3		4	
Sisyrinchium campestre		2	1	3	1	5	2
Solanum carolinense			3		2		5
Solidago gymnospermoides	C	1	3	38	11	39	14
Solidago missouriensis	C	1	6	3	8	4	14
Solidago nemoralis	C		1		3		4
Solidago rigida	C		1		15		16
Sorghastrum nutans	G	8	24	28	17	36	41
Specularia perfoliata		1	1	1	1	2	2
Sporobolus heterolepis	G	99	52	62	31	161	83
Tephrosia virginiana	L	23	10	18	15	41	25
Vernonia crinita	C		6		5		11
Vernonia fasciculata	C	3	13	10	3	13	16
Viola kitaibeliana		1		3		4	
Viola pedata		19	1	1	1	20	2
Viola sagittata		58	81	1	2	59	83
Zizia aurea		2	1	8	15	10	16
Cyperaceae		2		9		11	
Gramineae			8		6		14
Orchidaceae		3	9	1	1	4	10
unknown dicot		2	1	1	1	3	2

Appendix 7. Name, family, and prairie of occurrence for all plant species sampled at Osage, Diamond Grove, and Paint Brush Prairies.

Plant Species	Common Name	Family	Occurrence		
			Osage	Diamond Grove	Paint Brush
Acalypha gracilens Gray	three-seeded mercury	Euphorbiaceae	X		X
Achillea millefolium* L.	yarrow	Compositae	X		X
Agropyron repens (L.) Beauv.*	quack grass	Gramineae	X		
Agrostis elliottiana Schultes	bent grass	Gramineae	X	X	X
Agrostis hyemalis (Walt.) BSP.	hair grass	Gramineae	X	X	X
Agrostis stolonifera (Gaud.) Farw.	redtop	Gramineae	X		X
Allium L.	wild onion	Liliaceae	X		
Alopecurus carolinianus Walt.	foxtail	Gramineae	X		
Ambrosia artemisiifolia L.	common ragweed	Compositae	X	X	X
Ambrosia bidentata Michx.	ragweed	Compositae	X		
Ambrosia coronopifolia T.& G.	western ragweed	Compositae	X		
Amorpha canescens Pursh	lead plant	Leguminosae	X		X
Andropogon gerardii Vitman	big bluestem	Gramineae	X	X	X
Andropogon saccharoides Sw.	silver beardgrass	Gramineae	X	X	
Andropogon scoparius Michx.	little bluestem	Gramineae	X	X	X
Andropogon ternarius Michx.	split beard	Gramineae	X		
Andropogon virginicus L.	broom sedge	Gramineae	X	X	X
Anemone caroliniana Walt.	prairie anemone	Ranunculaceae	X		
Antennaria neglecta Greene	pussy's toes	Compositae	X	X	X
Apocynum cannabinum L.	Indian hemp	Apocynaceae	X		
Aristida dichotoma Michx.	poverty grass	Gramineae	X		
Aristida longespica Poir.	poverty grass	Gramineae	X		
Aristida oligantha Michx.	prairie three awn grass	Gramineae	X		
Aristida purpurascens Poir.	arrowfeather	Gramineae	X	X	
Asclepias amplexicaulis Sm.	milkweed	Asclepiadaceae	X		
Asclepias hirtella (Pennell) Woodson	tall green milkweed	Asclepiadaceae	X	X	X
Asclepias stenophylla Gray	narrow-leaved green milkweed	Asclepiadaceae	X	X	X
Asclepias verticillata L.	whorled milkweed	Asclepiadaceae	X		
Asclepias viridiflora Raf.	green milkweed	Asclepiadaceae	X		X
Asclepias viridis Walt.	green-flowered milkweed	Asclepiadaceae	X	X	
Aster azureus Lindl.	azure aster	Compositae	X	X	X
Aster ericoides L.	wreath aster	Compositae	X		X
Aster linariifolius L.	stiff-leaf aster	Compositae	X		
Aster patens Ait.	spreading aster	Compositae	X		

Appendix 7. (Continued)

Plant Species	Common Name	Family	Occurrence: Osage	Occurrence: Diamond Grove	Occurrence: Paint Brush
Aster pilosus Willd.	white heath aster	Compositae	X	X	
Astragalus L.	milk vetch	Leguminosae	X	X	X
Baptisia leucantha T.& G.	white wild indigo	Leguminosae	X	X	
Baptisia leucophaea Nutt.	long-bracted wild indigo	Leguminosae	X	X	X
Bidens polylepis Blake	tickseed sunflower	Compositae	X		
Bromus racemosus L. *	hairy chess	Gramineae	X	X	
Buchnera americana L.	blue hearts	Scrophulariaceae	X		
Cacalia tuberosa Nutt.	Indian plantain	Compositae	X		
Callirhoe digitata Nutt.	fringed poppy mallow	Malvaceae		X	
Calopogon tuberosus (L.) BSP.	grass pink	Orchidaceae	X		
Camassia scilloides (Raf.) Cory	wild hyacinth	Liliaceae	X		
Cardamine parviflora L.	small-flowered bitter cress	Cruciferae	X		
Carex abdita Bickn.	sedge	Cyperaceae	X	X	
Carex bushii Mackenz.	sedge	Cyperaceae	X	X	X
Carex meadii Dew.	sedge	Cyperaceae	X	X	X
Castilleja coccinea (L.) Spreng.	Indian paintbrush	Scrophulariaceae	X	X	
Ceanothus americanus L.	New Jersey tea	Rhamnaceae	X	X	
Centunculus minimus L.	Chaffweed	Primulaceae	X	X	X
Cerastium vulgatum L.*	common mouse-ear chickweed	Caryophyllaceae	X		X
Chrysopsis pilosa Nutt.	golden aster	Compositae	X		
Cicuta maculata L.	water hemlock	Umbelliferae	X		
Cirsium altissimum (L.) Spreng.	tall thistle	Compositae	X		
Cirsium discolor (Muhl.) Spreng.	field thistle	Compositae	X		
Claytonia virginica L.	spring beauty	Portulacaceae	X	X	
Comandra richardsiana Fern.	bastard toadflax	Santalaceae	X	X	X
Coreopsis grandiflora Hogg	tickseed	Compositae	X	X	X
Coreopsis palmata Nutt.	tickseed	Compositae	X	X	X
Cornus drummondii Meyer	rough-leaved dogwood	Cornaceae	X		
Crotalaria sagittalis L.	rattlebox	Leguminosae	X		X
Croton glandulosus L.	croton	Euphorbiaceae	X		
Croton monanthogynus Michx.	croton	Euphorbiaceae	X		X
Crotonopsis elliptica Willd.	rushfoil	Euphorbiaceae	X	X	X

Appendix 7. (Continued)

Plant Species	Common Name	Family	Occurrence: Osage	Occurrence: Diamond Grove	Occurrence: Paint Brush
Cyperus L.	umbrella sedge	Cyperaceae	X		
Danthonia spicata (L.) Beauv.	poverty grass	Gramineae	X		X
Delphinium L.	larkspur	Ranumculaceae		X	
Delphinium virescens Nutt.	prairie larkspur	Ranunculaceae	X		
Desmodium canadense (L.) DC.	tick trefoil	Leguminosae	X		
Desmodium sessilifolium (Torr.) T.& G.	tick trefoil	Leguminosae	X		
Diodia teres Walt.	rough buttonweed	Rubiaceae	X		X
Dodecatheon meadia	shooting star	Primulaceae	X	X	X
Draba brachycarpa Nutt.	whitlow grass	Cruciferae	X		
Echinacea pallida Nutt.	pale-purple coneflower	Compositae	X	X	X
Eleocharis obtusa (Willd.) Schultes	spikerush	Cyperaceae	X		
Eleocharis tenuis (Willd.) Schultes	spikerush	Cyperaceae	X	X	X
Elymus canadensis L.	Canada wild rye	Gramineae	X	X	
Elymus virginicus L.	wild rye	Gramineae	X		
Eragrostis spectabilis (Pursh) Steud.	purple love grass	Gramineae	X	X	X
Erigeron annuus (L.) Pers.	daisy fleabane	Compositae	X	X	
Erigeron canadensis L.	horse weed	Compositae	X		
Erigeron strigosus Muhl.	daisy fleabane	Compositae	X	X	X
Eryngium yuccifolium Michx.	rattlesnake master	Umbelliferae	X	X	X
Erythronium albidum Nutt.	white dog-tooth violet	Liliaceae	X		
Eupatorium perfoliatum L.	boneset	Compositae	X		
Eupatorium serotinum Michx.	late boneset	Compositae	X		
Euphorbia corollata L.	flowering spurge	Euphorbiaceae	X	X	X
Festuca octoflora Walt.	six-weeks fescue	Gramineae	X	X	X
Festuca elatior L.*	meadow fescue	Gramineae	X		X
Fimbristylis caroliniana (Lam.) Fern.		Cyperaceae	X	X	X
Galium obtusum Bigel.	wild madder	Rubiaceae	X		
Gentiana puberulenta Pringel	downy gentian	Gentianaceae	X	X	X
Geranium carolinianum L.	wild cranesbill	Geraniaceae	X		
Gerardia fasciculata Ell.	gerardia	Scrophulariaceae	X		
Gnaphalium purpureum L.	purple cudweed	Compositae	X	X	

Appendix 7. (Continued)

Plant Species	Common Name	Family	Occurrence: Osage	Occurrence: Diamond Grove	Occurrence: Paint Brush
Habenaria lacera (Michx.) Lodd.	ragged orchid	Orchidaceae		X	
Helenium flexuosum Raf.	sneezeweed	Compositae	X	X	X
Helianthus mollis Lam.	ashy sunflower	Compositae	X	X	X
Hieracium longipilum Torr.	hawkweed	Compositae	X	X	X
Houstonia minima Beck.	bluets	Rubiaceae	X	X	X
Hypericum drummondii (Grev. & Hook.) T.& G.	nits-and-lice	Hypericaceae	X		
Hypericum punctatum L.	spotted St. Johns-wort	Hypericaceae	X		
Hypoxis hirsuta (L.) Coville	yellow star grass	Amaryllidaceae	X	X	X
Isoetes butleri Engelm.	quillwort	Isoetaceae	X		
Juncus brachycarpus Engelm.	rush	Juncaceae	X	X	X
Juncus dudleyi Wieg.	rush	Juncaceae	X		
Juncus interior Wieg.	rush	Juncaceae	X	X	
Juncus marginatus Rostk.	rush	Juncaceae	X		X
Juniperus virginiana L.	eastern red cedar	Cupressaceae	X		X
Koeleria cristata (L.) Pers.	june grass	Gramineae	X	X	
Krigia dandelion (L.) Nutt.	dwarf dandelion	Compositae	X		X
Krigia occidentalis Nutt.	dwarf dandelion	Compositae	X		
Krigia virginica (L.) Willd.	dwarf dandelion	Compositae	X		
Lactuca canadensis L.	wild lettuce	Compositae	X		
Lepidium virginicum L.	pepper grass	Cruciferae	X		X
Leptoloma cognatum (Schultes) Chase	fall witch grass	Gramineae	X		X
Lespedeza capitata Michx.	round-headed bush clover	Leguminosae	X		
Lespedeza striata (Thunb.) H.& A.*	Japanese lespedeza	Leguminosae	X		
Lespedeza virginica (L.) Britt.	slender bush clover	Leguminosae	X	X	X
Liatris aspera Michx.	rough blazing star	Compositae	X	X	
Liatris pycnostachya Michx.	button snakeroot	Compositae	X	X	X
Liatris squarrosa (L.) Michx.	blazing star	Compositae			X
Linaria canadensis (L.) Dumort.	blue toadflax	Scrophulariaceae	X		
Linum medium (Planch.) Britt.	flax	Linaceae	X		X
Linum sulcatum Riddell	flax	Linaceae	X	X	X
Lithospermum incisum Lehm.	yellow puccoon	Boraginaceae	X		
Lobelia spicata Lam.	spiked lobelia	Campanulaceae	X	X	X

Appendix 7. (Continued)

Plant Species	Common Name	Family	Occurrence: Osage	Occurrence: Diamond Grove	Occurrence: Paint Brush
Ludwigia alternifolia L.	seedbox	Onagraceae	X		
Luzula bulbosa (Wood) Rydb.	wood rush	Juncaceae	X	X	
Marshallia caespitosa Nutt. ex DC.	Barbara's buttons	Compositae		X	
Monarda fistulosa L.	wild bergamot	Labiatae	X		
Myosotis virginica (L.) BSP	scorpion grass	Boraginaceae	X	X	X
Nothoscordum bivalve (L.) Britton	false garlic	Liliaceae	X		
Oenothera linifolia Nutt.	sundrops	Onagraceae	X	X	X
Oxalis dillenii Jacq.	yellow wood sorrel	Oxalidaceae	X	X	X
Oxalis violacea L.	violet wood sorrel	Oxalidaceae	X	X	X
Panicum lanuginosum Ell.	panic grass	Gramineae	X	X	X
Panicum linearifolium Scribn.	panic grass	Gramineae	X	X	
Panicum oligosanthes Schultes	panic grass	Gramineae	X	X	X
Panicum scoparium Lam.	panic grass	Gramineae	X		X
Panicum sphaerocarpon Ell.	panic grass	Gramineae	X	X	X
Panicum virgatum L.	switch grass	Gramineae	X	X	X
Paspalum ciliatifolium Michx.	bead grass	Gramineae	X	X	X
Paspalum laeve Michx.	bead grass	Gramineae	X		
Pedicularis canadensis L.	wood betony	Scrophulariaceae	X	X	
Penstemon digitalis Nutt.	beard-tongue	Scrophulariaceae	X	X	X
Penstemon pallidus Small	beard-tongue	Scrophulariaceae			X
Penstemon Mitchell	beard-tongue	Scrophulariaceae	X	X	X
Petalostemon candidum (Willd.) Michx.	white prairie clover	Leguminosae	X		
Phleum pratense L.*	timothy	Gramineae	X	X	X
Phlox pilosa L.	downy phlox	Polemoniaceae	X		
Physalis heterophylla Nees	ground cherry	Solanaceae	X		
Physalis pumila Nutt.	ground cherry	Solanaceae	X		X
Physalis virginiana Mill.	ground cherry	Solanaceae	X	X	
Physostegia angustifolia Fernald	false dragonhead	Labiatae	X	X	
Plantago aristata Michx.	bracted plantain	Plantaginaceae	X		X
Plantago langeolata L.*	English plantain	Plantaginaceae	X	X	
Plantago virginica L.	hoary plantain	Plantaginaceae	X	X	X
Poa compressa L.*	Canada blue grass	Gramineae	X	X	X

Appendix 7. (Continued)

Plant Species	Common Name	Family	Occurrence: Osage	Occurrence: Diamond Grove	Occurrence: Paint Brush
Poa pratensis L. *	Kentucky blue grass	Gramineae	X	X	
Polygala incarnata L.	milkwort	Polygalaceae	X		X
Polygala sanguinea L.	milkwort	Polygalaceae	X	X	X
Polygala verticillata L.	milkwort	Polygalaceae	X	X	
Polytaenia nuttallii DC.	prairie parsley	Umbelliferae	X		X
Potentilla recta L.*	rough-fruited cinquefoil	Rosaceae	X	X	
Potentilla simplex Michx.	cinquefoil	Rosaceae	X	X	X
Premanthes aspera Michx.	rough white lettuce	Compositae	X	X	
Prunella vulgaris L.	self-heal	Labiatae	X	X	
Prunus americana Marsh.	wild plum	Rosaceae			X
Psoralea psoralioides (Walt.) Cory	Sampson's snakeroot	Leguminosae	X	X	X
Ptilimnium nuttallii (DC.) Britt.	mock bishop's weed	Umbelliferae	X		
Pycnanthemum tenuifolium Schrad.	slender mountain mint	Labiatae	X	X	X
Pyrrhopappus carolinianus (Walt.) DC.	false dandelion	Compositae	X		
Ranunculus fascicularis Muhl.	early buttercup	Ranunculaceae	X		
Rhus copallina L.	dwarf sumac	Anacardiaceae	X		
Rhynchospora globularis (Chapm.) Small	beak-rush	Cyperaceae	X	X	X
Rhynchospora harveyi Boott	beak-rush	Cyperaceae	X		
Rosa carolina L.	pasture rose	Rosaceae	X	X	X
Rosa multiflora Thunb.*	multiflora rose	Rosaceae	X		
Rubus enslenii Tratt.	dewberry	Rosaceae	X	X	X
Rubus flagellaris Willd.	dewberry	Rosaceae	X	X	X
Rubus orarius Blanchard	high-bush blackberry	Rosaceae	X		
Rudbeckia hirta L.	black-eyed susan	Compositae	X	X	X
Ruellia humilis Nutt.	wild petunia	Compositae	X	X	X
Rumex acetosella L.	sheep sorrel	Polygonaceae	X		
Salvia azurea Lam.	blue sage	Labiatae	X	X	
Schrankia uncinata Willd.	sensitive brier	Leguminosae	X	X	X
Scirpus koilolepis (Steud.) Gleason	bulrush	Cyperaceae	X		
Scleria ciliata Michx.	nut grass	Cyperaceae	X	X	

Appendix 7. (Continued)

Plant Species	Common Name	Family	Occurrence: Osage	Occurrence: Diamond Grove	Occurrence: Paint Brush
Scleria pauciflora Muhl.	nut grass	Cyperaceae	X	X	
Scleria triglomerata Michx.	tall nut grass	Cyperaceae	X	X	X
Scutellaria parvula Michx.	small skullcap	Labiatae	X	X	X
Senecio L.	groundsel	Compositae			X
Serinia oppositifolia (Raf.) Ktze.	dwarf dandelion	Compositae			X
Setaria geniculata (Lam.) Beauv.	prairie foxtail	Gramineae	X	X	X
Silene antirrhina L.	sleepy catchfly	Caryophyllaceae	X		
Silphium integrifolium Michx.	rosin-weed	Compositae	X	X	X
Sisyrinchium campestre Bickn.	prairie blue-eyed grass	Iridaceae	X		X
Solanum carolinense L.	horse nettle	Solanaceae	X	X	X
Solidago gymnospermoides (Greene) Fern.	grass-leaved goldenrod	Compositae	X	X	X
Solidago missouriensis Nutt.	Missouri goldenrod	Compositae	X	X	X
Solidago nemoralis Ait.	old-field goldenrod	Compositae	X		X
Solidago rigida L.	stiff goldenrod	Compositae	X	X	X
Solidago speciosa Nutt.	showy goldenrod	Compositae	X		
Sorghastrum nutans (L.) Nash	Indian grass	Gramineae	X	X	X
Specularia biflora (R.& P.) Fisch. & Mey.	Venus' looking glass	Campanulaceae		X	
Specularia perfoliata (L.) A. DC.	Venus' looking glass	Campanulaceae	X	X	X
Spermolepis inermis (Nutt.) Math. & Const.		Umbelliferae		X	
Sphenopholis obtusata (Michx.) Scribn.	wedge grass	Gramineae		X	
Spiranthes cernua (L.) Richard	common ladies tresses	Orchidaceae	X		
Spiranthes vernalis Engelm. & Gray	ladies' tresses	Orchidaceae	X		
Sporobolus asper (Michx.) Kunth	dropseed	Gramineae	X		
Sporobolus heterolepis Gray	prairie dropseed	Gramineae	X	X	X
Strophostyles leiosperma (T.& G.) Piper	wild bean	Leguminosae	X		

Appendix 7. (Concluded)

Plant Species	Common Name	Family	Occurrence		
			Osage	Diamond Grove	Paint Brush
Stylosanthes biflora (L.) BSP.	pencil flower	Leguminosae	X	X	
Tephrosia virginiana (L.) Pers.	goat's rue	Leguminosae	X	X	X
Tradescantia ohiensis Raf.	spiderwort	Commelinaceae	X		
Tragia betonicifolia Nutt.		Euphorbiaceae	X		
Tridens flavus (L.) Hitch.	purpletop	Gramineae	X		
Tridens strictus (Nutt.) Nash		Gramineae	X		
Trifolium campestre Schreb.*	large hop clover	Leguminosae	X	X	
Valerianella radiata (L.) Dufr.	corn salad	Valerianaceae	X	X	
Verbesina helianthoides Michx.	crown-beard	Compositae	X	X	
Vernonia baldwini Torr.	ironweed	Compositae	X		
Vernonia crinita Raf.	ironweed	Compositae	X		X
Vernonia fasciculata Michx.	ironweed	Compositae			X
Vernonia missurica Raf.	ironweed	Compositae	X		
Viola kitaibeliana R.& S.*	field pansy	Violaceae	X		X
Viola pedata L.	pansy violet	Violaceae	X		X
Viola pedatifida G. Don	prairie violet	Violaceae		X	
Viola sagittata Ait.	arrow-leaved violet	Violaceae	X	X	X
Zizia aurea (L.) Koch	golden alexanders	Umbelliferae			X

	OSAGE - SPRING								OSAGE - SUMMER								OSAGE - FALL											
	SW Hay	SC Hay	SE Hay	C Graze	E Graze	NW Hay/Burn	NE Hay/Burn	W Graze/Hay	SW Hay	SC Hay	SE Hay	C Graze	E Graze	NW Hay/Burn	NE Hay/Burn	W Graze/Hay	SW Hay	SC Hay	SE Hay	C Graze	E Graze	NW Hay/Burn	NE Hay/Burn	W Graze/Hay	Diamond Grove-E	Diamond Grove-W	Paint Brush-N	Paint Brush-S
OSAGE - SPRING																												
SW Hay	100	84	72	60	47	64	61	57	48	50	48	38	36	47	49	41	57	45	42	50	51	52	46	41	46	47	36	43
SC Hay		100	77	59	47	65	62	59	46	49	48	40	37	46	49	41	57	43	43	50	51	50	47	41	45	46	35	42
SE Hay			100	60	48	66	61	59	48	46	55	42	36	48	50	41	52	42	43	48	50	51	50	41	48	50	35	42
C Graze				100	75	55	54	59	36	38	38	49	48	40	43	43	42	36	33	55	56	41	40	38	38	41	34	36
E Graze					100	54	55	56	35	37	34	48	55	36	39	39	36	33	30	48	54	35	36	36	36	37	34	37
NW Hay/Burn						100	77	67	52	53	56	41	43	62	57	51	50	48	48	48	50	56	54	48	49	52	42	40
NE Hay/Burn							100	70	57	59	57	44	45	62	66	52	54	50	48	49	52	58	60	48	51	55	38	41
W Graze/Hay								100	57	58	58	52	52	59	60	65	50	51	52	56	57	53	55	59	54	55	41	45
OSAGE - SUMMER																												
SW Hay									100	83	79	54	53	74	70	64	54	61	58	44	45	53	56	50	59	60	46	54
SC Hay										100	75	54	54	71	69	66	55	66	61	44	48	52	54	50	58	60	44	52
SE Hay											100	52	47	73	70	63	54	58	61	44	45	56	57	52	60	61	44	50
C Graze												100	73	52	53	58	45	44	44	55	56	44	45	48	48	49	41	48
E Graze													100	50	51	62	41	45	41	52	61	41	41	47	43	45	39	44
NW Hay/Burn														100	81	72	57	61	60	49	50	65	65	58	56	62	48	47
NE Hay/Burn															100	69	61	61	58	53	54	64	71	56	56	60	45	47
W Graze/Hay																100	51	59	57	55	55	54	58	71	52	55	46	47
OSAGE - FALL																												
SW Hay																	100	68	71	62	56	69	47	59	46	45	34	42
SC Hay																		100	81	50	50	65	65	66	49	49	34	39
SE Hay																			100	47	46	63	64	67	50	49	37	40
C Graze																				100	78	58	54	56	40	40	33	37
E Graze																					100	56	54	54	42	42	35	39
NW Hay/Burn																						100	78	69	46	47	38	40
NE Hay/Burn																							100	70	48	49	36	40
W Graze/Hay																								100	47	46	40	40
Diamond Grove - E																									100	78	43	47
Diamond Grove - W																										100	51	51
Paint Brush - N																											100	69
Paint Brush - S																												100

Appendix 8. Sorenson similarity index values for 8 management units at Osage Prairie sampled in spring, summer, and fall, and for 2 units at each Diamond Grove and Paint Brush Prairies sampled only in summer. Management unit abbreviations are as follows: SW=southwest, SC=south central, SE=southeast, C=central, E=east, NW=northwest, NE=northeast, W=west, N=north, and S=south. The future management and name of each unit are given in Table 1.

Appendix 9. Species richness, diversity (Shannon-Weiner index) and dominance concentration (Simpson's index) for all prairie units sampled at Osage, Diamond Grove and Paint Brush Prairies. Abbreviations are as follows: SP=spring, SU=summer, FA=fall, SW=southwest, SC=south central, SE=southeast, E=east, C=central, W=west, NW=northwest, NE=northeast, N=north, and S=south. The future management and name of each unit are given in Table 1.

Prairie and Unit	Species Richness			Shannon-Weiner Index			Simpson's Index		
	SP	SU	FA	SP	SU	FA	SP	SU	FA
Osage									
1. SW Hay	72	93	62	3.56	3.91	3.56	.036	.025	.035
2. SC Hay	71	87	80	3.60	3.77	3.63	.034	.029	.035
3. SE Hay	75	96	87	3.73	3.97	3.77	.029	.023	.029
4. C Graze	91	114	74	3.97	4.08	3.61	.024	.021	.035
5. E Graze	102	105	67	3.94	3.98	3.63	.025	.025	.033
6. NW Hay/Burn	77	88	74	3.69	3.87	3.69	.031	.027	.034
7. NE Hay/Burn	91	88	73	3.78	3.76	3.61	.031	.032	.035
8. W Graze/Hay	108	101	78	4.01	3.94	3.74	.024	.025	.030
Diamond Grove-E		107			4.00			.024	
Diamond Grove-W		109			4.08			.022	
Paint Brush - N		97			3.88			.027	
Paint Brush - S		100			3.91			.026	