

WILSON'S CREEK NATIONAL BATTLEFIELD

**A PLAN FOR THE RESTORATION
OF THE HISTORIC VEGETATION**

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INTRODUCTION

On August 10, 1861, the area now known as Wilson's Creek National Battlefield was the site of one of the earliest conflicts of the Civil War. This battle, and events that transpired in its immediate aftermath, were critical in keeping Missouri officially allied with the Union. To commemorate the significance of these events, in 1960 the site of the battle of Wilson's Creek was designated a National Battlefield. From 1964 to 1967, the cooperative efforts of state and federal agencies made possible the purchase of 1,750 acres which now constitute Wilson's Creek National Battlefield.

Any attempt to properly convey the events that transpired during the day of the battle requires that the setting, both in terms of cultural and natural features, closely resembles conditions that existed in 1861. Since its inception, restoration of the historic scene has been the long-term management goal of Wilson's Creek National Battlefield. In May 1985, the National Park Service (NPS) contracted with the Missouri Department of Conservation (MDC) to conduct a two year study of the battlefield for the purpose of producing a management plan to effect this restoration. This final report of that study, presents the restoration management plan as well as examines the data upon which it is based.

The process of arriving at a comprehensive management plan for the battlefield required research into the vegetation of the site during three time periods: current, historic and presettlement. Because the project's goal was to restore the historic

scene, research into the vegetation of this time period was the logical starting point. However, information on the battlefield's vegetation dating to the time of the battle is relatively scarce. Conversely, information on the area's presettlement or natural vegetation is abundant. Additionally, at the time of the battle the site of Wilson's Creek had been settled for only 10 to 15 years, and it retained much of its natural character. For these reasons the determination of the battlefield's historic vegetation is based largely on the presettlement vegetation of the site.

The third objective of the restoration was the collection of detailed and comprehensive information on the battlefield's current vegetation. This involved rigorous mapping, as well as quantitative and qualitative characterizations of the vegetation of most management units. When an accepted common name exists for a plant, it is used in the text. Appendix 1 is a list of the latin and common names of all plant species appearing in the report.

Management recommendations to restore the battlefield to its historic conditions are generally based on the comparison between current and historic vegetation of each management unit. This process of determining appropriate management recommendations relied heavily on the expertise of Department of Conservation personnel working in the areas of prairie restoration and timber management. Wherever possible, the current vegetation will be used in the restoration effort. However, in many areas of the battlefield the current vegetation bears no resemblance to the

historic vegetation and complete renovation of the site will be necessary.

The success of the restoration effort will depend largely upon the commitment and motivation of the Wilson's Creek staff and NPS regional people. Efforts to secure adequate funding and to gain permission to use the necessary management tools (herbicides, fire) will be critical. On the management level, the resource personnel must continually monitor the progress of the vegetation and when necessary make adjustments in management to achieve the desired results. Given positive efforts in these various areas observable progress toward restoration should be noticeable within a few years of initiating management. Twenty years from that date, much of the battlefield should be approaching historic conditions. When this occurs, interpretation of the battle will be greatly enhanced by a visual setting that closely approximates that experienced by the battle's participants.

PRESETTLEMENT VEGETATION

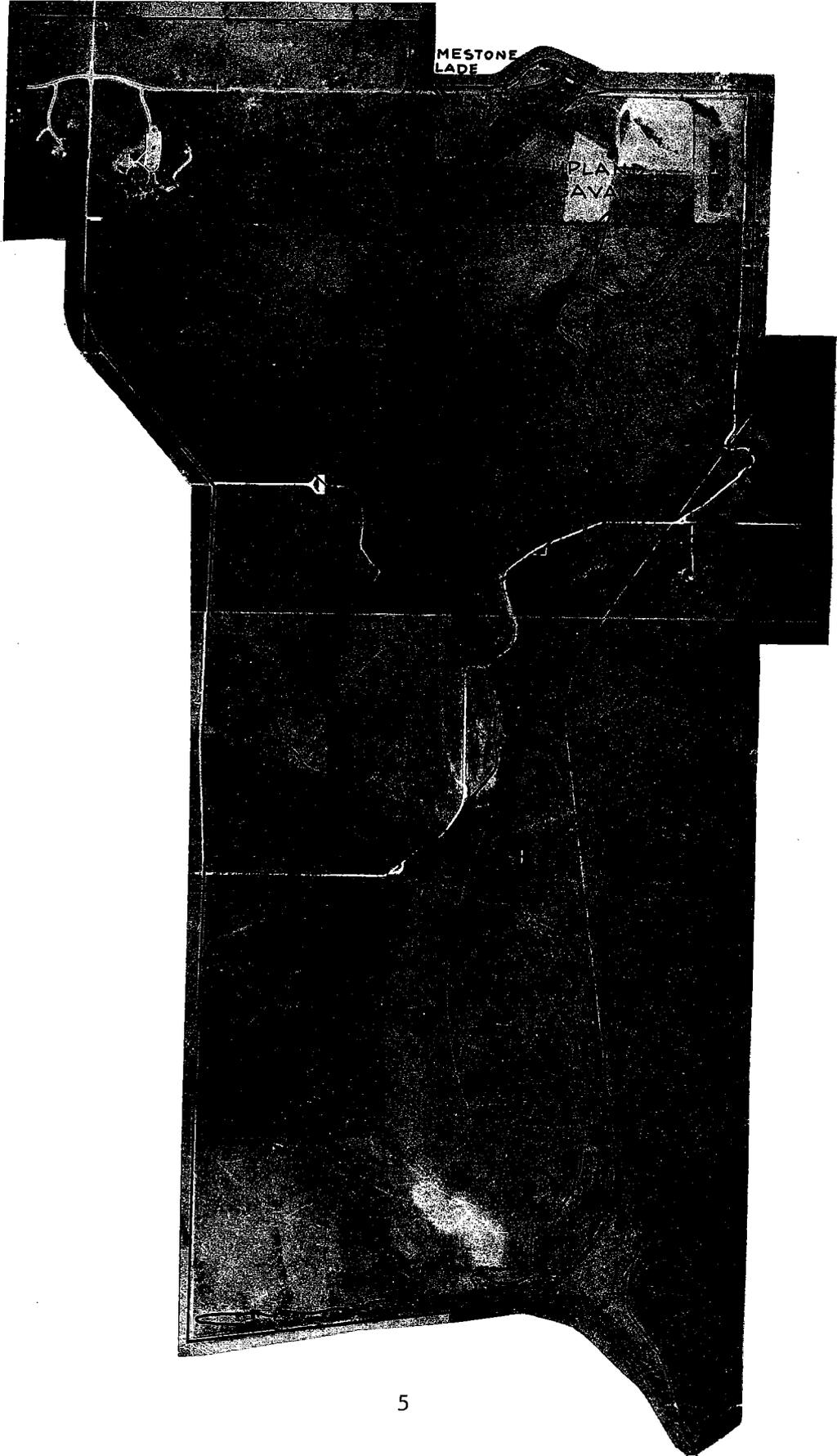
In the report that summarized the findings of this study's first year, we concluded that prior to white settlement the majority of the battlefield's vegetation was a savanna with a prairie plant herbaceous layer and scattered oaks. The tree density of the savanna was surmised to have varied considerably both spatially and temporally, but we could only speculate on the actual range of this variation. In some locales the tree density was sparse enough to approximate an open prairie, and in scattered areas on knobs and slopes, bedrock outcropped creating glades occupied by a xeric, primarily herbaceous flora. Riparian areas along Wilson's Creek and the larger stream branches supported a denser, more typically forest vegetation with considerable underbrush.

After a second year of study, our view of the battlefield's presettlement vegetation is much the same (Figure 1). Additional inquiries have resulted in a few changes, but for the most part they have supported this earlier interpretation while adding detail. Some of the references used are more substantial and informative than others; however, each independently indicates a savanna landscape. Taken together they build a convincing argument for presettlement savanna.

The sources of information used in determining the presettlement scene fall into two general categories. First are direct observations of the battlefield's vegetation dating from the early to mid-1800s. In this category are both the qualitative and quantitative information from the original land

PRESETTLEMENT VEGETATION OF
WILSON'S CREEK NATIONAL BATTLEFIELD

Figure 1.



survey notes, and observations of the vegetation made by the soldiers and the early explorer Henry Rowe Schoolcraft. Secondly are indirect indications of the vegetation based on environmental factors. These include the information on soils and potential natural vegetation contained in the Greene and Christian counties soil surveys, and the ecological implications of the battlefield's geographical position on the prairie/forest border.

The original land survey notes are the primary reference for the presettlement vegetation, and the bulk of this section will be devoted to discussion of the information they contain. So as to not obscure the contributions of the other references they will be discussed prior to the land survey data.

SCHOOLCRAFT'S OBSERVATIONS

In 1819, American explorer and topographer Henry Rowe Schoolcraft and a small party of fellow travelers arrived at the junction of the James River and Wilson's Creek, about a mile south of the site of Wilson's Creek National Battlefield. From this visit, Schoolcraft recorded the first known written observations of the region's natural vegetation. Although these observations do not pertain specifically to the battlefield, they do describe the presettlement vegetation of a site only a mile or two distant. The following are excerpts from "Schoolcraft in the Ozarks, Reprint of Journal of a Tour into the Interior of Arkansas in 1818 and 1819," (Park 1955).

"Along the river banks, are found extensive bodies of the choicest land, covered by a large growth of forest trees and cane, and interspersed with prairies. Oak, Maple, White and Black Walnut, Elm, Hackberry, and Sycamores are the

common trees, and attain a very large size. On the west commences a prairie of unexpected extent, stretching off towards the Osage River, and covered with tall rank grass."

The prairies "which commence at the distance of a mile west of the river"... "are covered by a high coarse wild grass which obtains so great a height that it completely hides a man on horseback in riding through it. The deer and elk abound in this quarter, and the buffalo is occasionally seen in droves upon the prairie, and the open high-land woods."

Schoolcraft's comments contain several points of interest in terms of corroborating information from other references. The bottomlands of the James River were largely forested but were "interspersed with prairies." He also mentions "open high-land woods" which sounds very much like a savanna community. Additionally, Schoolcraft's reference to herds of buffalo and abundant elk documents the presence of large herbivores which may have been very important in maintaining a savanna vegetation. On the other hand, Schoolcraft notes an abundance of cane in the bottomlands of the James River. No reference to the battlefield itself mentions cane as being present on the site. Cane was abundant only a mile downstream and it seems likely that it occurred along the water courses of the battlefield. However, it apparently was not very common.

SOLDIERS' ACCOUNTS

Although the comments of the soldiers pertained to a vegetation that was not presettlement, we feel that the period of settlement preceding 1861 was sufficiently short that much of the vegetation's presettlement character remained.

Most of the soldier's comments pertaining to the battlefield's vegetation are of questionable value. They were made from a poor perspective and are usually brief and often contradictory. However, some of these accounts do contain observations of detail, and several others make brief references to the vegetation that are of some value in the reconstruction. The following excerpts from these accounts were taken from Bearss' (1978) report on the battlefield's historic scene.

This passage from Ware (1907) is a description of the general countryside, and in part describes the view from Bloody Hill.

"The hills bore some scattering oaks and an occasional bush, but we could see clearly, because the fires had kept the undergrowth eaten out and the soil was flinty and poor. Since that time a large portion of the country has been covered with a very dense thicket of small oaks. But in those days the few trees were rather large, scrawling, and straggling, and everything could be distinctly seen under them all around."

From Mudd (1913) is a description of Bloody Hill and the fields to the south:

"Large black oak trees grew all over the field, but on Bloody Hill the probably average space between them fifty yards, with a dense undergrowth between 2 and 3 feet high, and here and there bare spots covered with flint stones."

Watson (1888) describes the landscape east of Wilson's Creek including Bloody Hill:

"...were several grassy ridges the principal of which terminated in a hill about half-a-mile from the creek. This hill, near the top, was covered with stunted or scrub oak trees, and it bore the name of 'Oak Hill.' On the grassy ridges, forming the spurs of the hill, Price's division(s) encamped."

Wherry (1884-1887) wrote that east of Wilson's Creek:

"...the hills assume the proportion of bluffs; on the right or western bank the ground is a succession of broken ridges, at that time covered for the most part with trees and a stunted growth of scrub oaks with dense foliage, which in places become an almost impenetrable tangle. Rough ravines and deep gullies cut up the surface."

Snead (1886) wrote that Bloody Hill:

"...was densely covered with undergrowth through which was interspersed a species of scrub-oak (blackjacks), and near its summit the rock cropped out in many places."

Melcher (1910) in a letter to Martin Hubble wrote that in August 1861:

"Heavy timber skirted the banks of the creek. Bloody Hill and the plateau east of the creek were open except for some scattered scrub oaks and some bushes, but the view was far more open than now."

These accounts of the battlefield's vegetation are unanimous in describing Bloody Hill and the surrounding countryside as being sparsely timbered. Watson's account is unique in that it refers to the herbaceous vegetation of the site, describing Bloody Hill and adjacent prominences as being "grassy ridges." This observation of grass groundcover provides additional support for a natural savanna vegetation.

Many of the accounts refer to stunted or scrub oaks on Bloody Hill. However, Ware and Mudd describe the trees of the general area as being large, probably referring to their diameter, not their height. Because the larger trees would be the first cut, this would indicate that the Bloody Hill vicinity had probably not been logged.

One point of disagreement in the accounts concerns the quantity of brush on the area. The passage from Ware reports

that brush was sparse or absent; however, most of the other accounts indicate that there was considerable brush in some areas. Any substantial amounts of brush were almost certainly a post-settlement phenomenon. This topic will be discussed more thoroughly in the section on historic vegetation.

A final observation that is pervasive in many of the battle accounts is that of visibility. Almost every account contains several passages alluding to the ability to see long distances (e.g. 300+ yards). Obviously the landscape was fairly open; it would not be possible to see nearly so far in typical forest cover. When these accounts refer to men or batteries being concealed by vegetation the distances involved are almost always considerable. It does not take a very dense vegetation to conceal objects or men at distances of several hundred yards.

ECOLOGICAL INFLUENCES

The following arguments are based on knowledge of the ecological factors known to influence vegetation. The influence of one of these agents, edaphic factors, is still evident on the battlefield. The influences of fire and grazing by large herbivores, factors so important in determining the battlefield's presettlement condition, have long since ceased to operate.

Geographically, Wilson's Creek National Battlefield is located on what is commonly recognized as the border of the prairie and forest biomes. In a broad view of the Middle West, this area is a zone of dynamic transition with the multitude of climatological and ecological factors that determine vegetative

expression slowly shifting to favor grasslands to the west, and deciduous forest to the east. That this change in dominance of major vegetation types should occur gradually over a fairly broad zone of transition is consistent with the way natural processes operate. Except at points of abrupt topographical change, or where markedly different edaphic conditions are juxtaposed, the expression of natural communities occurs along a gradient or continuum. This being true on a local level, it is unreasonable to believe that the change from one biome to another, in which climatic factors operating on a huge scale without respect to any definite boundaries are the basic determinant, could be anything but gradual.

In this zone of transition, variable, dynamic communities combining vegetative features of both forest and prairie would be expected. Savannas, characterized by a generally prairie plant herbaceous layer and scattered trees would be the logical vegetation in such an area. Savannas are primarily fire maintained communities occurring as transitional areas at the prairie/forest interface (Nelson 1985). The frequent occurrence of prairie fires extending into this border zone is supported by the pervasive presence of blackjack oak (as noted in the Original Land Survey Notes), an archetypical fire species. In this dynamic setting both spatial and temporal changes in the vegetation were probably considerable. Although it is purely speculative, it is easy to envision the area alternating between more or less open conditions depending upon the recent fire history. An additional factor influencing the vegetation would have been the use of the

area by bison. The presence of Wilson's Creek, a permanent source of water, would have made the immediate area more attractive, and the grazing and trampling of large herds of these animals would have contributed to an open landscape.

Most of the soils on the area are neither true prairie nor true forest soils, but rather are transitional in nature presumably having developed under some mix of the two cover types. For example, Newtonia and Pembroke soils are generally considered to have developed under a prairie vegetation. However, they are very closely related to Peridge, which is generally classified as a forest soil. Greene County soil conservationist Jerry Dodd (pers. comm.) feels that characterizing these three soils as either prairie or forest soils, and distinguishing between them, is extremely tenuous because of their similar mixed prairie/forest origins.

In general, much of the battlefield's upland soils are relatively infertile with poor tree potential. The cherty limestone geology is evidenced by the abundant chert fragments on the soil surface in many areas and the shallow cherty fragipan of the Wilderness soils, both of which are impediments to good tree growth. Exposures of the Gasconade Rock Outcrop Complex form scattered glades, and elsewhere this complex provides only a thin mantle of soil covering the underlying bedrock. Conversely, the alluvial soils of the Wilson's Creek valley and colluvial soils of the larger stream branches are relatively fertile, as are the Newtonia, Pembroke and Peridge soils which generally occupy the more gradual slopes along Wilson's Creek in the northeast quarter of the battlefield.

ORIGINAL LAND SURVEY NOTES

The best source of information on the battlefield's presettlement vegetation is the Original Land Survey Notes. The outside lines of the township containing the battlefield were surveyed by a crew led by A. Fithian Garrison in the first quarter of 1835. In the second quarter of that year the same crew surveyed the interior lines of the township. The notes from this survey provide qualitative and quantitative information on the area's natural vegetation.

Description of the Land Survey Information

Information presented in the survey notes is of three kinds: qualitative descriptions of the vegetation along each half-mile segment of the section lines; witness tree data from each section corner and quarter section point; and a general survey map of the township's physical features.

The qualitative or descriptive comments generally consist of a single phrase describing the quality, density and species composition of the timber observed along the section line. A typical entry for the battlefield might read "Land thinly timbered blackjack, black and white oaks." Occasionally the surveyors commented on the presence or absence of undergrowth and the species concerned.

Land survey maps provide crude boundaries of vegetation types and the location of cultural features such as buildings and fields. In this way the maps are potentially useful in

determining the presettlement character of a site. However, at the time of the survey no settlement had occurred on the battlefield, and with few exceptions, the vegetation was described as thinly timbered. For these reasons, the survey maps were of little use in this study, and except for a brief reference, the information they contain will not be discussed in this report.

Witness tree data from the land survey was used to calculate tree density and to examine the relationships between topography and tree species composition and density. The points from which trees were witnessed were of three types. At section corners, a tree was witnessed in each of the four quarter sections (the ninety degree quadrants that lie between the four cardinal axes). Quarter-section points are located at the half-mile points along each north-south and east-west section line. At each of these points trees were witnessed in only two of the four quadrants. The selection of quadrants (which two of the four) at these points was not consistent and it is uncertain how they were chosen. The final type of points were along the exterior lines of the township at both section corners and at quarter-section points. At all of these points, trees were witnessed in the two quadrants that extended into the township (i.e., along the south exterior line the quarters used were the NW and NE). For each tree witnessed the species, diameter (inches) and right angle distances from the center point were recorded. A typical entry might read "Post Oak 10 inches in diameter bears 75 links north and 48 links west."

Potential Biases

The information provided by the descriptive comments and survey maps is simple and straightforward and would appear to provide little room for bias. However, many researchers feel that an underlying concern of the surveyors was to make the land appear attractive to potential settlers. Because of this, resources of economic value or those which would favor settlement may have been overemphasized. Dr. Walter Schroeder, University of Missouri Geography Department, has worked extensively with the survey notes. It is his opinion that this orientation resulted in disproportionate emphasis on the timber resources of an area, and often a disregard for other types of vegetation such as brush and herbaceous vegetation (pers. comm.).

Unlike the qualitative or descriptive comments and the survey maps, the witness tree data contains many potential sources of bias. The following discussions will examine the data for the presence and magnitude of these potential biases.

The most important assumption that is made in using the witness tree data to calculate tree densities is that the witness tree was the tree closest to the center point in that quarter. If trees other than those closest to the center are chosen, then the estimates will tend to underestimate the true tree density. Bias in witness tree selection could have occurred as a result of basically two factors; size and species. Witness trees had to be large enough to have the location information inscribed upon them, thus small trees may have been discriminated against. On the other hand, very large trees may not have been

selected because of a relatively short life expectancy. Species selection may have occurred as a result of average species longevity (i.e., against short-lived species), or because of physical characteristics which made marking difficult as with the low branches of cedars.

The bulk of witness trees fell between 8 and 14 inches in diameter; however, they ranged from 6 to 30 inches with over 18 percent exceeding 20 inches in diameter (Table 1). This represents what may have been a very reasonable natural size distribution considering the species concerned (primarily blackjack oak), the poor site and the frequent occurrence of fire which would have decreased tree longevity. Trees of less than 6 inches in diameter were surely selected against; however, the surveyors frequent allusions to a lack of brush suggest that small trees were usually lacking.

Witness tree species are in close agreement with the qualitative comments of species composition (Tables 2 and 3). The qualitative comments indicate that oaks were dominant throughout the battlefield; non-oak species are rarely mentioned. Consistent with this, oaks constitute nearly 92 percent of the trees witnessed. Relatively short-lived species such as elms and sycamores were sometimes witnessed in the bottoms where ecologically one would expect them to occur, even though the qualitative comments for these habitats indicate that these species were not predominant in such areas.

TABLE 1. Trunk Diameter of Witness Trees by Species

SPECIES	No. of Occurrences	Diameter (inches)																			
		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22	26	27	28	30
Blackjack Oak	31			2	2	7	2	7	2	3		1	2			1			1		1
Black Oak	12	1		2		4				1			1				1	1			1
Post Oak	6					1		3											2		
White Oak	6				1	1		1		1									1		1
Chinquapin Oak	2							1							1						
Hickory	2			1		1															
Sycamore	2							1								1					
Elm	1							1													
Totals	62	1	-	5	3	14	2	14	2	5	-	2	3	-	-	2	1	1	4	1	2

Table 2. Species Composition of Witness Trees

<u>Species</u>	<u>Number</u>	<u>Percent</u>	<u>Cumulative Percent</u>
Blackjack Oak	31	50.0	50.0
Black Oak	12	19.3	69.3
Post Oak	6	9.7	79.0
White Oak	6	9.7	88.7
Chinquapin Oak	2	3.2	91.9
Hickory	2	3.2	95.2
Sycamore	2	3.2	98.4
Elm	1	1.6	100.0
	<hr/>	<hr/>	
	62	100.0	

This evidence would indicate that witness tree selection was relatively objective. A final observation that suggests a general lack of bias in witness tree selection is provided by the fact that at two section corners no tree was within a reasonable distance to be witnessed. This would indicate that because of tree sparsity there was often no opportunity for selection and thus bias. The surveyors had demonstrated that they would accept trees between 6 and 30 inches in diameter, and of short-lived species such as elms and sycamores, yet apparently none meeting these very general criteria were available within a distance of over 200 feet (the maximum distance a tree was witnessed was approximately 215 ft.).

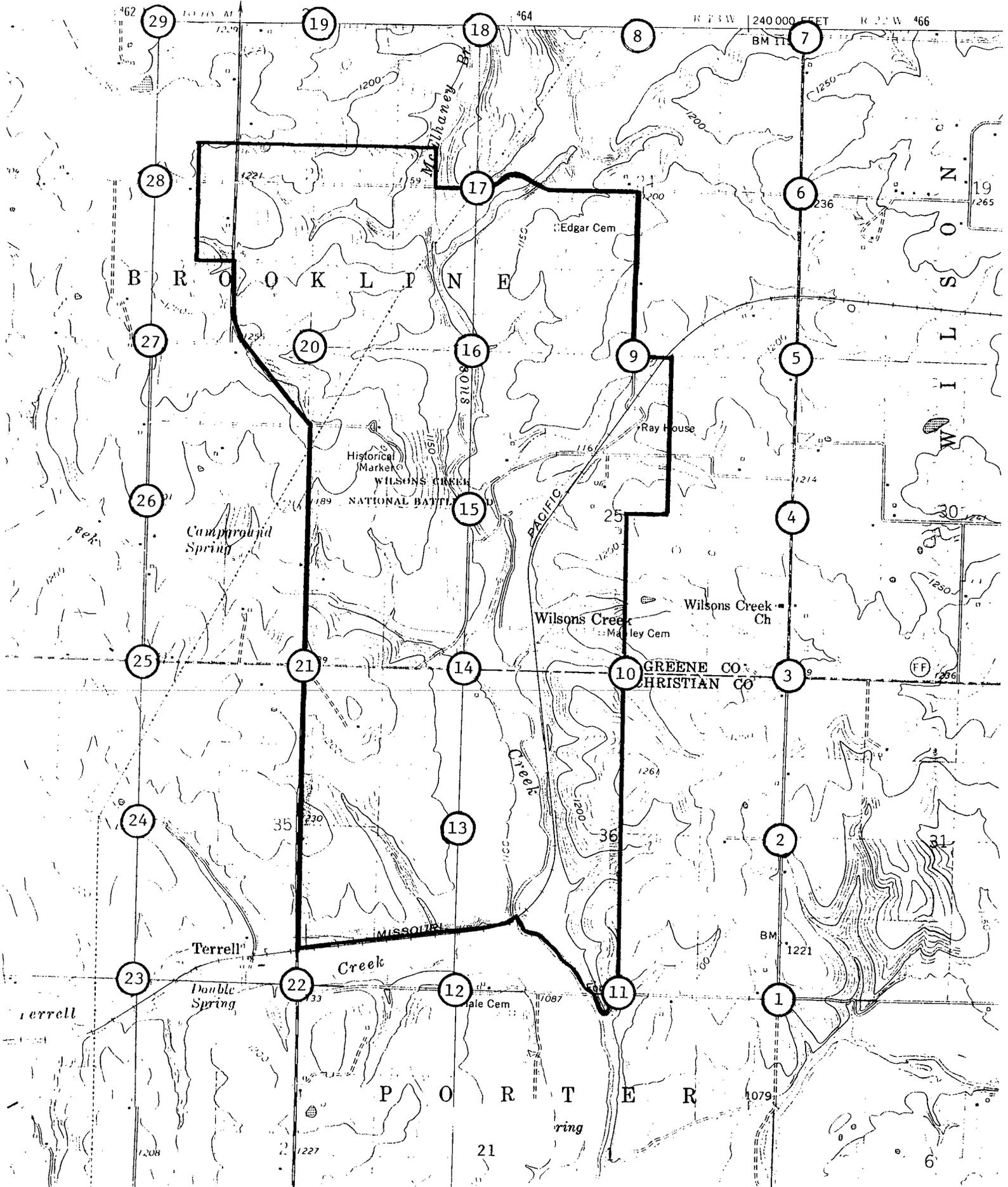
There is a potential for bias on interior quarter section points due to the manner in which quadrants were chosen. At

Table 3. Vegetation Comments from the Original Land Survey Notes

<u>Location</u>	<u>Comments</u>
Pt. 12-13	Thinly timbered with black, white and blackjack oaks.
Pt. 13-14	Thinly timbered, scattering blackjack and post oaks.
Pt. 3-10	Thinly timbered with black, white and blackjack oaks.
Pt. 10-14	Thinly timbered with black, white and blackjack oaks. Undergrowth oak.
Pt. 14-15	Thinly timbered with scattering blackjack.
Pt. 15-16	Very thinly timbered, scattering blackjack.
Pt. 5-9	Thinly timbered with blackjack and post oaks.
Pt. 9-16	Thinly timbered with black, white and blackjack oaks. No undergrowth.
Pt. 16-17	Thinly timbered with blackjack and post oaks.
Pt. 17-18	Thinly timbered with blackjack and post oaks. No undergrowth.
Pt. 7-8	Thinly timbered with black and white oaks, blackjack and hickory.
Pt. 8-18	Thinly timbered with black, white and blackjack oaks.
Pt. 23-24	Thinly timbered with blackjack and post oaks.
Pt. 24-25	Thinly timbered with blackjack, black and white oaks. No undergrowth.
Pt. 14-21	Thinly timbered with blackjack, black and white oaks.
Pt. 21-25	A few scattering blackjack and post oaks.
Pt. 23-22	Thinly timbered with black and white oaks.
Pt. 22-12	Thinly timbered with black, white and blackjack oaks. Undergrowth hazel.
Pt. 11-1	Thinly timbered black, white and blackjack oaks. No undergrowth.

- Pt. 12-11 Thinly timbered black and white oaks. The 4 or 5 chains on Wilson's Creek with better quality black and white oaks.
- Pt. 1-2 Thinly timbered with black, white and blackjack oaks.
- Pt. 2-3 Timber tolerable good, black, white and blackjack oaks. No undergrowth.
- Pt. 3-4 Timber tolerable good, black, white and blackjack oaks. No undergrowth.
- Pt. 4-5 Timber first rate; black, white, chinquapin oaks and hickory. Undergrowth hazel.
- Pt. 5-6 Timber first rate; black and white oaks, hickory.
- Pt. 6-7 Timber good; black and white oaks, hickory and pin oak. Undergrowth hazel.
- Pt. 16-20 Very thinly timbered with blackjack, black and white oaks.
- Pt. 20-27 Thinly timbered with blackjack and post oaks. No undergrowth.
- Pt. 27-28 Thinly timbered with blackjack and black oaks.
- Pt. 25-26 Thinly timbered with blackjack, black and white oaks.
- Pt. 26-27 Thinly timbered with black, white and blackjack oaks.
- Pt. 28-29 Timber tolerable good; black, white and blackjack oaks.

FIGURE 2. Location Index for Vegetation Comments from the Original Land Survey Notes (Table 3).



section corners and at all points on the exterior lines, the quadrants in which trees were to be witnessed were fixed. However, at interior quarter section points two of the four possible quadrants were chosen in an inconsistent and inexplicable manner. It is possible that the quadrants to be used were chosen randomly. If this were true no bias would result. However, it is also possible that the quadrants chosen were those two with the closest trees. If this is true, the true tree density will be overestimated. One way to check for this bias would be to compare density estimates for the quarter section points with those from the section corners and exterior line points where this type of selection could not occur. Mean estimated tree density per acre for interior quarter section points is 22.4, versus 19.0 and 11.8 for the other two point types (Table 4). While this figure is larger, possibly as a result of bias, the difference is not great. Two points with relatively high estimates (79 & 46) pulled the mean of the interior section quarters up considerably, and with the great variation in point estimates and the small sample sizes these differences are not significant.

There is some reason to believe that biases were systematic in the land survey because of instruction provided the surveyors designed to produce a rigorous, uniform survey. However, it is Dr. Schroeder's opinion that Missouri surveyors had not received instruction that would have resulted in systematic biases. It was not until somewhat later, for example during the survey of the Great Lakes states, that such bias producing standardization

of the survey was introduced. The data that we have examined seem to support this contention. Although surely present to some degree, biases do not appear to be systematic or prohibitive. Therefore, the survey data for the battlefield locale is viewed as a relatively accurate and objective portrayal of the vegetative conditions circa 1861.

Table 4. Estimated Tree Density by Sample Point Type

<u>Section Corners</u>	<u>Interior Quarter Secs.</u>	<u>Outside Lines</u>
30.0	29.3	1.6
1.7	11.5	26.5
31.0	17.9	5.1
28.6	5.8	14.6
3.8	6.8	1.7
19.2	2.7	4.7
	79.7	3.1
	1.7	5.2
mean 19.0	22.2	49.8
	46.0	5.6
range 1.7-31.0		
	mean 22.4	mean 11.8
	range 1.7-79.7	range 1.6-49.8

Calculations of Tree Density

The witness tree data was used to calculate tree densities of the presettlement battlefield. Relative to current field investigations, the sampling intensity of the land survey data (per unit area) is woefully inadequate. Only two section corners and eight quarter section points actually fall within, or on the border of, the battlefield. Also, qualitative comments essentially pertain to only the area along section lines. This is not

a statistically based sample that will allow fine comparisons between local sites or statistically valid estimates of tree density for local sites. Instead, it is used recognizing its limitations, but also acknowledging its value as a good general description of the vegetation on a very broad scale. As such, it was appropriate to expand the region for which we evaluated the land survey notes to include all of the six sections that contain a part of the battlefield. This increase in area boosted the number of points we used from 11 to 27.

The method used to calculate tree density was worked out with the assistance of MDC biometrician Steve Sheriff. It proceeded as follows:

To convert links to feet:

$$1 \text{ link} = 7.92 \text{ inches}$$

$$\text{So: } (\# \text{ links}) \times 7.92/12 = \# \text{ feet}$$

To calculate straight line distances (radii) from the center point to witness trees we used the standard formula for calculating the hypotenuse of a right triangle:

$$c = \sqrt{a^2 + b^2}$$

To calculate the area for the tree in each quadrant we simply used the formula for calculating the area of a circle and divided by four:

$$\text{So: } \pi(r^2)/4 \text{ for each quarter}$$

Figures for the quarters were summed and then divided by the number of quarters to give the average square feet per tree at the point

Finally converting to trees per acre:

43560 (sq. ft./acre)/the average sq. ft. per tree yields the estimated number of trees per acre at that point.

Sheriff ran several computer simulations using this method and determined that it was accurate. Using an area of known dimensions stocked with 1,000 trees the average of 100 simulations was 1,073, a slight overestimate but within the 95% Confidence Interval.

Discussion of Land Survey Data

It is obvious from the qualitative descriptions of the vegetation that the battlefield was sparsely timbered throughout (Table 3). Timber along half-mile segments of the section lines was described as "thin," "very thin" or "scattering" on 26 of 32 occasions, or 81 percent of the time. Even in the one region of the area examined where the timber is described as "tolerable good" or "first rate," the surveyors make special mention of a "remarkably fine grove of Chinquapins" (they even mapped it), indicating that this particular occurrence was probably a denser stand of trees within a generally sparsely treed area.

The density estimates from witness tree data concur with the findings from the qualitative descriptions (Table 5). Fully half of the sample points gave density estimates of less than 7 trees per acre. Only four of the twenty-six (15 percent) had estimates of greater than 30 trees per acre. By contrast MDC's Springfield area resource forester Carl Hauser (pers. comm.) estimates that a mature forest stand contains approximately 75-80 trees exceeding

8" in diameter per acre. An important feature to note is that this data reveals a great deal of small scale variation in tree density irrespective of topography.

TABLE 5. Estimated Tree Density by General Topographic Position

		General topographic Position				
		Alluvial Bottom	Upland, flat to Moderate Slope	Upland Draw	North-Northeast Slope Generally Steep	Steep Southwest Slope
D E N S I T Y E S T I M A T E		6.8	4.7	1.7	5.1	31.0
		11.5	3.1	5.6	30.0	
		1.7	5.2	14.6	26.5	
		1.6	49.8	1.7	TOTAL	<u>61.6</u>
		TOTAL	21.6		MEAN	20.5
		MEAN	5.4	17.9	RANGE	5.1-30.0
		RANGE	1.6-11.5	TOTAL	<u>26.3</u>	
			29.3	MEAN	5.3	
			5.8	RANGE	1.7-14.6	
			79.7			
			28.6			
			46.0			
			3.8			
			22.2			
		<u>19.2</u>				
	TOTAL	345.3				
	MEAN	26.6				
	RANGE	3.1-79.7				

Based on the general qualitative descriptions, tree density was uniformly sparse regardless of topographic position (Table 3, Figure 2). It might be expected that bottomlands being more moist and fertile than uplands would be more densely forested. This may have been true along the southern border of Section 36 where "the 4 or 5 chains on Wilson's Creek supported better quality black and white oaks." However, in most bottomland areas, notably along the lines separating Sections 35 & 36, 25 & 26 and 23 & 24, the timber was described as thin, very thin, or scattering much like that on the uplands. The one instance in which the qualitative comments can definitely be associated with an upland draw indicates that these sites were also thinly timbered, although the shallow soils in this particular area is a complicating factor. The section line separating Sections 23 and 26 follows an upland draw of shallow, rocky soils where the survey notes describe the vegetation as "very thinly timbered with blackjack, black and white oaks." The one area that apparently supported better timber (east of park, east boundary Sections 24 & 25) is not distinguishable topographically, but does include some shallow draws of relatively rich colluvial soil.

Tree density estimates from the witness tree data according to general topographic position are presented in Table 5. Because this data is more point or location specific, it is more useful for examining topography/plant relationships.

Ignoring the substantial variations in density within any one topographic grouping, this data suggests some rather sur-

prising density/topography relationships. Although in agreement with the indications of the qualitative descriptions, the sparseness of the estimated tree density for the bottomlands is still unexpected. The points falling in upland draws also gave unexpectedly low estimates, although this may be due in part to some of these areas being of shallow rocky soils. Completing this paradox is the relatively high density estimates of the uplands. Five of the 13 upland points did give densities of less than 6 trees per acre. However, the mean density for this group was 26.6 trees/acre and six of the eight highest estimates occurred here. The relatively high density estimates for the few points that occurred on steep slopes (both N & S facing) is the one area in which the data agrees with expectations. Despite these somewhat surprising results it is only in regards to the bottomlands that the picture of the presettlement vegetation really deviates from what might be expected. On the uplands only one estimate approximates the stocking of typical forest conditions. Estimates at the remaining points paint a picture of very sparsely to moderately stocked savanna.

Both the qualitative and quantitative data from the land survey notes indicate that the area was dominated by oaks (Tables 2 and 3). Blackjack oak accounted for fully half (31 of 62) of the trees witnessed. Black oak was the second most common species used as witness trees, and in all, oak species accounted for 92 percent of trees witnessed.

Unlike density, species composition demonstrates some predictable relationships with topographic position (Table 6).

Table 6. Species Composition by General Topographic Position

<u>General Topo. Position</u>	<u># Pts.</u>	<u>Species</u>	<u>No.</u>	<u>%</u>	<u>Cum. %</u>	<u>Freq.</u>
Bottomland	4	Black Oak	4	44	44	2/4
		Post Oak	2	22	67	2/4
		Sycamore	2	22	89	2/4
		Elm	1	11	100	1/4
Upland, flat to moderate slopes	13	Blackjack	24	77	77	11/13
		Black Oak	5	16	94	4/13
		Chinquapin	2	6	100	1/13
Upland Draw	5	Post Oak	4	40	40	3/5
		Blackjack Oak	3	30	70	2/5
		White Oak	1	10	80	1/5
		Hickory	2	20	100	2/5
North-NE slope Generally Steep	3	White Oak	5	62	62	3/3
		Black Oak	3	37	100	3/3
Steep Southwest Slope	1	Blackjack Oak	4	100	100	1/1

Blackjack oak was the overwhelming dominant on uplands, but was not witnessed in the bottomlands or on northeast slopes. Black oak was dominant or co-dominant in these mesic environs and was a minor component on the uplands. White oak shared dominance with black oak on mesic slopes, and white oak and post oak were witnessed only in the more mesic sites of draws, slopes and bottomlands.

Non-oaks were witnessed only in the relatively moist sites of bottomlands and upland draws. Among the five non-oak witness trees, there were two sycamores, two hickories and one elm.

One area of disagreement between the qualitative and quantitative pictures concerned the abundance of white oak. This species was mentioned frequently (on 21 of 32 occasions) in the qualitative notes, but was witnessed only six times, primarily on the mesic slopes and never on the uplands.

A final piece of information available in the land survey notes concerns the abundance and species composition of brush (undergrowth) or shrubs on the area. Information on this topic is given only in the qualitative comments (Table 3). Comments concerning brush or the lack of brush appear in only 11 of the 32 individual qualitative statements that we reviewed. The fact that this subject was not addressed in every case makes it somewhat difficult to evaluate the status of brush on the battlefield site at the time of the survey. In the eleven instances where comments were made about brush, seven stated that no brush was present along that particular half-mile section. In the four cases where brush was present, three of the times it was hazel and in the other case it was oak.

The location in which oak undergrowth was present includes relatively mesic sites in the form of bottomland and steep north slopes. Both of these sites might logically have supported a vegetation that approached a typical forest stand with some brush in the form of oak regeneration. The three sites where hazel was noted include a steep north slope and two sites on gently rolling upland cut by relatively shallow draws. The two upland sites are in the area where the timber was described as "good" or "first rate." Hazel is generally a mesic site species and these three areas were apparently some of the richest sites in the sampled area.

Although it often grows in forest conditions, hazel is not restricted to these habitats. In fact, this species grows best where it is exposed to full sunlight such as in fencerows or at the forest edge. In his work with the survey notes, Schroeder (1985) noted hazel as occurring on prairies in Jackson County, Missouri. Hazel may have been a common component in savannas or on prairies along the prairie/forest border.

The seven sites where the absence of undergrowth is expressly noted are primarily upland, but do include some bottomland and upland draws. In most of the areas where the subject of brush was not addressed, it is likely that it did not occur. It is probable that the presence of brush was more consistently noted than was the absence of brush.

All the sites where undergrowth was present were relatively rich sites. Undergrowth probably existed throughout the battle-

field in many of these local sites. It apparently did not occur in all the alluvial areas. The dry, rocky sites which constitute the majority of the battlefield probably supported little or no shrub/undergrowth component.

SYNOPSIS OF PRESETTLEMENT VEGETATION

In general, the presettlement vegetation of Wilson's Creek National Battlefield was a savanna of scattered oaks and a prairie plant herbaceous layer. The savanna of the uplands was dominated by blackjack oak. Structurally this savanna varied in density with the bulk of it supporting less than 10 trees per acre. Within this sparsely treed matrix there were scattered groves of trees. These groves were of relatively dense timber with a stocking occasionally reaching over 40 trees per acre. However, even in these more densely treed patches of the battlefield the shrub component of the community was sparse or absent. Most of the upland draws did not vary from this sparse savanna character except in terms of the species composition, with blackjack diminishing at the expense of post and white oaks.

The few steep mesic slopes (north and east facing) on the area ostensibly did support a more dense and varied flora. However, by tree density most of these areas might still be classified as savanna. These areas were dominated by better quality black and white oaks, and hazel was frequently present as a shrub component. Some of the more protected (below bluffs) and mesic of these small sites surely supported a near typical forest vegetation.

Rock outcrop soils of the Gasconade-Rock outcrop and Goss-Gasconade complexes are scattered across the battlefield. In places where the bedrock is exposed, most notably on Bloody Hill, limestone glades supporting a xeric herbaceous flora and scattered stunted trees occurred. Other glades were located on west-facing slopes east of Wilson's Creek, and on the prominence north of Bloody Hill. In areas of these soil types where the bedrock is mantled by a shallow layer of soil, savannas of relatively sparse, moisture-stressed trees would have occurred. Some of these shallow soil areas occur in draws, and the depauperating influences of the substrate apparently overrode the effect of a more favorable topographic position. These sites supported an impoverished savanna.

In terms of the density of the vegetation, the bottomlands of the battlefield were often as sparsely timbered as the uplands. These sites, did however, differ from the uplands in species composition and in tree quality or size. Somewhat unexpectedly, and probably a result of the presettlement fire ecology of the site, the bottomlands were dominated by oaks. The species involved were typically black, post and probably white oak. Although they were not dominant, non-oak species such as sycamore, elm, hackberry and walnut were also present. In some areas, the bottomlands supported a more typical forest vegetation with denser timber and undergrowth.

The exact nature (species, physical character) of the herbaceous component of the battlefield's presettlement savanna is largely undocumented. As Schroeder noted, the surveyors

tended to emphasize timber resources and generally ignored herbaceous vegetation. The assumption that the herbaceous vegetation of the site was composed of prairie species is based primarily on current knowledge of savanna communities. The few published comments on the battlefield's herbaceous vegetation also seem to indicate a prairie vegetation. Watson refers to "grassy ridges;" a few other soldiers' accounts briefly mention prairie grasses; and the surveyors reported a prairie in Section 26. Based on this information, our best estimate is that the herbaceous component of the battlefield's vegetation was composed primarily of prairie species. The majority of prairie plant species are very widespread. However, the species list for nearby La Petite Gemme prairie (Appendix 6) may be a good reference for the battlefield region.

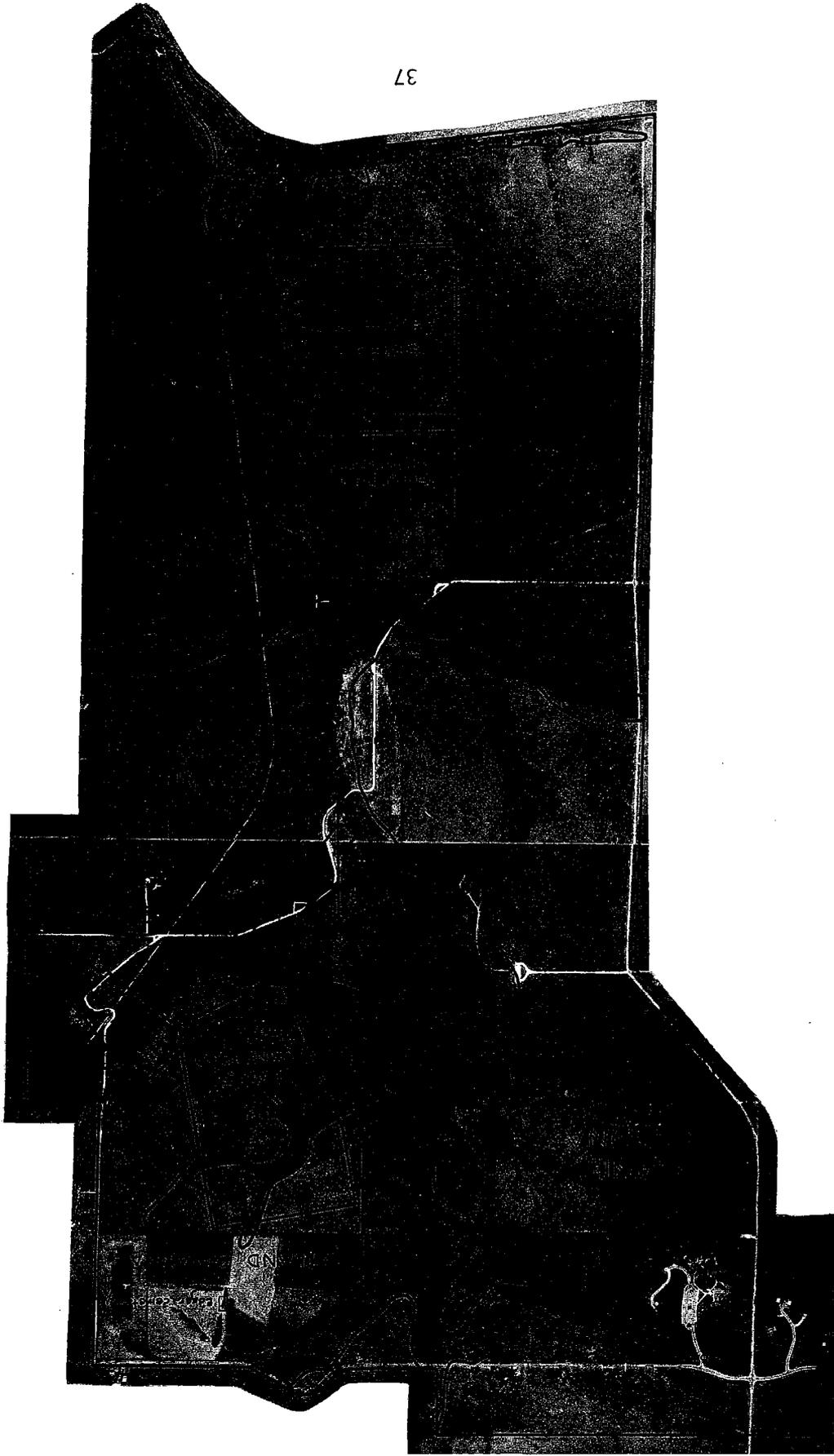
A final vegetative community to consider in the presettlement picture of the battlefield is that of prairie. It is likely that throughout the battlefield and occupying all topographic positions, treeless areas large enough to be called prairies existed. This contention is supported by the land surveyors' notes of a prairie in the bottomlands in the northeast corner of Section 26, and by the additional instance where one quadrant of a section corner contained "no tree within a reasonable distance to witness." By and large these openings were probably small enough (a few acres) that they were not noteworthy within the context of the surrounding sparsely treed savanna.

HISTORIC SCENE

The overall goal of this project is to return the site of Wilson's Creek National Battlefield to the conditions that existed at the time of the battle. As Bearss (1978) determined, information on the battlefield's vegetation dating from this period is scarce. The only known published documents that deal with the battlefield's vegetation circa 1861 are accounts of the battle written by Union and Confederate participants. These accounts and their shortcomings were discussed in the section on presettlement vegetation.

A few of the soldiers' accounts do provide brief, but fairly good, descriptions of the area on and around Bloody Hill. Others give some clues as to the general appearance of the landscape in terms of its open character and the presence of brush. These observations are of some value in the reconstruction and have been considered in the determination of presettlement vegetation. However, in view of the inadequacy of this material, our interpretation of the historic scene is based primarily on the determinations of the presettlement vegetation combined with known settlement-related modifications to the area. Bearss presents a map detailing the known post-settlement modifications to the battlefield. This map meshed with the map of presettlement vegetation serves as this study's map of the historic scene (Figure 3).

The location and nature of the obvious cultural modifications such as buildings and crop fields are well documented. There undoubtedly were less apparent factors that affected the



HISTORIC MAP OF
WILSON'S CREEK NATIONAL BATTLEFIELD

Figure 3.

battlefield's vegetation. Selective cutting of trees surely occurred in timber stands that were not clear cut. Wildfire suppression and open-range grazing of livestock also would have accompanied settlement.

Outside of the known cultural impacts, most accounts indicate that in 1861 the battlefield's vegetation was similar to presettlement conditions. The notable exception was an apparent increase in brush. The most credible soldier's account of the vegetation (Ware) reports that brush was sparse or absent on the battlefield. However, several other references indicate that there was considerable brush in some areas. The specific locales mentioned are on Bloody Hill, the borders of the Ray and Gibson cropfields, and the Wilson's Creek bottoms in the north half of the battlefield. References to "a luxuriant woods through which no eye could pierce" (Snead) along Skeggs Branch suggests that this area may also have supported substantial brush.

Any increase in brush on the battlefield was apparently a post-settlement phenomenon. On a general level, wildfire suppression and grazing by livestock could have resulted in an increase in brush throughout the battlefield. In the absence of fire-induced mortality, woody species gain a foothold in prairie habitats. As a source of sprouts, the battlefield's scattered trees would have augmented this effect. Grazing by livestock which weakened grass cover could have aided the increase of an unpalatable woody growth.

In localized areas, both clear-cutting and selective logging may have increased brush. Trees cut at the edges of cropfield

clear-cuts would have sent up sprouts that survived in the absence of fire. Land clearing for crop fields probably provided much of the wood required for heating and cooking; however, logs for building construction were also needed. The short-boled, open-grown trees of the uplands would not have filled this need, and it is likely that better quality trees from the bottomlands were selectively cut for this purpose. Selective cutting in the bottoms and draws would have increased sunlight and decreased competition. A combination of stump sprouts from cut trees and new seedlings would have increased brushiness in these areas.

As stated previously, information on the battlefield's vegetation contained in the soldier' accounts indicate that much of the presettlement character remained. The short length of time that the region was settled prior to the battle would seem to support a lack of major changes to the battlefield's presettlement vegetation. Records of land purchases contained in the Missouri Tract Books show that most of the battlefield's lands were purchased between the mid-1840s and mid-1850s, and a few tracts still had not been sold by 1861. Therefore, the battlefield had been settled only 10 to 15 years prior to the date of the battle. Additionally, several large tracts of the battlefield, including Bloody Hill, were deeded to the Atlantic-Pacific Railroad. Railroad ownership of the lands would not preclude their use for grazing and probably some selective timber cutting. However, they should have been protected from major habitat alterations.

CURRENT VEGETATION

Essential to achieving the stated goal of vegetation restoration was the collection of accurate and detailed information of the battlefield's current vegetation. The site's current vegetation will dictate the management practices to be implemented, and in many cases will provide the raw material from which the historic scene will be derived.

Prior to going afield, current aerial photos (8"/mile) of the battlefield were used to map the battlefield's vegetation. Using these photos, preliminary boundaries of stands of essentially uniform vegetation were delimited. This mapping of stands was an ongoing process with continual refinements being made as each tract was evaluated in the field.

Study of the current vegetation was accomplished using both quantitative and qualitative techniques. Forested lands and other vegetation types supporting substantial woody vegetation were systematically sampled using accepted forestry techniques. Dependent upon stand size, anywhere from 3 to 13 prism and fixed plots were taken in each forest tract. Plots were taken at predetermined intervals along transect lines, the direction and starting points of which were chosen by looking at the maps of each stand prior to going afield. Prism plots were taken using a 10 factor prism with the number of individuals per species being recorded. Fixed area plots of 1/20 acre were taken from the same points, with the number of species per size class (1-2" dbh, 2-4", ... 16+" dbh) being recorded. In successional field habitats only fixed area plots (1/20 acre) were taken.

Habitats without substantial woody vegetation, as well as wooded stands, were qualitatively evaluated as to species composition and dominance. In all habitat evaluations particular attention was paid to "desirable" native grass and woody species that could be utilized in the restoration effort. The presence of problem "exotics," such as fescue and Osage orange, was also closely noted.

Like all lands in the area, the site of Wilson's Creek National Battlefield has been subjected to intensive and long-term agricultural use. At some time in the past many of the fields were plowed, and the whole area has been heavily grazed. Early aerial photographs of the battlefield (1941, 1959) serve to illustrate the site's more recent history of use. As late as 1959 the large field north of Bloody Hill (now an advanced successional field) was devoid of trees, and several of the fields in the northeast corner of the park which now support a rank growth of fescue were under cultivation. An extreme example of past land use now hidden involves a rectangular-shaped 80-acre tract in the battlefield's southwest quarter. Partly cropped and essentially without trees in 1941, this tract now supports a vigorous young forest. With the cessation of agricultural activities, the mosaic of habitats on the battlefield are now in various stages of revegetation and recovery. Persistent reminders of a history of use and abuse include the pervasive presence of two "exotic" plants, fescue and Osage orange, and an often impenetrable growth of thorny brush.

A first step in dealing with the variety of vegetation types present on the battlefield was to set up a system of classification. Classification was based generally on the structure and species composition of the vegetation. Some habitat patches could conceivably be placed in more than one class. For example, distinguishing between advanced successional fields and young forests was sometimes difficult.

Mapping of the battlefield yielded 100 separate vegetation units. This figure does not include the continuous, dendritic riparian forest areas along Wilson's Creek and the larger stream branches. The independently summed acreages of all the units, plus the riparian areas, totaled 1763.5 by my calculations, slightly exceeding the park's official acreage of 1751. Of this total, approximately half is essentially treeless, and half supports substantial woody vegetation in the form of forests and successional fields.

The vegetation classes used are briefly described as follows:

Fescue Field (FF) - Grasslands dominated by fescue, most of which have been maintained by haying. In some fields, annual forbs are common to abundant; in others, scattered native warm season grasses occur. At least two of these fields are unsuccessful prairie plantings.

Old Prairie Plantings - Good (OPP-G) - Good quality old prairie plantings dominated by warm season native grasses

with little or no cool season grasses. Dominants are generally Indian grass and little bluestem with some big bluestem, sideoats grama and occasionally switchgrass.

Old Prairie Plantings - Fair (OPP-F) - Old prairie plantings of fair quality with common to abundant fescue mixed in with native grasses.

New Prairie Plantings (NPP) - Recent (2-3 years old) prairie plantings generally of poor quality. Native grasses and forbs are generally sparse and most of these stands are dominated by fescue, purple top or annual forbs.

Successional Field (SF) - Former pasture or hayland of generally exotic grasses now invaded by young woody vegetation. This woody vegetation is mostly of native species, generally covers less than 50 percent of the field, and typically is less than 15 feet in height.

Advanced Successional Field (ASF) - More advanced (older) stages of the above class differing in that typically much greater than 50 percent of field is occupied by woody species and these species generally exceed 15 feet in height.

Exotic Savanna (Sa-E) - Area of recent timber thinnings designed to create savanna structure. Typically dominated

by large honey locusts over fescue. Some smaller Osage orange, native trees and brush, mostly buckbrush, also occur.

Post Oak Savanna (Sa-N) - Area of old growth post oaks over fescue that has a fairly natural savanna structure.

Young Forest (YF) - Forest stands of typically native species (not always desirable), but sometimes with considerable "exotic" component. These stands are generally dominated by trees less than 40 years of age (often considerably younger).

Mature Forest (MF) - Similar to above class but with mostly native species and dominants generally exceeding 40 years of age.

Limestone Glade (LG) - Areas of shallow soils or exposed bedrock that were for the most part naturally occurring glades (may be enlarged by erosion). Most of these sites have considerable exotic plant populations but also some natives. Cedar invasion is a serious problem on glades east of creek, and hardwood invasion is a problem on some areas west of the creek, most notably on Bloody Hill.

Exempt Areas - Tracts which surround the information center, the maintenance buildings and the ranger's residence which will for the most part be excluded from management.

The map of the current vegetation (Figure 4) shows the distribution of these vegetation types on the battlefield. A summary of the current vegetation by vegetation class or type is presented in Table 7.

Presentation of the battlefield's current vegetation on a site by site basis, including reference to the fixed area plot data, will be done in the restoration section. The comparison of the current and historic vegetation of each management unit was the basis for formulating management recommendations. To present this information in both sections would be redundant.

A special feature of the battlefield's current vegetation is the presence of three "rare" plant species. The known locations of these plants are mapped on Figure 5. Bladderpod (Lesquerella filiformis), a Missouri endemic that is listed as federally endangered, occurs on the limestone outcrops of Bloody Hill and at a second site in the southwest quarter of the battlefield. Thelesperma trifidum is a state endangered composite that is also found on limestone glades. A large population of the plant occurs on glade 6-C and a smaller population grows on Bloody Hill. Royal Catchfly (Silene regia) occurs in small populations scattered throughout the battlefield. This species is fairly common in Missouri, but it is rare outside the state and is being considered for federal listing.

An obvious omission on this report's maps of the battlefield is the newly constructed interior tour road. Because the new road passes through, and therefore alters some of the vegetation

units, it would have been desirable to include it on the maps. However, its absence should not make the restoration any more difficult.

Table 7. Acreages of Current Vegetation Classes

<u>Vegetation Class</u>	<u>Acreage</u>	<u>Percent</u>
Fescue Field (FF)	552.5	31.3
Old Prairie Plantings - Good (OPP-G)	50.5	2.9
Old Prairie Plantings - Fair (OPP-F)	181.0	10.3
New Prairie Plantings (NPP)	91.5	5.2
Successional Field (SF)	133.0	7.5
Advanced Successional Field (ASF)	79.5	4.5
Exotic Savanna (SA-E)	64.0	3.6
Post Oak Savanna (SA-PO)	18.0	1.0
Young Upland Forest (YF)	197.5	11.2
Mature Upland Forest (MF)	129.0	7.3
Riparian Forest (RF) Young & Mature	173.5	9.8
Limestone Glade (LG)	37.5	2.1
Exempt Areas (EA)	50.5	2.9
Disturbed Field (DF)	5.5	0.3
<hr/>		
Total	1763.5	100.0

Figure 4.

CURRENT VEGETATION OF WILSON'S CREEK NATIONAL BATTLEFIELD

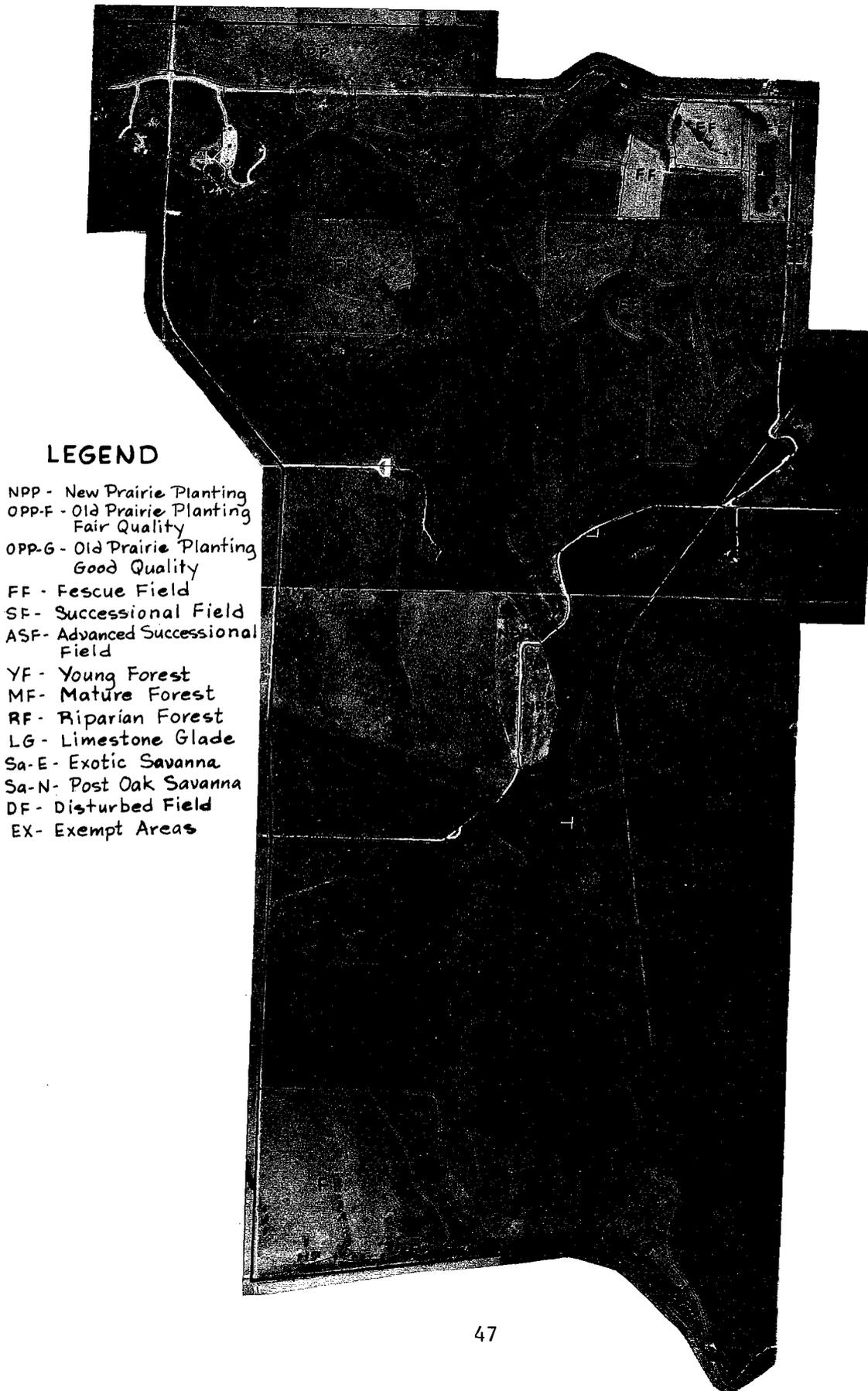
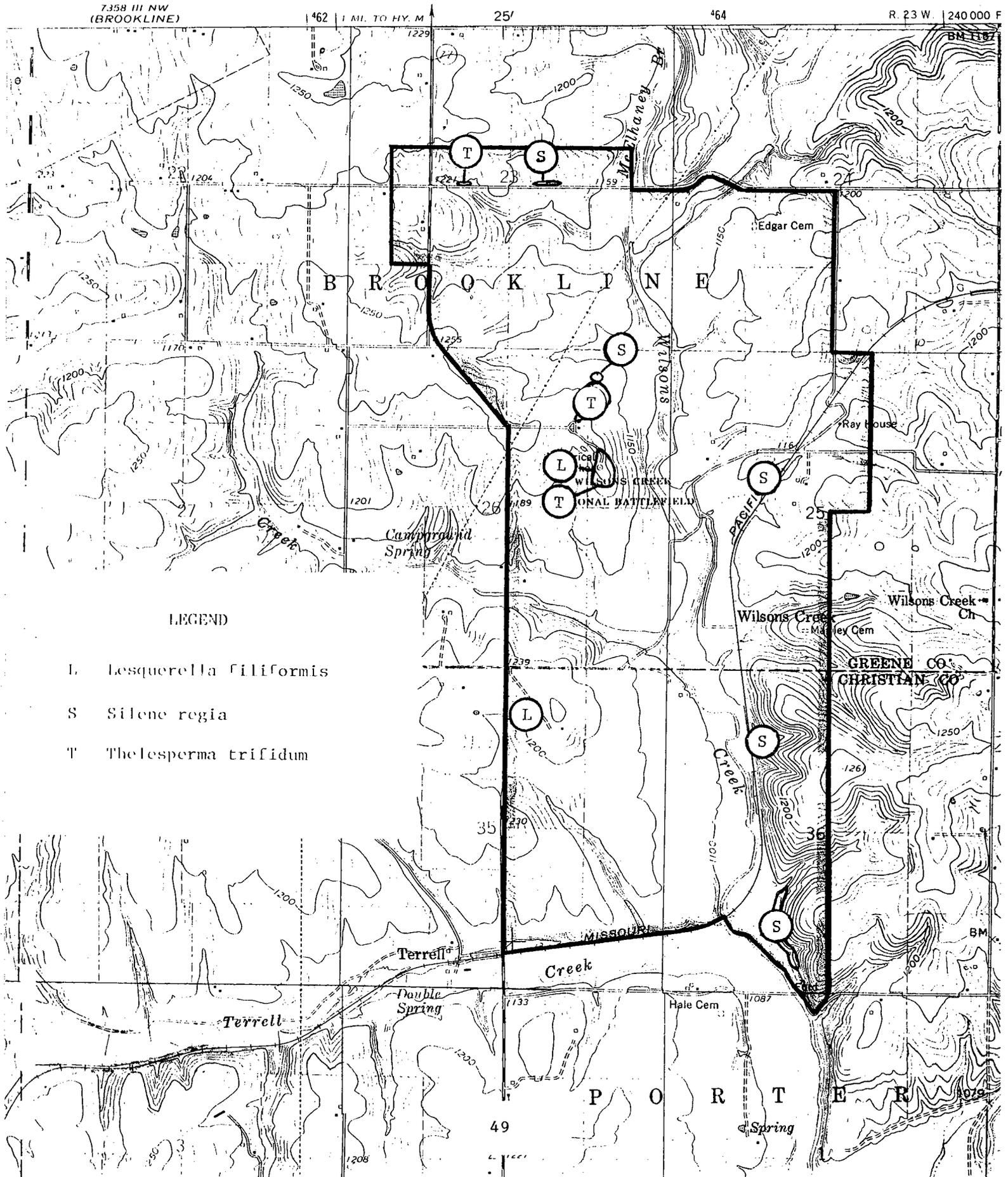


Figure 5. Known Locations of "Rare" Plants on Wilson's Creek National Battlefield



RESTORATION

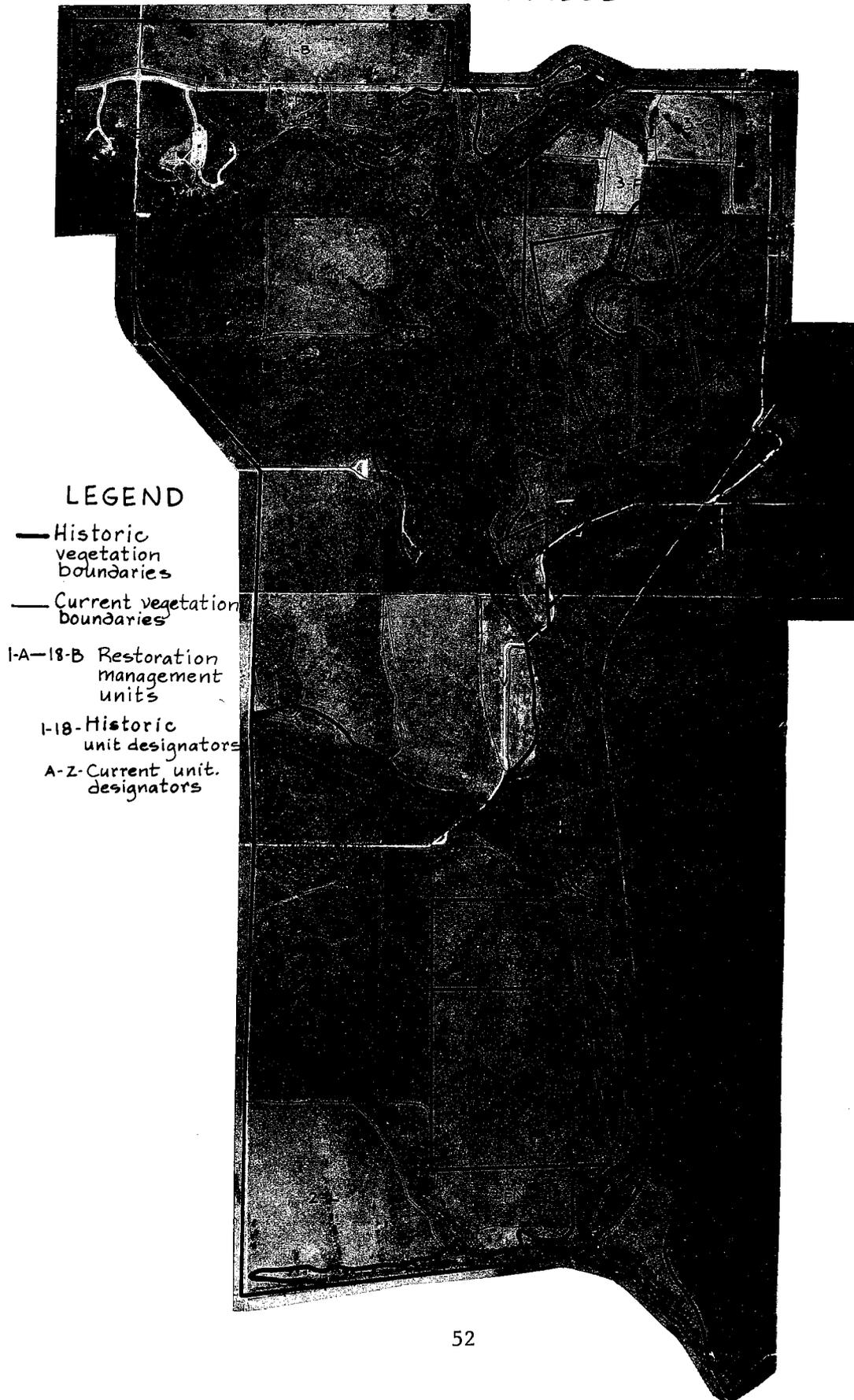
This final section details the means by which we will achieve our project goal: restoration of the battlefield's historic vegetation. The current vegetation of each site is examined and compared to the historic vegetation, and based on this comparison management steps to restore the historic scene are proposed. Wherever it is possible, the current vegetation of the site will be used in the restoration. This effort should reduce the project's ultimate costs, but more importantly it will speed the return to a vegetation approximating that present at the time of the battle.

From a practical standpoint, the restoration of the battlefield's vegetation should probably include a few compromises to the historic scene. For reasons that will be discussed later in this section, we are proposing that forested areas in the bottomlands and on steep slopes be left in a typical forest vegetation rather than be converted to the historically accurate savanna condition. The historic scene also included substantial brush in some locales and almost certainly heavy selective cutting in the riparian areas. It is undesirable to replicate these conditions for reasons of aesthetics and because of the periodic maintenance they would require. Taking these compromises into consideration, the goal of the restoration effort should be a map of the presettlement vegetation modified by the obvious settlement related modifications (buildings, fields) to the battlefield.

The restoration map of the battlefield is a composite of the maps of current and historic scenes (Figure 6). It was created by overlaying the historic map onto the map of current vegetation. The large vegetative units of the historic map are labeled numerically. Within each of these numerical units, the current vegetation units, and portions of those units that are enclosed, are labeled alphabetically. The results are alpha-numerically (i.e., 1-A, 3-C) identified vegetation management units.

Before the restoration of the battlefield's vegetation can begin, it will be necessary to determine the boundaries of the separate management units in the field. Most of the unit boundaries are clearly defined by sharply different vegetation types. The fact that most of the units are old farm fields which are rectangular in shape and have straight borders, remnant fencerows and different management histories, facilitates boundary determinations. In the riparian areas, however, current vegetation borders often do not conform to presettlement vegetation boundaries and defining the unit boundaries is more difficult. On the presettlement map, the borders of these riparian vegetation units are defined by the distribution of alluvial and colluvial soils. In general the distribution of these soils, and thus that of the riparian units, is readily discernable by a slight but noticeable rise in elevation signaling the start of the uplands. However in many areas, especially along the smaller stream branches, this change in elevation will not be distinct. Because of this the limits of the riparian areas should be defined generously. This slight

RESTORATION MANAGEMENT UNITS OF WILSON'S CREEK NATIONAL BATTLEFIELD



bias will not only provide a greater acreage of more heavily timbered riparian vegetation which is small (in acres) compared to the thinly timbered uplands, but it will also provide additional protection against erosion when the adjacent uplands are disturbed for prairie plant establishment. Where steep slopes or bluffs border the streams, they are included in the riparian unit with the unit boundary then being located atop the slope.

In presettlement and historic times, oaks were the dominant trees of the battlefield. Blackjack oak dominated the uplands with other oak species present in small numbers. Black, white and post oaks were dominant in the draws and bottoms. Because blackjack oak is now uncommon on the battlefield, in wooded habitats where the current vegetation will be used to recreate the historic scene this species will be under-represented. However, where blackjack oak is present it should be the most favored species. In field habitats where tree establishment will be necessary, blackjack oak and post oak (a much longer-lived species) should dominate the plantings.

In most of the management units that have substantial woody vegetation, oaks of several species are common enough that they can be favored and will eventually dominate the restored scene. This tendency to favor oaks should, however, not be unconditional. Where large or good quality individuals of non-oak natives are present they should be retained, especially if no oaks are present. They should also be retained where only small oaks are available or where they are not competing directly with good

quality oaks of some size. On the uplands such species would include walnut, white ash, hickories and hackberry. Natural grove forming species such as persimmon and sassafras would also be desirable, although sassafras's susceptibility to disease will limit this species' size and longevity. In the more mesic habitats on steep slopes and in the bottoms non-oak mesic site species should receive consideration equal to that of oaks. In all areas Osage-orange should be eradicated along with other exotics such as Chinese elm. All cedars should be removed with the exception of a few large individuals on the glades east of Wilson's Creek. Honey locust should be eradicated on the uplands, and they should not be favored in the bottoms, with only an occasional large individual being retained.

The vegetation types of the historic battlefield are relatively few. Excluding the scattered limestone glades and areas of cultural modifications, the uplands will be entirely savanna. The savanna should be thinly timbered (1-10 trees per acre) with scattered denser groves or clumps of trees ranging in size from a fraction of an acre up to 1 or 2 acres. Although it was not apparent in the quantitative data from the land survey, it is likely that tree density on moderate north and east slopes, and in upland draws, was slightly higher than elsewhere on the uplands, and these sites should probably be managed to exhibit this difference. From an ecological standpoint this relationship would be expected, particularly in an area where fire was an important factor influencing the vegetation. On the other extreme, it would be consistent with the historic scene to occasionally manage for treeless areas of an acre or more.

Although they historically supported a savanna vegetation, the forested uplands in the battlefield's southeast corner should probably remain in a forest condition. This area is not critical to the interpretation of historic events and is generally hidden from the public view. Also, it would be unwise to cultivate or otherwise severely disturb the many steep, rocky slopes in this area.

Research into the presettlement scene indicated that the vegetation of the bottoms, much like that of the uplands, was generally a sparsely treed savanna. However, most of the soldiers accounts indicate that at the time of the battle there was considerable brush along Wilson's Creek. Also the deeper, moister edaphic conditions of the bottoms would logically seem to have supported a lush vegetation than the thin soiled uplands. Whether this was in fact the case, I think it would be desirable from the standpoint of interpretation and erosion control to have the riparian corridors occupied by a thicker woody vegetation that differs markedly from the uplands. For these reasons I am proposing that the bottomlands be managed primarily as an area of mesic forest, with occasional areas that approximate a dense savanna and scattered small prairie openings. Except for two prairie areas (one currently established and one historic) the distribution of these vegetation types has not been determined and should be dictated by the current vegetation. In areas where a closed canopy of mature trees suppresses the growth of brush and understory trees, it may be possible to maintain a dense savanna character with only infrequent thinning of immature woody

vegetation. Thick young forest stands should be left in a forest condition. As these riparian forests mature it may be practical and desirable to manage more acreage as savanna.

A synopsis of the vegetation conversions that the restoration requires (including compromises) is presented in Table 8. Figures for the battlefield's uplands include 99 separate management units totaling 1434 acres. Of this, 1,067 acres representing most of the current vegetation types is scheduled for conversion to a savanna vegetation. The largest single vegetation class to be converted to savanna is fescue fields, which includes 21 management units and 361.5 acres. Forest to savanna conversions also involves substantial acreages (210 acres). Ranking second to savanna among the intended vegetation is that of prairie/cropfield which totals 178.5 acres. An estimated 278 acres of the battlefield falls into the general category of bottomlands. The greatest percentage of this area is proposed for management as mesic forest. However, this area also includes the only areas specifically targeted for management as "prairie."

The three "rare" plant species that occur on the battlefield should be given special consideration in the restoration effort. The known populations of these species should be located and protected from the cultivation that accompanies native grass establishment or other similarly drastic disturbances. As a federally listed species whose response to various management

TABLE 8. Acreages of Vegetation Conversions (Including Compromises)

<u>Current Vegetation</u>	<u>Intended Vegetation</u>	<u># of Units</u>	<u>Total Acres</u>
<u>Uplands</u>			
New Prairie Planting	Savanna	6	N 86.0 ✓
Old Prairie Planting-Fair Quality	Savanna	4	N 168.0 ✓
Old Prairie Planting-Good Quality	Savanna	2	N 9.0 ✓
Fescue Field	Savanna	21	N 361.5 ✓
Successional Field	Savanna	4	B 111.5 ✓
Advanced Successional Field	Savanna	4	S 45.0 ✓
Young Forest	Savanna	17	Y F 162.5 ✓
Mature Forest	Savanna	7	F 47.5 ✓
Post Oak Savanna	Savanna	1	S 16.5 ✓
Exotic Savanna	Savanna	2	S 60.0 ✓
Successional Field	Forest	1	B B 11.5 ✓
Advanced Successional Field	Forest	2	Y B B 14.0 ✓
Young Forest	Forest	3	Y F 24.0 ✓
Mature Forest	Forest	5	F 81.5 ✓
Limestone Glade	Limestone Glade	6	G 37.5 ✓
Fescue Field	Prairie/Crop	7	N 142.0 ✓
Old Prairie Planting-Good Quality	Prairie/Crop	2	N 26.5 ✓
Advanced Successional Field	Prairie/Crop	1	B 10.0 ✓
Old Prairie Planting-Good Quality	Orchard	1	N 4.5 ✓
Disturbed Field	Orchard	1	N 8.0 ✓
Young Forest	Homestead	1	Y F 4.0 ✓
Homestead	Homestead	1	Y F 3.0 ✓
<u>Bottomland</u>			
New Prairie Planting	Mesic Forest/Savanna		N 5.5 ✓
Old Prairie Planting-Good Quality	Mesic Prairie/Savanna		N 13.0 ✓
Old Prairie Planting-Fair Quality	Mesic Forest/Savanna		N 5.0 ✓
Fescue Field	Mesic Forest/Savanna		N 49.0 ✓
Successional Field	Mesic Forest/Savanna		B 10.0 ✓
Exotic Savanna	Mesic Forest/Savanna		S 4.0 ✓
Forest	Mesic Forest/Savanna		Y F 175.0 ✓
Forest	Prairie		Y F 5.5 ✓
Advanced Successional Field	Mesic Forest/Savanna		B 10.5 ✓

practices is largely unknown, Lesquerella filiformis should be protected from all management until further research is conducted. All three of these species evolved under the ecological factors operating on prairies and glades, which included fire. Burning will be needed to restore the glade habitat of Thelesperma trifidum and the intended savannas where Silene regia occurs, and I see no reason to exclude these sites from prescribed fires. As a final note, the resource people involved in the restoration should continually be alert for new locations of these plants. In particular, all glades not currently known to support Lesquerella filiformis should be carefully searched (in early May) for this plant prior to any management.

MANAGEMENT PRESCRIPTIONS AND SUMMARIES

This section of the report presents management recommendations designed to convert each of the current vegetation types to its historical conditions. These recommendations are presented as optimal given current understanding and knowledge of each management unit. However, it is very likely that at some point in a unit's restoration, adjustments to the prescribed treatment will be required. In this way, the success of the restoration depends upon continual monitoring of the stands as they are managed and the flexibility to alter the management when it is not achieving the desired result. This process of monitoring and evaluation requires a good working knowledge of the vegetation and its response to various management practices.

In the process of restoring the stands there are four vegetative conditions that management must address. These four conditions are:

- 1) Management of woody vegetation
- 2) Eradication of exotic or undesirable ground cover
- 3) Establishment of prairie vegetation
- 4) Establishment of savanna trees

Management of most of the management units will not require addressing all four of these vegetative conditions. For example most of the stands that currently support some woody vegetation will require dealing only with the first three conditions. Restoration of fescue fields will address only the last three conditions.

In general, there is a management prescription that deals with the initial management of each of the battlefield's current vegetation types (Table 9). In the case of woody habitats, this prescription will generally address both the management of the unit's trees as well as eradication of the woody and herbaceous groundcover. In addition to the management prescriptions that are tailored to a particular vegetation type, there are general prescriptions that deal with native grass establishment and tree planting. Following the initial phase of management, stands will then be scheduled for prescriptions dealing with prairie plant establishment, and if appropriate, for tree planting.

As a general rule, conversion of stands from current vegetation to historic conditions should be intensive and fairly rapid. Protracted management of a stand will often lead to new

problems that must then be addressed. For example, delays between fescue eradication and planting operations will result in a dense regrowth of weeds, and possibly fescue, which will then require the cost and time of repeating the eradication phase. Similar situations could arise in the eradication of brushy habitats. Concentrating efforts to quickly lead a stand through the initial stages of management, ground cover eradication, and prairie establishment may necessitate converting fewer acres in a given unit of time. However, it will increase the chances of a satisfactory result on the first try.

Immediately following the management prescriptions are the management unit summaries (Table 10). It is in the summaries that the proposed management of each unit is presented, along with vital statistics such as unit size, current vegetation and intended vegetation.

Table 9. Management Prescriptions

Prescription
Number

- 1 New Prairie Plantings - These fields should be given a one year evaluation period to see if native grasses will establish. During this period they should be treated as if they were first year prairie plantings. Weeds should not be allowed to grow to more than one foot tall before mowing. Mow to a stubble height of 4 to 6 inches the first time, and 6 to 8 inches the second time. After early August, either discontinue mowing or mow high enough to avoid cutting the native grasses. In midsummer (July or August) these stands should be evaluated for the success of the native grasses. If they show good potential, the stands can then be treated as second year plantings the following year. Cool season broadleaf weeds should be mowed in May. Cool season grasses should be controlled with Atrazine or Roundup before native grasses become active. If upon evaluation the native grasses show little potential for establishment, the field management should revert to the eradication phase (prescription 7) followed by replanting.

- 2 Old Prairie Plantings - Fair Quality - Management of these stands should be initiated with prescribed spring burns. Because cool season grasses are common in these fields, they should probably be burned in each of the first two years of management. Burns should be conducted when new growth of the warm season grasses is about 1 inch tall, usually in early April. If fescue or cool season weed problems persist they may be controlled with Roundup before warm season grasses become active. Where woody vegetation occurs, desirable individuals should be

saved and all others cut at a maximum height of 4 inches. Stumps should be treated with 2,4-D to control sprouting. When the stand is burned, these trees should be protected from fire by mowing or backfiring around prior to the burn.

- 3 Old Prairie Plantings - Good Quality - These fields could be set aside until more immediate concerns are addressed. However, to ensure a continued good stand, management should probably be initiated within a year or two. Because these fields have not been burned in recent years, management should probably begin with a prescribed burn. After the initial burn, the stands can then be placed in a rotation employing mowing, rest and prescribed fire. A typical rotation on MDC-managed prairies is alternate years of mowing and rest, with a prescribed burn every five or six years. If problems with cool season grasses or broad-leaved weeds should arise, they should be treated as specified in Prescription 2. If lessees are allowed to mow these stands prior to further management, mowing should be done in early July.

All of the battlefield's established stands of prairie grass are generally devoid of native prairie forbs; eventually these will be desired. Two methods can be used to establish these species. A light discing of these stands would provide a suitable seedbed upon which to broadcast forb seeds. This practice will not do lasting damage to the established grasses.

A second method is to manually plant rootstocks of forb species into the stands. The Missouri Department of Conservation is currently growing approximately 20 species of prairie forbs at its state nursery. It is very likely that some of this

stock could be provided to the project at no cost. The species and amount will vary by year dependent upon production and demand, but it is almost certain that some of this stock will be available each year. Surplus stock (after orders) will probably often consist of large numbers of relatively few species. However, if some species are in short supply year after year, it will probably be possible to special order those species. This method of establishment will be labor intensive; however, success is assured and it will provide a good diversity of forbs at no initial cost. Inquiries into the availability of surplus should be made in January after the regular orders have been filled. The rootstocks should be planted in the late fall or early spring.

4

Successional Fields/Advanced Successional Fields -

Locate and mark scattered clumps and individual trees that will be retained. Clear the rest of the woody vegetation down to a size that can be brush hogged, making sure to cut trees at a maximum of 4 inches from the ground. Treat all stumps with 2,4-D. Remove or pile and burn the cut woody vegetation. Where the undesirable trees are of sufficient size it may be possible to issue woodcutting permits. However, the size and species (Osage-orange, honey locust) involved may preclude this option. As a general rule, it is probably not practical to leave large, scattered, exotic trees to temporarily create a savanna character. These trees will eventually have to be removed, and in the interim they will make fieldwork for ground cover eradication and prairie establishment more difficult. In fields where brush is not a problem and cool season grasses are the major ground cover, these fields should then be treated with Prescription 7. However, in fields

where there is little grass cover and brush (particularly buckbrush) is dense, the treatment will be slightly different. Buckbrush, multiflora rose and species of Rubus are effectively killed with Roundup when they are actively growing (Steve Clubine, MDC Wildlife Biologist, pers. comm.). These fields should be sprayed with Roundup at a rate of one quart per acre in mid-May to early June when these brush species are leafed out and actively growing. The Roundup should be mixed with water (10 gallons) and a Surfactant (3 oz.) per quart. If the dead standing brush is particularly heavy it may be desirable to brush hog the sites prior to discing for seedbed preparation.

- 5 Young and Mature Forests - This treatment is prescribed for those forest areas that are to be converted to a sparse savanna. Locate and mark scattered individual trees that are to be retained. Clear-cut all trees and woody vegetation too large to brush hog, leaving small clumps or groves (fraction of an acre up to 1 or 2 acres) of trees surrounding the marked individuals. Thin these remaining clumps to the 60 percent level. This retention of groves around marked individuals is intended to protect them from possible injury due to the shock of sudden exposure to full sunlight. The groves can also eventually be used to form denser groves of trees within a sparsely treed matrix that was typical of the presettlement vegetation. When the forest consists of scattered large individuals surrounded by young regrowth, this buffer of surrounding trees is not necessary and the groves that are retained should be done so only for the purposes of recreating the historic scene. Treat all stumps with 2,4-D to control sprouting. In accessible areas, firewood permittees should be used to do most of the clearing if

at all possible. All cut vegetation should be removed from the site or piled and burned. In these timbered areas the remaining vegetation will generally consist of small trees, brush and herbaceous vegetation which will require brush hogging prior to further treatment. Chemical treatment of these fields is the same as detailed in Prescription 4. If the site is brush hogged, the vegetation should be allowed to regrow and leaf out prior to chemical application to ensure an effective kill.

- 6 Young and Mature Forests - This treatment is generally intended for riparian timber, steep slopes and less visible timber areas in the battlefield's southeast corner. Practical considerations dictate that these areas be left in a more densely timbered, generally forested condition. Management in these areas should be primarily in the form of timber stand improvement (TSI). Exotic species should be first priority for removal. To more closely approximate the natural condition, cutting could reduce stocking to 70 or 80 percent, a density which should not result in an undue increase in brush. Forestry personnel of MDC should be consulted and used in guiding the management. After trees are marked for removal, woodcutting permits should be issued (if possible) to accomplish the actual cutting. The fire road extending into the southeast quarter of the battlefield should provide adequate access to that area during most of the year. Much of the bottomland is readily accessible by way of the adjacent farm fields. Firewood cutters should be required to remove all woody material that is cut. Stumps should be treated with 2,4-D to control sprouting.

7 Fescue/Cool Season Grasses and Forbs - These areas should be mowed in late summer (August 15 to September 1) to remove excess material and stimulate vigorous regrowth. Apply Roundup herbicide at a rate of 24 ounces (16-32 oz.) per acre when fescue is 6 to 8 inches tall and actively growing (usually September 15 to October 15). Reapply Roundup at 1 pint per acre in the following spring (April 15 to May 15) when fescue regrowth and seedlings are 6-8 inches tall and actively growing. The Roundup should be mixed with 10 gallons of water and 3 ounces of Surfactant per acre.

8 Establishing Prairie Vegetation - Establishing prairie plantings requires three basic steps: 1) seedbed preparation, 2) planting, and 3) management during early years of establishment. Presented here are two methods of seeding the stand. With both methods of planting, steps 1 and 3 are the same.

Seedbed Preparation - Proper ground preparation is one of the most important aspects of establishing native grasses. The seedbed should be firm, preferably cultipacked. Soils of the battlefield are generally too shallow to plow, so heavy discing (2-3 passes) will be used to initiate seedbed preparation. Following discing, the field should be cultipacked just prior to planting. If planting is delayed, fields should be disced as needed to control weeds.

Drill Planting - The most efficient means of planting native grasses is with a small grain drill. Seeding rates should be 6 to 8 pounds of Pure Live Seed (PLS) per acre. A mixture of little bluestem, Indian grass, big bluestem and sideoats grama would probably

be desirable although other grasses of generally short stature such as poverty grass (Danthonia spicata) and dropseed (Sporobolus spp.) should be considered if they are available. Care must be taken to avoid planting too deep; the desired depth is 1/4 inch. Do not harrow after seeding.

Broadcast Seeding - Broadcast seeding should be done before March 15 to allow freezing and thawing to cover the seed. Broadcast seeding is most efficient if debarbed seed is mixed with P & K fertilizer before spreading. A whirlwind seeder or fertilizer spreader can be modified to plant many of the grasses. Another method, which could make use of prairie hay, would be to use a mulcher to mulch and distribute the seed. When broadcast seeding is used, the field should be cultipacked both before and after seeding. Do not harrow after seeding.

Management During Establishment - Seeded areas require close attention for early stand development. During the first year, weeds should not be allowed to grow more than a foot tall before mowing. Mow stubble height of 4 to 6 inches the first time, 6 to 8 inches the second time. After early August, either discontinue mowing or mow high enough to avoid cutting the new grasses when they are developing their root systems. During the second year, cool season broadleaf weeds should be mowed in May. Cool season grasses should be controlled with Atrazine if native forbs were not planted with the grasses. Herbicides (Roundup) may be used to effectively control broadleaf weeds by spot treating or spraying when the native grasses are dormant. If the planting is successful, by the third year it can be put on a rotation of mowing, rest, and spring burns to main-

tain its quality. Several brochures concerning establishment and management of native grasses are available from MDC.

For reasons of both aesthetics and accuracy, some native prairie forbs should be included in the seed mixtures. The cost of forb seed can be prohibitive; however, this can be minimized by using very light seeding rates and only a few species. If a small number of the plants are established, natural spread and increase should eventually build up the populations. Perhaps varying the species used on each stand would provide a seed source for both natural and manual spread in the future. Only species that are native to the region should be used. Several sources of native prairie plants and their seeds are listed in Appendix 2.

- 9 Limestone Glade - The most obvious management problem on these habitats is encroachment by woody vegetation. Glades should be essentially treeless or support only scattered individuals and clumps of trees. All cedars except perhaps an occasional large individual should be removed from the glades. This concerns primarily those glades east of Wilson's Creek, and this step alone should dramatically improve their condition. However, the return to natural conditions on these glades will be slowed by the accumulated cedar duff which will inhibit invasion of the microsites by glade species. Cedar stumps will not require chemical treatment as this species does not sprout. On glades west of Wilson's Creek (especially Bloody Hill and 6A) invasion by hardwood species is a problem. This woody growth should be cut, saving only scattered large or old oaks, ash and bumelia. The stumps of these hardwood species will require spraying with 2,4-D to control

sprouting. The glade area of Bloody Hill includes some areas of somewhat deeper soils. Tree density should probably be somewhat higher (though still sparse) in these areas, including some clumps or small groves.

All of the glades support a variety of native glade grass and forb species although populations are generally small and local. However, weedy and undesirable grass and forb populations are large. On Bloody Hill there are sizable populations of Carolina moonseed, cheat and *Sericea lespedeza*. These plants should be eradicated and spot spraying with Roundup is the most likely solution. Some experimentation will be done to determine the effectiveness of this treatment, and if it is unsuccessful, other methods will be examined. Several other weedy species are common on all the glades. Prescribed burning should be effective in controlling these species and improving the natural quality of the glades in general. The glades west of Wilson's Creek are surrounded by areas that will be managed for savanna vegetation, and these glades should be included in the prescribed burns of those habitats. It is likely that the glades east of Wilson's Creek will be surrounded by a more forested habitat, at least in the short term, and burning of these areas will have to be conducted independently.

Bloody Hill is a site for the federally listed bladderpod, *Lesquerella filiformis*. Future studies to determine this species response to different management practices, including fire, will be conducted and until that time fire will not be used on the Bloody Hill glade. The other glade sites should be searched to determine if they also support this bladderpod prior to the use of prescribed fire in these areas.

Establishing Trees - This is the final step in creating a savanna vegetation. Seedlings should be planted in random clumps into established prairie stands. The clumps should generally be sparse so as not to cause undue inconvenience to mowing operations. Clumping of the seedlings will provide for groves where they are desired, and also allow for some inevitable mortality. The immediate vicinity of the seedlings should be cleared of herbaceous vegetation to provide them with a non-competitive environment. To improve survival of the seedlings, they should be watered when conditions are droughty during the first year.

It is likely that the species most desirable for planting--blackjack oak--is not readily available from commercial nurseries. Cost of seedlings may also be a concern. We are looking into the possibility that this species can be propagated at the MDC nursery for the purposes of this project. This effort will be dependent upon the acquisition of adequate acorns for propagation. It is probable that at least some blackjack can be grown at the nursery, and these plants would be provided at an estimated cost of \$80-90/1000. Other species of oaks that are desirable for planting on the site are currently available from the nursery. This attempt to propagate blackjack oaks would be greatly aided by the Wilson's Creek staff's efforts in collecting seed of this species.

Table 10. Management Unit Summaries

<u>Unit 1</u>	<u>Intended Vegetation--Savanna</u>
1-A	Size--9.5 acres Current Vegetation--New Prairie Planting Comments--Fair amount native grasses Management--Prescription 1.
1-B	Size--47 acres Current Vegetation--New Prairie Planting Comments--Very little native grasses. Some disturbed gladey areas. Management--Prescription 1.
1-C	Size--9.5 acres Current Vegetation--Young forest Comments--Mostly natives. Scattered large open- grown trees. Management--Prescriptions 5, 8.
1-D	Size--4 acres Current Vegetation--New Prairie Planting Comments--Old homesite. Few native grasses. Bluegrass dominant. Some disturbed gladey areas. Management--Prescriptions 7, 10.
1-E	Size--9 acres Current Vegetation--New Prairie Planting Comments--Locally common sideoats grama, but dominated by cool season grasses. Some disturbed gladey areas. Management--Prescriptions 7, 8, 10.
1-F	Size--12.5 acres Current Vegetation--Mature Forest Comments--Dominated by large open grown oaks. Filled in by young regrowth. Management--Prescriptions 5, 8.
1-G	Size--6.5 acres Current vegetation--Successional Field Comments--Fescue with common young Osage-orange and native woody plants. Management--Prescriptions 4, 7, 8.
1-H	Size--16 acres Current Vegetation--Advanced Successional Field Comments--Very dense. Mixed species with some oaks and other natives. Very scattered larger trees. Management--Prescriptions 4, 7, 8.

- 1-I Size--17 acres
Current Vegetation--Fescue Field
Comments--A few scattered scraggly trees.
Management--Prescriptions 7, 8, 10.
- 1-J Size--9.5 acres
Current Vegetation--Advanced Successional Field
Comments--Mixed species. Some oaks. Very
scattered larger trees.
Management--Prescriptions 4, 8.
- 1-K Size--12 acres
Current Vegetation--Successional Field
Comments--Thick in places. Scattered and clumped
fair sized oaks.
Management--Prescriptions 4, 7, 8.
- 1-L Size--3 acres
Current Vegetation--Mature Forest
Comments--Mature oak stand. Poor vigor post and
blackjacks. Data Appendix 3.
Management--Prescriptions 5,8. Potential grove.
- 1-M Size--34.5 acres
Current Vegetation--Fescue Field
Comments--Scattered small Osage-orange and sumac
patches.
Management--Prescriptions 7, 8, 10.
- 1-N Size--61 acres
Current Vegetation--Successional Field
Comments--Mixed species with common Osage-orange,
honey locust and some sapling oaks. Very dense
buckbrush. Some gladey areas. Data
Appendix 3.
Management--Prescriptions 4, 8.
- 1-O Size--9 acres
Current Vegetation--Advanced Successional Field
Comments--Dominated by fairly large Osage-orange
and honey locust. Very few oaks. Very dense
buckbrush. Data Appendix 3.
Management--Prescriptions 4, 8.
- 1-P Size--5 acres
Current Vegetation--Mature Forest
Comments--Mature oak stand dominated by large
chinquapin oaks. Filled in by younger natives.
Data Appendix 3.
Management--Prescriptions 5, 8.

- 1-Q Size--73.5 acres
 Current Vegetation--Old Prairie Planting-Fair
 Quality
 Comments--Substantial woody invasion. Some oaks.
 Common Osage-orange and honey locust especially in
 east draw.
 Management--Prescription 2.
- 1-R Size--9.5 acres
 Current Vegetation--Mature Forest
 Comments--Mature oak stand dominated by large post
 oaks. Filled in by younger natives. Data
 Appendix 3.
 Management--Prescriptions 5, 8.
- 1-S Size--2.5 acres
 Current Vegetation--Mature Forest
 Comments--Dominated by large walnuts. Data
 Appendix 3.
 Management--Prescriptions 5, 8. Potential grove.
- 1-T Size--6.5 acres
 Current Vegetation--Mature Forest
 Comments--Dominated by mature post oaks. Data
 Appendix 3.
 Management--Prescriptions 5, 8. Potential grove.
- 1-U Size--47.5 acres
 Current Vegetation--Old Prairie Planting-Fair
 Quality
 Comments--Some areas dominated by fescue.
 Management--Prescriptions 2, 10.
- 1-V Size--10 acres
 Current Vegetation--New Prairie Planting
 Comments--Dominated by weedy forbs. Sparse native
 grasses and forbs.
 Management--Prescription 1.
- 1-W Size--6.5 acres
 Current Vegetation--New Prairie Planting
 Comments--Dominated by weedy forbs. Sparse native
 grasses and forbs.
 Management--Prescription 1.
- 1-X Size--10.5 acres
 Current Vegetation--Young Forest
 Comments--Diverse stand. Fair number mature and
 sapling oaks. No Osage-orange or honey locust.
 Common walnut and hackberry. Data Appendix 3.
 Management--Prescriptions 5, 8.

1-Y Size--8 acres
Current Vegetation--Young Forest
Comments--Diverse stand. Good young to mature oak component. Hickory often dominant. Data Appendix 3.
Management--Prescriptions 5, 8.

1-Z Size--8.5 acres
Current Vegetation--Young Forest/Advanced Successional Field
Comments--Area not evaluated.
Management--Prescriptions 4 or 5, 8.

Unit 2 Intended Vegetation--Savanna

2-A Size--8.5 acres
Current Vegetation--Mature Forest/Gladey
Comments--Gladey-thin soil band. Scattered large chinquapins. Diverse other woody natives. Data Appendix 3.
Management--Prescriptions 5, maybe 8.

2-B Size--13.5 acres
Current Vegetation--Advanced Successional Field
Comments--Diverse, native woody plants. Small numbers of sapling and small pole-sized oaks. Data Appendix 3.
Management--Prescriptions 4, 8.

2-C Size--16 acres
Current Vegetation--Young/Mature Forest Stand
Comments--Good number of oaks. No exotics. Data Appendix 3.
Management--Prescriptions 5, 8.

2-D Size--12.5 acres
Current Vegetation--Young Forest
Comments--Most larger trees are hickories. Fairly common pole sized oaks. Common Osage-orange and honey locust. Data Appendix 3.
Management--Prescriptions 5, 8.

2-E Size--32 acres
Current Vegetation--Successional Field
Comments--Highly eroded; soil generally bare. Very little grass. Weedy forb ground cover. Lesquerella on SW aspect.
Management--Prescriptions 4, 8. Protect Lesquerella site.

- 2-F Size--8.5 acres
 Current Vegetation--Young Forest
 Comments--Dense to open stand. Dominants Osage-
 orange, honey locust and walnut. Common sapling
 oaks with some small poles. Data Appendix 3.
 Management--Prescriptions 5, 8.
- 2-G Size--4 acres
 Current Vegetation--Young Forest
 Comments--Dominated by Osage-orange, honey locust,
 walnut and hackberry. Almost no oaks. Data
 Appendix 3.
 Management--Prescriptions 5, 8.
- 2-H Size--45.5 acres
 Current Vegetation--Fescue Field
 Management--Prescriptions 7, 8, 10.
- 2-I Size--6 acres
 Current Vegetation--Young Forest
 Comments--Dominated by Osage-orange and hickories.
 Scattered mature and sapling oaks. Data
 Appendix 3.
 Management--Prescriptions 5, 8.
- 2-J Size--19.5 acres
 Current Vegetation--Young Forest
 Comments--Diverse stand dominated by Osage-orange,
 hackberry and honey locust. Common oak saplings
 with some small poles. Often dense but with one
 large opening.
 Management--Prescriptions 5, 8.
- 2-K Size--8.5 acres
 Current Vegetation--Fescue Field
 Management--Prescriptions 7, 8, 10.
- 2-L Size--68 acres
 Current Vegetation--Fescue Field
 Management--Prescriptions 7, 8, 10.
- 2-M Size--16.5 acres
 Current Vegetation--Post Oak Savanna
 Comments--Scattered large, open-grown post oaks
 with fescue ground cover. A few chinquapins and
 other native species. Dense small Osage-orange and
 natives along upper creekbed. Data Appendix 3.
 Management--Prescriptions 7, 8.
- 2-N Size--22 acres
 Current Vegetation--Fescue Field
 Management--Prescriptions 7, 8, 10.

Unit 3

Intended Vegetation--Savanna

- 3-A Size--4 acres
 Current Vegetation--Old Prairie Planting-Good
 Quality
 Comments--Good stand of Indian grass and little
 bluestem.
 Management--Prescriptions 3, 10.
- 3-B Size--7.5 acres
 Current Vegetation--Fescue Field?
 Comments--Dominated by fescue and broom sedge with
 maybe some little bluestem. Hairy hawkweed
 present. May be degraded prairie remnant.
 Management--Leave uncut till midsummer. Evaluate
 native component. Probable Prescriptions 7, 8, 10.
- 3-C Size--13.5 acres
 Current Vegetation--Fescue Field
 Management--Prescriptions 7, 8, 10.
- 3-D Size--16 acres
 Current Vegetation--Fescue Field
 Management--Prescriptions 7, 8, 10.
- 3-E Size--11 acres
 Current Vegetation--Fescue Field
 Management--Prescriptions 7, 8, 10.
- 3-F Size--9 acres
 Current Vegetation--Fescue Field
 Management--Prescriptions 7, 8, 10.
- 3-G Size--11 acres
 Current Vegetation--Old Prairie Planting-Fair
 Quality
 Comments--May be old prairie planting. Fescue
 probably dominant, but fair amount of native
 grasses.
 Management--Prescriptions 2, 10.
- 3-H Size--9.5 acres
 Current Vegetation--Fescue Field
 Management--Prescriptions 7, 8, 10.
- 3-I Size--36 acres
 Current Vegetation--Old Prairie Planting-Fair
 Quality
 Comments--Mowed when evaluated. Probably is fairly
 good stand with some cool season grasses. A few
 scattered trees.
 Management--Prescriptions 2, 10.

- 5-D Size--15 acres
Current Vegetation--Mature Forest
Comments--Dominated by hickories, walnut and oaks.
Somewhat patchy and brushy upslope. Data
Appendix 3.
Management--Prescription 6. Forest Compromise.
- 5-E Size--5.5 acres
Current Vegetation--Fescue Field
Management--Prescriptions 7, 8, 10.
- 5-F Size--43 acres
Current Vegetation--Mature Forest
Comments--Oak-hickory dominants. Heavy double
trunking on north ridge. Data Appendix 3.
Management--Prescription 6, maybe 5, 8 on flatter
uplands. If savanna is managed for, may be a
natural native grass response precluding prairie
establishment. Mostly forest compromise.
- 5-G Size--11.5 acres
Current Vegetation--Successional Field
Comments--Often dense with abundant oaks. Common
broom sedge and possibly other native grasses.
Management--Prescription 6; or if savanna is
managed for, Prescription 4, maybe 7, 8. However,
natural native grass response may preclude the need
for Prescriptions 7 & 8. Possible forest
compromise.
- 5-H Size--12.5 acres
Current Vegetation--Young Forest
Comments--Scattered larger trees. Few oaks and
exotics. Walnuts dominant on north slope. Data
Appendix 3.
Management--Prescription 6. Forest compromise.
- 5-I Size--13 acres
Current Vegetation--Mature Forest
Comments--Mostly dry grading to mesic in some
places at base slope. Oak-hickory dominants.
Gladey at powercut and likely grown-up glade in
this area. Data Appendix 3.
Management--Prescription 6. Forest compromise.
- 5-J Size--12 acres
Current Vegetation--Young Forest
Comments--Oaks dominant. Some blackjack oaks.
Data Appendix 3.
Management--Prescription 6. Forest compromise.

- 5-K Size--4.5 acres
 Current Vegetation--Advanced Successional Field
 Comments--Generally very dense. All natives. Did not sample, but appears similar to 2-B.
 Management--Prescription 6. Forest compromise.
- Unit 6 Current Vegetation--Degraded Limestone Glade/Gladey
Intended Vegetation--Limestone Glade
- 6-A Size--7.5 acres
 Comments--Some natives. Abundant prickly pear. Some parts with heavy growth young walnuts.
 Management--Prescription 9.
- 6-B Size--4.5 acres
 Comments--Glade/gladey. Uncertain of exact boundaries. Much of draw is rocky/gladey. Very weedy.
 Management--Prescription 9.
- 6-C Size--6 acres
 Comments--Very weedy. Abundant Thelesperma trifidum.
 Management--Prescription 9. Considerations for Thelesperma.
- 6-D Size--12.5 acres
 Comments--Probably natural glade/dry forest complex. Lesquerella filiformis site. Exotic/weed problems; cheat, moonseed, Sericea lespedeza, some Osage-orange. Fairly common large old oaks. Bloody Hill. Data Appendix 3.
 Management--Prescription 9. Probably defer most management until Lesquerella study completed.
- 6-E Size--3.5 acres
 Comments--Approximately 70 percent tree cover, mostly cedars. Weedy, but fair diversity of natives. Species list Appendix 4. Data Appendix 3.
 Management--Prescription 9.
- 6-F Size--3.5 acres
 Comments--Approximately 90 percent tree cover, mostly cedars. Weedy, but good diversity of natives. Species list Appendix 4. Data Appendix 3.
 Management--Prescription 9.

Unit 7

Intended Vegetation--Variable

- 7-A Size--5.5 acres
 Current Vegetation--Young Forest
 Intended Vegetation--Prairie
 Comments--Primarily a dense young elm stand and
 scattered larger trees.
 Management--Clear-cut. Soften border by leaving
 scattered savanna trees. Brush treatment from
 Prescription 4. Then Prescription 8.
- 7-B Size--13 acres
 Current Vegetation--Old Prairie Planting-
 Good/Successional Field.
 Intended Vegetation--Sparse Savanna
 Comments--Heavy woody invasion of mostly sycamores.
 Management--Prescription 2. Cut most of the trees.
- 7-C Size--250+ acres
 Current Vegetation--Of all classes, fescue fields
 to forest.
 Intended Vegetation--Primarily Forest.
 Comments--Data Appendix 3 for Skegg's Branch.
 Management--Prescription 6 for forest areas. Allow
 field habitats to succeed to forest. Define
 boundaries generously.

Unit 8

Intended Vegetation--Savanna

- 8-A Size--2 acres
 Current Vegetation--Fescue Field
 Comments--Failed prairie planting.
 Management--Prescriptions 7, 8, 10.
- 8-B Size--7.5 acres
 Current Vegetation--Young Forest
 Comments--Young forest/successional field
 vegetation. Some fairly large trees.
 Management--Prescriptions 5, 8.
- 8-C Size--1.5 acres
 Current Vegetation--Young Forest
 Comments--Area of Osage-orange removal. Mostly
 thin young forest. Not evaluated, so uncertain of
 species mix.
 Management--Prescriptions 5, 8.

Unit 13

Intended Vegetation--Orchard/Prairie

- 13-A Size--4.5 acres
 Current Vegetation--Old Prairie Planting
 Comments--Uncertain of Quality. Good?
 Management--Prescription 2. Plant orchard trees.
- 13-B Size--8 acres
 Current Vegetation--Disturbed Field in part
 Comments--Probably about half of this area has been
 paved for road and parking lot. Rest is weedy
 forbs.
 Management--Prescriptions 7, 8. Plant orchard
 trees.

Unit 14

Intended Vegetation--Homestead

- 14-A Size--3 acres
 Current Use--Ray house and yard.
 Management--Continue current management.

Unit 15

Intended Vegetation--Prairie/Cropfield

- 15-A Size--30 acres
 Current Vegetation--Fescue Field
 Management--Prescriptions 7, 8.
- 15-B Size--72 acres
 Current Vegetation--Fescue Field
 Management--Prescriptions 7, 8.

Unit 16

Intended Vegetation--Savanna

- 16-A Size--10.5 acres
 Current Vegetation--Fescue Field
 Comments--Weedy fescue, bluegrass and purpletop.
 Management--Prescriptions 7, 8, 10.

Unit 17

Intended Vegetation--Homesite

- 17-A Size--4 acres
 Current Vegetation--Young Forest
 Comments--Caleb Manley homesite. Diverse stand.
 Fairly common honey locust.
 Management--Possible forest compromise. If so
 Prescription 6. If restore homestead: clear-cut,
 eradicate brush as described in Prescription 4,
 then Prescription 8.

Unit 18

Intended Vegetation--Prairie Meadow

18-A

Size--3 acres
Current Vegetation--Fescue Field
Management--Prescriptions 7, 8.

18-B

Size--4.5 acres
Current Vegetation--Fescue Field
Comments--Former prairie planting. Unsuccessful.
Essentially weedy fescue field.
Management--Prescriptions 7, 8.

IMPLEMENTING THE RESTORATION

The restoration effort will make use of several different sources of labor and expertise. In addition to the park's own staff, project cooperators will include Natural History and Forestry personnel of MDC, and farm operators and firewood cutters contracted through open bidding processes.

It is possible that much of the timber management and clearing activities can be done at little or no cost to the project. The planning and marking phases of various timber management activities will be done by resource professionals led by local MDC Forestry personnel. Hopefully, much of the actual timber cutting will be conducted by firewood cutting permittees. Good access to most of the park's forested units is a factor favoring this option. In units where the timber is undesirable to firewood cutters because of small size or poor species, it may be necessary to contract for its removal. However, park resource personnel should be able to do some of this work.

Prairie restoration will require a variety of farm custom work both to plant the stands and to manage them during early development. The most practical way to accomplish these tasks is by contracting with local farm operators. Bill Phillips, Wildlife District Supervisor for MDC has used private farm operators to perform custom farm work on the nearby Bois D'Arc Wildlife Area. Provided it is consistent with federal requirements for bidding and contracting processes this same procedure should be used to secure the services needed on

Wilson's Creek National Battlefield. Materials used by MDC in the bidding and contracting procedures are contained in Appendix 5. Included is a list of names and addresses of contractors that submitted bids for work on the Bois D'Arc Wildlife Area.

Following is a list of the farm services that will be required in the restoration effort (Table 11). Costs of the various services are based on prices paid for these activities on nearby MDC lands, and also on 1983 costs compiled by Missouri Extension Specialists. These prices are based on contractors furnishing all the necessary equipment, labor and fuel. When herbicides are applied they should be purchased by the Park and supplied to the contractor. An exception to the condition that contractors supply all the equipment concerns the seed drill.

Table 11. Estimated Rates for Custom Farm Work

<u>Activity</u>	<u>Cost Per Acre</u>	<u>Cost Per Hour</u>
Disc only	5.38	
Cultipack only	4.18	
Plant-small grain drill	5.52	
Mowing weeds	5.62	14.36
Cutting brush-brush hog		9.85
Spraying (no materials)		
Chemicals with truck	3.36	
Chemicals with tractor	3.20	

The planting of native grass seed requires modifications to a standard drill. Use of contractors' personal drills would be inconvenient and probably produce unsatisfactory results. For this reason, and because the restoration calls for the planting of hundreds of acres over a period of several years, it would probably be most practical for the Park to purchase a seed drill. Steve Clubine, who directs the MDC warm season grass program, could furnish information on drills that are available as well as on the modifications that would be required.

Using these figures, the estimated costs of converting fields of undesirable vegetation to prairie grasses are presented below, including the itemized costs of all the required steps (Table 12). These estimates pertain only to the conversion from fescue and brush to native grasses, and do not include any costs accruing to clearing and thinning of timber. The costs of these activities will likely be variable. However, as previously discussed, it is hoped that much of this work can be done at little or no cost.

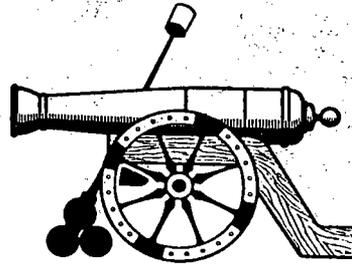
Table 12. Estimated Costs of Conversion to Native Grasses

For Fescue

<u>Activity</u>	<u>Cost Per Acre</u>
Late Summer Mowing	5.62
Fall Herbicide Application	
Spraying	3.35
Roundup (16-32 oz.) 24 oz. @ \$76.50/gal.	14.34
Surfactant 3 oz. @ \$14.00/gal.	0.33
Spring Herbicide Application	
Spraying	3.35
Roundup 16 oz. @ \$76.50/gal.	9.56
Surfactant 3 oz. @ \$14.00/gal.	0.33
Discing (2-3 passes) 2 @ \$5.38/acre	10.76
Cultipack	4.18
Drill Planting	5.52
Grass Mix 7.5 lbs. PLS	<u>45.00</u>
Subtotal	\$102.34
First 2 Years Management	
Mowing weeds 4-6 times (5 @ \$5.62/acre)	<u>28.10</u>
Total Cost	\$130.44

Appendices

Wilson's Creek National Battlefield



A Plan for the Restoration of the Historic Vegetation

by
Greg Gremaud

Missouri Department of Conservation

LIST OF APPENDICES

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APPENDIX 1. List of Plant Species Used in the Report
(Latin and Common Names)

<u>Latin Name</u>	<u>Common Name</u>
Agrostis alba	Purpletop, Redtop
Andropogon gerardii	Big bluestem
Andropogon virginicus	Broomsedge
Arundinaria gigantea	Cane
Bouteloua curtipendula	Sideoats Grama
Bromus tectoris	Cheat
Bumelia lanuginosa	Gum Bumelia
Carya spp.	Hickory
Celtis occidentalis	Hackberry
Cocculus caroliniana	Carolina Moonseed
Corylus americana	Hazel
Danthonia spicata	Poverty Grass
Diospyros virginiana	Persimmon
Festuca elatior	Fescue
Fraxinus americana	White Ash
Gleditsia triacanthos	Honey Locust
Hieraceum longipilum	Hairy Hawkweed
Juglans nigra	Black Walnut
Juniperus virginiana	Red Cedar
Lespedeza cuneata	Sericea Lespedeza
Lesquerella filiformis	Bladder-pod
Maclura pomifera	Osage Orange
Panicum virgatum	Switchgrass
Platanus occidentalis	Sycamore
Quercus alba	White Oak
Quercus marilandica	Blackjack Oak
Quercus muhlenbergii	Chinquipin Oak
Quercus stellata	Post Oak
Rosa multiflora	Multiflora Rose
Rubus spp.	Bramble
Sassafras albidum	Sassafras
Schizachyrium scoparium	Little Bluestem
Silene regia	Royal Catchfly
Sorghastrum nutans	Indian Grass
Sporobolus spp.	Prairie Dropseed
Symphoricarpos orbiculatus	Buckbrush
Thelesperma trifidum	Thelesperma
Ulmus pumila	Chinese Elm
Ulmus spp.	Elm

APPENDIX 2. Sources of Prairie Plants and Seeds

Bluestem Seed Company
Grant City, MO 64456
(816)786-2401

Environmental Seed Producers, Inc.
P.O. Box 5904
El Monte, California 91734
(213)442-3330

Kester's Wild Game Food Nurseries, Inc.
P.O. Box V
Omro, Wisconsin 54963

Lincoln-Oakes Nurseries
Box 1601
Bismarck, North Dakota 58501
(701)223-8575

Mangelsdorf and Bros., Inc.
P.O. Box 327
St. Louis, MO 63166
(314)535-6700

Missouri Wildflowers Nursery
Route 2
Jefferson City, MO 65101

Native Plants, Inc.
9180 S. Wasatch Blvd.
Sandy, Utah 84092

NorthPlan Seed Producers
P.O. Box 9107
Moscow, Idaho 83843

Plants of the Southwest
1812 Second Street
Santa Fe, NM 87501
(505)983-1548

Prairie Moon Nursery
Route 3, Box 163
Winona, Minnesota 55987
(507)452-5231

Prairie Nursery
P.O. Box 365
Westfield, Wisconsin 53964
(608)296-3679

Prairie Restorations, Inc.
P.O. Box 327
Princeton, Minnesota 55371
(612)389-5733

Prairie Ridge Nursery
Route 2
9738 Overland Road
Mt. Horeb, Wisconsin 53572
(608)437-5245

Prairie Seed Source
P.O. Box 83
North Lake, Wisconsin 53064

Sharp Brothers Seed Company
Healy, Kansas 67850

Sharp Brothers Seed Company
Route 4
Clinton, MO 64735

Southwestern Native Seed
Box 50503
Tucson, Arizona 85703

Stock Seed Farms, Inc.
R.R. 4, Box 112
Murdock, Nebraska 68407
(402)867-3771

Wildlife Nurseries
P.O. Box 2724
Oshkosh, Wisconsin 54903

Windrift Prairie Shop
Route 2
Oregon, Illinois 61061

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 1-1 # of Plots 3 (x6.7)

Species	DBH											Comments		
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+					
<i>Quercus stellata</i>				27	33	7	7							3 of 3
<i>Quercus marilandica</i>				7	7	20	7							3 of 3
<i>Carya tex./tom.</i>	3	20	7	7	13	13								3 of 3
<i>Ulmus rubra</i>	4	27	0	0	0	0	0	0	0	0	0	0	0	2 of 3
<i>Ulmus americana</i>	2	13	7	0	7	0	0	0	0	0	0	0	0	2 of 3
<i>Celtis occid.</i>	12	80	0	0	7	0	0	0	0	0	0	0	0	3 of 3
<i>Juglans nigra</i>	0	0	7	7	7	0	0	0	0	0	0	0	0	2 of 3
<i>Sassafras alb.</i>	3	20	0	0	0	0	0	0	0	0	0	0	0	1 of 3
<i>Pinus serotina</i>	5	33	0	0	0	0	0	0	0	0	0	0	0	2 of 3
<i>Vitis sp.</i>	8	53	0	0	0	0	0	0	0	0	0	0	0	3 of 3
<i>Morus rubra</i>	2	13	0	0	0	0	0	0	0	0	0	0	0	1 of 3
<i>Cercis cano.</i>	1	7	0	0	0	0	0	0	0	0	0	0	0	1 of 3
Total	246	99	21	48	74	40	14							
Oaks				34	40	27	14							

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 1-N # of Plots 8 (x 2.5)

Species	DBH								Comments	
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16		16+
<i>Maclura pomifera</i>	5	15	7	2	1	0	0	0	0	5 of 8
<i>Gleditsia triacanth.</i>	12	37	17	5	2	0	0	0	0	4 of 8
<i>Celtis occid.</i>	7	2	2	0	0	0	0	0	0	3 of 8
<i>Ulmus americana</i>	2	5	10	2	0	1	2	0	0	4 of 8
<i>Prunus serotina</i>	5	10	2	0	0	0	0	0	0	4 of 8
<i>Prunus sp. (plum)</i>	8	20	0	0	0	0	0	0	0	2 of 8 local
<i>Nitris sp.</i>	7	17	0	0	0	0	0	0	0	4 of 8
<i>Scatoegus sp.</i>	28	70	47	0	0	0	0	0	0	4 of 8 11 persons list
<i>Juglans sp.</i>	5	12	5	0	0	0	0	0	0	3 of 8
<i>Quercus muhlen.</i>	17	17	5	0	0	0	0	0	0	3 of 8 local
<i>Quercus stellata</i>	1	2	0	0	0	0	0	0	0	1 of 8
<i>Quercus velutina</i>	2	5	2	0	0	0	0	0	0	2 of 8
<i>Morus rubra</i>	1	2	0	0	0	0	0	0	0	1 of 8
<i>Juniperus virg.</i>	0	1	2	0	0	0	0	0	0	1 of 8
Total	190	142	36	9	2	2	2	2	2	
<i>Maclura Gleditsia</i>	24	49	19	7	2	0	0	0	0	
Oaks	24	7								

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 1-0 # of Plots 5 (x4)

Species	DBH										Comments
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+		
<i>Maclura pomifera</i>	2	9	36	5	1	0	0	0	0	0	4 of 5
<i>Gleditsia triacanth.</i>	1	4	32	20	4	0	0	0	0	0	3 of 5
<i>Celtis occidentalis</i>	1	4	4	0	0	0	0	0	0	0	4 of 5
<i>Ulmus americana</i>	1	4	12	4	0	0	0	0	0	0	3 of 5
<i>Prunus serotina</i>	0	2	8	0	0	0	0	0	0	0	1 of 5
<i>Prunus sp. (plum)</i>	2	1	4	0	0	0	0	0	0	0	1 of 5
<i>Vitis sp.</i>	1	0	0	0	0	0	0	0	0	0	1 of 5
<i>Coccoloba sp.</i>	5	0	0	0	0	0	0	0	0	0	2 of 5
Total	96	212	72	24	4						
<i>Maclura + Gleditsia</i>	56	172	68	20	4						

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 1-P.R. ^{Bloody Hill} Non-glade # of Plots 8 (x 2.5)

Species	DBH								Comments	
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16		16+
<i>Quercus stellata</i>	0	2	0	1	3	3	3	2	4	5 of 8 - Dominant on west side of glade
<i>Quercus muhlen.</i>	3	5	1	0	1	0	3	2	2	5 of 8 - dominant east of glade
<i>Quercus velutina</i>	3	7	2	0	0	0	0	0	2	5 of 8
<i>Quercus rubra</i>	1	22	3	1	1	1	0	0	0	3 of 8
<i>Quercus alba</i>	0	0	0	0	0	1	2	0	0	2 of 8
<i>Carya tom. / tex.</i>	42	35	4	2	2	2	0	0	0	6 of 8 most abundant west of glade
<i>Carya ovata</i>	3	15	2	0	0	0	0	0	0	3 of 8
<i>Maclura pomifera</i>	2	15	1	0	2	0	0	0	0	4 of 8
<i>Juglans nigra</i>	5	15	10	2	1	1	0	0	0	5 of 8
<i>Ulmus americana</i>	11	27	2	1	1	0	0	0	0	6 of 8 primarily west of glade
<i>Ulmus rubra</i>	13	32	2	0	0	0	0	0	0	4 of 8 primarily east of glade
<i>Celtis occid.</i>	21	52	2	2	1	0	0	0	0	8 of 8
<i>Morus rubra</i>	3	7	0	0	0	0	0	0	0	3 of 8
<i>Juniperus</i>	4	10	0	0	0	0	0	0	0	2 of 8 = all east of glade
Total	264	244	56	21	27	18	16	10	14	
Oaks	16	39	14	4	11	16	10	10	14	

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 1-1 # of Plots 4 (x5)

Species	DBH										Comments
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+		
<i>Quercus stellata</i>	0	0	0	0	5	5	30	20	20	4	4 of 4
<i>Carya cordiformis</i>	24	18	0	0	0	0	0	0	0	0	3 of 4 July unknown
<i>Carya tomentosa</i>	0	2	0	1	5	0	0	0	0	0	2 of 4
<i>Ulmus americana</i>	25	30	2	10	0	0	0	0	0	0	4 of 4
<i>Morus rubra</i>	4	20	0	0	0	0	0	0	0	0	3 of 4
<i>Juglans</i>	0	5	0	0	0	0	0	0	0	0	1 of 4
<i>UFTS sp</i>	7	35	0	0	0	0	0	0	0	0	2 of 4
<i>Celtis occident.</i>	4	20	10	0	0	0	0	0	0	0	2 of 4
<i>Alnus rubra</i>	0	15	0	0	0	0	0	0	0	0	1 of 4
<i>Gleditsia triacanth.</i>	0	0	0	15	0	0	0	0	0	0	1 of 4
<i>Juniperus virgin.</i>	15	0	0	0	0	0	0	0	0	0	1 of 4
<i>Prunus serotina</i>	15	0	0	0	0	0	0	0	0	0	1 of 4
<i>Quercus rubra</i>	0	0	0	15	0	0	0	0	0	0	1 of 4
Total	230	165	20	10	20	5	30	20	20	20	
Oaks			5		5	5	30	20	20	20	

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 1-X # of Plots 4 (x5)

Species	DBH										Comments				
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+						
<i>Celtis</i> sp.	15	75	21	8	40	2	10	0	0	1	5	0	0	0	4 of 4
<i>Quercus stellata</i>	0	0	1	5	0	1	5	0	0	2	10	0	0	0	2 of 4
<i>Ulmus</i> sp.	0	45	60	60	20	0	20	0	0	0	0	0	0	0	4 of 4
<i>Morus rubra</i>	0	0	1	5	15	0	15	0	0	0	0	0	0	0	2 of 4
<i>Juglans nigra</i>	0	0	0	5	5	2	5	10	10	2	10	5	0	0	2 of 4
<i>Diospyros virginiana</i>	2	10	0	0	0	0	0	0	0	0	0	0	0	0	1 of 4
<i>Quercus muhlenbergii</i>	2	10	5	0	0	0	0	0	0	1	5	0	0	0	3 of 4
<i>Sassafras albidum</i>	2	10	15	0	0	0	0	0	0	0	0	0	0	0	1 of 4 clumped
<i>Quercus velutina</i>	0	0	0	0	15	0	15	0	0	0	0	0	0	0	1 of 4
<i>Quercus rubra</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 of 4
<i>Viburnum prunifol.</i>	1	5	5	0	0	0	0	0	0	0	0	0	0	0	1 of 4
<i>Vitis</i>	9	45	15	15	0	0	0	0	0	0	0	0	0	0	4 of 4
<i>Prunus serotina</i>	0	2	10	0	0	0	0	0	0	0	0	0	0	0	1 of 4
Total	200	230	125	50	15	30	10	10	10	30	10	10	10	10	
Oaks	10	10	0	10	5	15	5	5	5	15	5	5	5	5	
Maclura + Gloditica	0	→													

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 10Y # of Plots 4 (X5)

Species	DBH											Comments		
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+					
<i>Carya texa./ toment.</i>	5	50	40	5	15	5	0	0	0	0	0	0	0	fre-3 of 4 very variable d.i.t/oa
<i>Quercus velutina</i>	25	15	0	2	10	0	0	0	0	0	1	5	0	fre-3 of 4
<i>Juglans nigra</i>	0	0	0	0	0	2	10	0	0	0	0	0	0	fre-2 of 4
<i>Quercus umblebarcisi</i>	9	45	10	2	20	3	15	0	0	0	0	0	0	3 of 4
<i>Ulmus rubra</i>	8	40	20	1	5	2	10	0	0	0	0	0	0	4 of 4
<i>Diospyros virginiana</i>	2	10	25	0	15	0	0	0	0	0	0	0	0	2 of 4
<i>Celtis sp.</i>	1	5	15	0	15	0	0	0	0	0	0	0	0	2 of 4
<i>Sassafras albidum</i>	0	3	15	0	0	0	0	0	0	0	0	0	0	4 of 4
<i>Ulmus americana</i>	0	1	5	0	0	0	0	0	0	0	0	0	0	1 of 4
<i>Quercus imbricaria</i>	0	1	5	0	1.5	0	0	0	0	0	0	0	0	1 of 4
<i>Prunus serotina</i>	1	5	0	0	0	0	0	0	0	0	0	0	0	2 of 4
<i>Vitis sp.</i>	6	30	25	0	0	0	0	0	0	0	0	0	0	3 of 4
<i>Crataegus</i>	1	5	0	0	0	0	0	0	0	0	0	0	0	1 of 4
Total	170	190	100	70	50	15	0	5	5	5	5	5	5	
Oaks	70	30	10	30	25	0	0	5	5	5	5	5	5	
<i>Maclura glauca</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	

Fixed Area Plot Summaries # / Size Class / Species / Acre

Plot Stand # Z-A # of Plots 3 (x6.7) This stand may require another plot or 2 on east

Species	DBH											Comments	
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+				
<i>Quercus rubra</i>	0	0	7	7	7	7	7	0	7	0			3 of 3
<i>Carya ovata</i>	33	13	7	7									3 of 3
<i>Carya cordiformis</i>	5	40	17										3 of 3
<i>Juglans nigra</i>	2	13	0	7									3 of 3
<i>Fraxinus</i> sp.	0	4	27	20	13	0	17						3 of 3
<i>Juniperus virginiana</i>	27	47	13	7									3 of 3
<i>Celtis occident.</i>	7	7	7	7	7								2 of 3
<i>Ulmus rubra</i>	47	60	7	0									3 of 3
<i>Maorus rubra</i>	7	7	7	7									2 of 3
<i>Viburnum prunif.</i>	4	0											1 of 3
<i>Eurocomus atro.</i>	2	13	0										1 of 3
<i>Carya toxi. tex</i>	17	0											1 of 3
<i>Ulmus ameris.</i>	0	7											1 of 3
<i>Prunus serotina</i>	7	0											1 of 3
<i>Aesculus glabra</i>	2	13											1 of 3
Total	234	221	75	55	14	14	7						

No *Medusa*, *Gladiaria*

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # Z-B # of Plots 7 (x29)

Species	DBH											Comments		
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+					
<i>Prunus serotina</i>	3	9	17	2	6	1	3							5 of 7
<i>Ulmus americana</i>	10	29	26	3	1	3	3							6 of 7
<i>Juniperus virginiana</i>	14	4	11	2	6	2	6							5 of 7
<i>Quercus muhlen</i>	2	6	1	3										2 of 7
<i>Quercus velutina</i>	1	3	0	0	1	3								2 of 7
<i>Quercus rubra</i>	0	1	3											1 of 7
<i>Celtis occid.</i>	1	3	2	6										3 of 7
<i>Ulmus rubra</i>	1	3	1	3										2 of 7
<i>Tuglans nigra</i>	1	3	1	3	0	1	3	0	1	3				2 of 7
<i>Fraxinus amer.</i>	10	29	14	6	2	6								1 of 7 local
<i>Gleditsia triacan.</i>	1	3	1	3										2 of 7
<i>Acer saccharinum</i>	1	3	1	3										1 of 7
<i>Vitis</i> sp.	39													2 of 7
<i>Prunus sp. (plum)</i>	1	3												1 of 7
<i>Sassafras albidum</i>	0	1	3											1 of 7
Total	143	95	21	24	3	3								
Oaks	9	6	0	3										

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 2-C # of Plots 4 (x5)

Species	DBH											Comments	
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+				
<i>Carya cordata</i>	25	30	40	15	5								4 of 4
<i>Carya ovata</i>	2	10	2	10									3 of 4
<i>Casahuate / Tor</i>	3	15	5	5	5								3 of 4
<i>Quercus rubra</i>	1	5	1	5	2	1	5						4 of 4
<i>Quercus muhlen</i>	1	5	1	5	2	1	5	1	5				1 of 4 on north near rock outcrop
<i>Quercus sp.</i>	5	0	1	5	5	5							
<i>Ulmus rubra</i>	8	40	1	5	1	5							4 of 4
<i>Ulmus americana</i>	0	2	10	2	10	1	5						3 of 4
<i>Celtis occident</i>	1	5	0	0	0	1	5	1	5				2 of 4 local
<i>Juglans nigra</i>	0	0	0	3	15	2	10						3 of 4
<i>Morus rubra</i>	3	15	0	0	0	1	5						3 of 4
<i>Fraxinus americana</i>	1	5											2 of 4
<i>Prunus serotina</i>	2	0	0	0	0	1	5						2 of 4
<i>Vitis</i>	11	55	2	10									4 of 4
<i>Melicope pumila</i>	0	0	0	1	5								1 of 4
<i>Gelettia triflor</i>	0	0	1	5									1 of 4

Total 190 115 75 80 50 30 15 10
 Oaks 10 15 10 15 20 10 10

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 2-D # of Plots 6 (x33)

Species	DBH											Comments	
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+				
<i>Quercus muhlenbergii</i>	7	23	3	3	0	1	3	0	0	0	0	0	5 of 6 (2 mabk x still hybrid?)
<i>Quercus stellata</i>	4	13	7	3	10	0	0	0	0	0	0	0	5 of 6
<i>Quercus imbricaria</i>	1	3	10	3	0	0	0	0	0	0	0	0	3 of 6
<i>Quercus velutina</i>	0	3	0	0	0	0	0	0	0	0	0	0	1 of 6
<i>Quercus rubra</i>	1	3	0	0	0	0	0	0	0	0	0	0	2 of 6
<i>Quercus laevis</i>	0	7	17	20	13	3	7	0	0	0	0	0	5 of 6
<i>Quercus sp.</i>	5	140	23	7	0	0	0	0	0	0	0	0	6 of 6
<i>Celtis sp.</i>	5	17	10	3	0	0	0	0	0	0	0	0	3 of 6
<i>Maclura pomifera</i>	7	23	13	0	0	0	0	0	0	0	0	0	3 of 6
<i>Prunus serotina</i>	3	4	13	7	3	0	0	0	0	0	0	0	4 of 6
<i>Gleditsia triacanthos</i>	0	1	3	2	3	1	3	0	0	0	0	0	4 of 6
<i>Vitis sp.</i>	7	23	3	0	0	0	0	0	0	0	0	0	4 of 6
<i>Juniperus virginiana</i>	3	10	3	0	0	0	0	0	0	0	0	0	2 of 6
<i>Ulmus sp.</i>	4	13	0	0	0	1	3	0	0	0	0	0	4 of 6
<i>Viburnum crenatum</i>	7	23	0	0	0	0	0	0	0	0	0	0	1 of 6
<i>Fraxinus americana</i>	1	3	0	0	0	0	0	0	0	0	0	0	1 of 6

Total 214 228 69 53 16 12 7

Oaks	42	46	9	13	3								
Gleditsia	23	16	7	3	3								

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 2-F (South of cable) # of Plots 4 (x5) DBH

Species	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+	Comments
Quercus muhlenbergii	30	10	10	0	0	0	0	0	0	3 of 4
Quercus velutina	2	0	0	0	0	0	0	0	0	2 of 4
Quercus alba	0	0	0	0	0	0	0	0	0	2 of 4
Quercus rubra	1	0	0	5	0	0	0	0	0	1 of 4
Sassafras albidum	20	145	75	0	0	0	0	0	0	4 of 4
Carya tomentosa	10	0	0	10	0	5	0	0	0	1 of 4
Juglans nigra	10	15	15	20	15	0	0	0	0	4 of 4
Gleditsia triacanthos	0	0	15	15	15	15	0	15	0	3 of 4, clumped dist.
Maclura pomifera	45	25	15	10	15	15	0	0	0	1 of 4
Morus rubra	15	0	0	0	0	0	0	0	0	4 of 4
Prunus serotina	7	4	15	0	0	0	0	0	0	3 of 4
Ulmus rubra	2	15	0	0	0	0	0	0	0	2 of 4
Celtis sp.	15	15	0	0	0	0	0	0	0	2 of 4
Juniperus virginiana	0	0	0	20	10	0	0	0	0	3 of 4
Urtica	10	3	15	0	0	0	0	0	0	1 of 4
Acer saccharinum	0	15	0	0	0	0	0	0	0	1 of 4
Viburnum grandifolium	15	0	0	0	0	0	0	0	0	1 of 4

Total 270 245 130 70 15 15 5

Oaks	75	10	10	5						
Gleditsia + Maclura	45	25	20	25	10	10	5			

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 2-G # of Plots 3 (6.7)

Species	DBH										Comments	
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+			
<i>Quercus rubra</i>	0	17	0	0	0	0	0	0	0	0	0	1 of 3
<i>Maclura pomifera</i>	0	8	27	3	0	0	0	17	0	0	0	2 of 3
<i>Gleditsia triacanthos</i>	0	8	27	3	0	0	0	17	0	0	0	2 of 3
<i>Juglans nigra</i>	0	2	0	17	3	20	20	0	0	0	0	3 of 3
<i>Ulmus sp</i>	20	134	7	0	0	0	0	0	0	0	0	3 of 3
<i>Celtis occident.</i>	12	27	7	0	17	17	0	0	0	0	0	2 of 3
<i>Ulmus rubra</i>	17	0	13	0	0	0	0	0	0	0	0	2 of 3
Total	221	160	74	47	27	27	14					
Oaks		7										
<i>Gledit. a. Mulara</i>	0	106	54	40			14					

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 2-I # of Plots 3 (x6.7)

Species	DBH										Comments	
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+			
Quercus sp.	0	0	0	0	0	0	0	0	0	0	0	1 of 3
Quercus rubra	4	0	0	0	0	0	0	0	0	0	0	2 of 3
Quercus imbricaria	0	0	0	0	0	0	0	0	0	0	0	1 of 3
Cornus/Tox.	0	0	2	4	6	3	0	0	0	0	0	3 of 3
Madia pennata	12	80	20	5	17	2	0	0	0	0	0	3 of 3
Celtis occidentalis	17	13	0	0	0	0	0	0	0	0	0	2 of 3
Ulmus americana	0	17	0	0	0	0	0	0	0	0	0	2 of 3
Vitis sp.	2	13	0	0	0	0	0	0	0	0	0	2 of 3
Prunus serotina	3	0	0	0	0	0	0	0	0	0	0	2 of 3
Galathea fraxinella	0	0	0	0	0	17	0	0	0	0	0	1 of 3
Juglans nigra	0	0	0	0	17	0	0	0	0	0	0	1 of 3
Parthenocissus	17	0	0	0	0	0	0	0	0	0	0	1 of 3
Total	81	100	33	60	75	40	7					

Fixed Area Plot Summaries # // Size Class / Species / Acre

Stand # 2-I # of Plots 6 (233)

Species	DBH										Comments	
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+			
<i>Quercus muhlenbergii</i>	11	5	1	2	0	0	0	0	0	0	0	1 of 6
<i>Quercus stellata</i>	3	10	0	0	0	0	0	0	0	0	0	2 of 6
<i>Quercus rubra</i>	0	0	1	3	0	0	0	0	0	0	0	1 of 6
<i>Quercus imbricaria</i>	0	1	0	0	0	0	0	0	0	0	0	1 of 6
<i>Celtis occidentalis</i>	5	14	7	6	4	2	7	0	0	0	0	5 of 6
<i>Ulmus rubra</i>	0	2	0	0	0	0	0	0	0	0	0	1 of 6
<i>Ulmus americana</i>	0	0	0	1	3	1	3	0	0	0	0	4 of 6
<i>Juglans nigra</i>	0	1	0	0	1	0	3	0	0	0	0	2 of 6
<i>Maclura pomifera</i>	3	21	15	6	4	1	3	3	3	10	2	6 of 6
<i>Vitis</i> sp.	10	0	0	0	0	0	0	0	0	0	0	4 of 6
<i>Gleditsia triacanthos</i>	0	1	0	2	7	1	3	0	0	0	3	4 of 6
<i>Morus rubra</i>	1	3	0	0	0	0	0	0	0	0	0	1 of 6
<i>Juniperus virginiana</i>	2	7	0	0	0	0	0	0	0	0	0	2 of 6
<i>Prunus serotina</i>	4	13	0	0	0	0	0	0	0	0	0	2 of 6
<i>Ulmus americana</i>	1	3	0	0	0	0	0	0	0	0	0	2 of 6
<i>Celtis occidentalis</i>	17	3	0	0	0	0	0	0	0	0	0	2 of 6
Total	150	176	79	50	49	16	6	3	10	10	10	
Maclura + Gledit	10	73	50	27	33	6	3	10	10	10	10	

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 2-M # of Plots 5 (x4)

Species	DBH								Comments	
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16		16+
<i>Quercus stellata</i>									3	Plots - Chinkapin prism
Plot 20'										
Stand 20'	3									
<i>Quercus stellata</i>									1	Walnut & Chinkapin, in
<i>Celtis occid.</i>									1	PRISM
Total									4	
Together 8 plots									3	
<i>Quercus stell.</i>									3	
<i>Celtis occid.</i>									1	
Total									4	

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 4-D (in part) # of Plots 4 (x5)

Species	DBH											Comments	
	1-2	2.4	4-6	6-8	8-10	10-12	12-14	14-16	16+				
<i>Nyctanthes tomentosa</i>	2	10	7	35	25	15	5	0	0	0	0	0	3 of 4
<i>Gliricidia sepium</i>	2	10	3	15	15	5	0	0	2	10	0	0	3 of 4
<i>Trichopus simplicifolius</i>	4	11	3	15	0	0	0	0	0	0	0	0	4 of 4 - one plot pure...
<i>Ulmus americanus</i>	0	5	1	5	0	0	0	0	0	0	0	0	2 of 4
<i>Ulmus rubra</i>	0	5	0	0	0	0	0	0	0	0	0	0	1 of 4
<i>Celtis occidentalis</i>	0	5	0	0	0	0	0	0	0	0	0	0	1 of 4
<i>Juglans nigra</i>	0	2	10	0	15	0	0	0	0	0	0	0	2 of 4
<i>Disporus virginicus</i>	0	5	0	0	0	0	0	0	0	0	0	0	1 of 4
<i>Vitex sp</i>	3	4	0	0	0	0	0	0	0	0	0	0	2 of 4
<i>Platanus occidentalis</i>	0	0	0	0	5	0	0	0	0	0	0	0	1 of 4
<i>Prunus serotina</i>	1	5	0	0	0	0	0	0	0	0	0	0	1 of 4
<i>Quercus rubra</i>	0	10	5	0	0	0	0	0	0	0	0	0	1 of 4
Total	60	160	75	50	20	5	10	0	0	0	0	0	
Oaks		10	5										
Glir. or Maclura	20	45	50	40	20	5	10						

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 5-C # of Plots 4 (x5)

Species	DBH										Comments
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+		
<i>Alnus incana</i>	35	40	20	5		30		5			2 of 4
<i>Alnus incana</i>	50	55		5							2 of 4
<i>Carya cordifolia</i>	0	0	5	5							2 of 4
<i>Taxodium nigra</i>	5	5	0	0	4	20	4	0	0		3 of 4
<i>Celtis occident.</i>	5	45	5	0	0	0	0	0	0		3 of 4
<i>Gladiolus tria.</i>	0	0	5	0	0	5	5	0	0		3 of 4
<i>Vitis sp.</i>	35										2 of 4
<i>Fraxinus sp.</i>	0	0	0	5	0	5	5	5	0		1 of 4 local
<i>Quercus alba</i>	5	0	0	5	0	5	5	0	0		1 of 4 local
<i>Platanus occidentalis</i>	0	0	0	0	0	0	0	0	2	10	1 of 4
<i>Viburnum fusculum</i>	5										1 of 4
Total	140	145	35	25	0	65	35	10	10		
Oaks	5			5		5	5				
Gladiolus			5			5	5				

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 5-D # of Plots 5 (x4)

Species	DBH											Comments		
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+					
<i>Quercus muhlenbergii</i>	312													1 of 5
<i>Quercus velutina</i>	28	28	14			14	14	14	14					4 of 5
<i>Quercus rubra</i>			4			4								2 of 5
<i>Quercus imbricaria</i>	4													1 of 5
<i>Quercus macrocarpa</i>														1 of 5
<i>Quercus stellata</i>						1								1 of 5
<i>Ulmus rubra</i>	114	728	28											4 of 5
<i>Ulmus americana</i>	520	416	312											3 of 5
<i>Carya tom.</i>	1		28			312	28	28	14					4 of 5
<i>Carya cordiformis</i>	416	28	14				14							2 of 5
<i>Juglans nigra</i>	0	416			28	312	14		14					5 of 5
<i>Prunus rubra</i>	14	28	416	14										4 of 5
<i>Celtis occidentalis</i>	312	312	14											3 of 5
<i>Urtica</i>	1248	312												5 of 5
<i>Gleditsia x Maclura</i>	1													1 of 5 total
Sassafras, Gabar + Rusty Blackhaw	214 12	312 12	1516 4	1 of 5 each										
Total	184	120	64	8	8	36	20	16	12					

Oaks	24	8	12			12	4	4	4					

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 5-F # of Plots 13 (x15)

DBH

Species	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+	Comments
White Oak	0	2	3	6	9	11	6	3	0	concentrated on N-slope of N-draw
Black Oak	0	3	2	3	12	23	22	3	6	Dominant species on N-draw
Post Oak	0	0	8	12	8	5	6	0	0	7 of 13
Chinkapin Oak	0	1	2	12	0	1	2	0	0	4 of 13 Confined to S-half of draw
Red Oak	0	1	2	2	1	2	0	0	0	3 of 13
Blackjack Oak	0	0	1	2	0	1	2	0	0	2 of 13
Mockernut (hex)	7	11	19	9	14	8	2	0	0	11 of 13
Bitternut	3	5	3	1	2	0	1	2	0	4 of 13 concentrated N-slope of N-draw
Shagbark	5	8	3	0	0	0	0	0	0	2 of 13 N-slope of N-draw
Slippery Elm	27	15	2	0	0	0	0	0	0	9 of 13
American Elm	5	8	1	0	0	0	0	0	0	6 of 13
Malberry	10	15	7	0	0	0	0	0	0	8 of 13
Walnut	1	2	3	3	5	7	6	0	0	6 of 13
Black Cherry	3	5	0	0	0	0	0	0	0	3 of 13
Urtica	7	11	2	0	0	0	0	0	0	3 of 13
White Ash	7	14	2	3	0	0	0	0	0	6 of 13

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 5-F # of Plots 13

Species	DBH										Comments	
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+			
Cedar	2	3										1 of 13
Sassafras		2	2									1 of 13
Red bud	1	2										1 of 13
Hackberry	2	3										1 of 13
Total	128	133	74	40	38	52	28	6	6			
Oaks	0	9	33	19	30	42	28	6	6			

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 5-I # of Plots 4 (x5)

Species	DBH											Comments		
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+					
<i>Quercus rubra</i>	0	0	1	5	2	1	5	1	5	1	5	1	5	4 of 4
<i>Quercus muhlen.</i>	0	2	10	5	0	0	2	10	5	0	0	0	0	3 of 4
<i>Quercus stellata</i>	0	0	0	1	0	0	3	15	0	0	0	0	0	1 of 4 relatively drier sites
<i>Carya cordiformis</i>	30	13	65	12	2	10	0	0	0	0	0	0	0	4 of 4
<i>Carya tom / tex.</i>	0	5	25	4	2	10	0	0	0	0	0	0	0	2 of 4 Most on drier sites w/ port oak
<i>Taxus nigra</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	2 of 4
<i>Fraxinus americana</i>	0	5	25	3	2	15	3	15	1	5	0	0	0	3 of 4
<i>Ulmus americana</i>	3	15	2	2	10	15	0	15	0	0	0	0	0	4 of 4
<i>Ulmus rubra</i>	3	15	2	2	0	0	0	0	0	0	0	0	0	2 of 4
<i>Celtis occidentalis</i>	4	20	10	2	10	0	0	0	0	0	0	0	0	3 of 4
<i>Juniperus virg.</i>	13	65	1	5	2	2	10	10	0	15	0	0	0	3 of 4
<i>Cercis canadensis</i>	3	15	2	1	5	0	0	0	0	0	0	0	0	2 of 4
<i>Viburnum (rufipum)</i>	4	20	4	0	0	0	0	0	0	0	0	0	0	2 of 4
<i>Fraxinus quadr.</i>	4	20	0	0	0	0	0	0	0	0	0	0	0	1 of 4
<i>Vitis</i>	0	15	0	0	0	0	0	0	0	0	0	0	0	1 of 4
<i>Aesculus glabra</i>	0	5	0	0	0	0	0	0	0	0	0	0	0	1 of 4

Total	205	195	135	45	60	25	30	15	5					
Oaks		10	15	10	10	20	20	10	5					

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # S-I # of Plots 4 (x5)

Species	DBH										Comments				
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+						
<i>Quercus stellata</i>	0	1	0	0	0	0	0	0	0	0	0	0	0	0	11 of 4
<i>Quercus marilandica</i>	0	0	1	5	0	0	0	0	0	0	0	0	0	0	2 of 4 North half
<i>Quercus rubra</i>	1	5	0	0	1	5	0	0	0	0	0	0	0	0	1 of 4 North end
<i>Quercus velutina</i>	0	0	1	5	0	0	0	0	0	0	0	0	0	0	1 of 4
<i>Quercus muhlenbergii</i>	0	1	5	0	0	0	0	0	0	0	0	0	0	0	1 of 4
<i>Ulmus americana</i>	30	11	5	4	0	0	0	0	0	0	0	0	0	0	4 of 4
<i>Ulmus rubra</i>	1	5	0	0	0	0	0	0	0	0	0	0	0	0	2 of 4
<i>Carya tom. tex.</i>	0	1	5	0	0	0	0	0	0	0	0	0	0	0	2 of 4
<i>Vitis sp.</i>	0	1	5	0	0	0	0	0	0	0	0	0	0	0	1 of 4
<i>Juniperus virg.</i>	1	5	10	0	0	0	0	0	0	0	0	0	0	0	2 of 4
<i>Morus rubra</i>	1	5	0	0	0	0	0	0	0	0	0	0	0	0	2 of 4
<i>Gleditsia triac.</i>	1	5	0	0	0	0	0	0	0	0	0	0	0	0	1 of 4
<i>Sassafras albidum</i>	3	15	0	0	0	0	0	0	0	0	0	0	0	0	2 of 4
<i>Celtis occident.</i>	2	10	15	0	0	0	0	0	0	0	0	0	0	0	2 of 4
<i>Juglans nigra</i>	0	0	0	1	5	0	0	0	0	0	0	0	0	0	1 of 4 S-end
Total	80	180	55	20	20	60	40	35	5	5					
Oaks	5	10	10	20	20	55	35	5	5						

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # S-H # of Plots 4 (x5)

Species	DBH										Comments					
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+							
<i>Celtis occidentalis</i>	11	15	2	0	0	0	0	0	0	0	0	0	0	0	4 of 4	Most common in stand
<i>Juglans nigra</i>	0	3	3	1	0	0	0	0	0	0	0	0	0	0	4 of 4	Dominant on NW slope
<i>Ulmus rubra</i>	10	5	1	0	0	0	0	0	0	0	0	0	0	0	3 of 4	lower slope
<i>Ulmus americana</i>	3	14	3	0	1	2	10	0	0	0	0	0	0	0	4 of 4	most common on low NW slope
<i>Quercus muhlen.</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 of 4	East in immed. flow
<i>Quercus rubra</i>	1	5	0	0	0	0	0	0	0	0	0	0	0	0	2 of 4	
<i>Morus rubra</i>	3	1	5	0	0	0	0	0	0	0	0	0	0	0	3 of 4	
<i>Fraxinus americana</i>	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1 of 4	East in immed. flow
Cedar	2	10	0	0	0	0	0	0	0	0	0	0	0	0	1 of 4	East in immed. flow
<i>Gleditsia triacan.</i>	0	0	1	5	2	0	0	0	0	0	0	0	0	0	1 of 4	on low NW slope
<i>Madura pomifera</i>	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1 of 4	Clumped
Total	155	230	100	25	30	25	25	5	10							
Oaks	5	5														
<i>Maclura + Gleditsia</i>		5	5	5	10											
All (exc. <i>Maclura</i>)	155	225	95	20	20											

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 6-EF # of Plots 4 (x5)

Species	DBH										Comments
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+	0	
<i>Juniperus virginiana</i>	23	18	9	8	8	2	1	0	0	0	4 of 4
<i>Quercus muhlenbergii</i>	3	15	0	5	2	10	5				3 of 4
<i>Quercus rubra</i>	15	5	0	0							2 of 4
<i>Fraxinus sp.</i>	2	10	0								3 of 4
<i>Ulmus ameri.</i>	0	15	0								3 of 4
<i>Juglans nigra</i>	0	2	0	0	5						2 of 4
<i>Cercis canadensis</i>	2	10	0								1 of 4
<i>Merus rubra</i>	1	5	0								1 of 4
<i>Carya cordiformis</i>	2	5	0								1 of 4
<i>Viburnum rufid.</i>	1	5	0								1 of 4
Total	175	145	45	45	55	10	5				
Oaks	20	10		5	10						

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 7 bottom # of Plots 7 (x 29)

Species	DBH										Comments	
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+			
<i>Ulmus americana</i>	13	25	23	5	1	3						7 of 7
<i>Ulmus rubra</i>	10	15	14	2	3							4 of 7
<i>Celtis occident.</i>	7	8	14	0	1	3						7 of 7
<i>Juglans nigra</i>	2	8	2	7	0	2	6	2	6	3		7 of 7
<i>Gleditsia tria.</i>	1	4	3	1	1	3	4	1	0	0		3 of 7
<i>Morus rubra</i>	5	2	2	0								4 of 7
<i>Acer negundo</i>	3	5	0	1	0							2 of 7 - lower reaches near Wilson's Cr.
<i>Nyctaginia palmifera</i>	1	1	2	2								1 of 7
<i>Quercus macrocarpa</i>	2	5	0									3 of 7 only in west section
<i>Quercus muhlen.</i>	1	0										1 of 7
<i>Fraxinus sp.</i>	1	0										1 of 7
<i>Aesculus glabra</i>	2	2	3									1 of 7 - local
<i>Prunus serotina</i>	1	0										1 of 7
Total	142	215	87	52	12	9	9	6	9			
Oaks	9	14										
<i>Nyctaginia palmifera</i>	6	14	15	9	3							

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 7 slope # of Plots 6 (x3.3)

Species	DBH											Comments	
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+				
<i>Celtis occidentalis</i>	5	11	12	7	3	1	1	0	1	3			6 of 6
<i>Carya cordiformis</i>	5	6	3	0	1	3							4 of 6
<i>Asculus glabra</i>	2	9	2	3	0								4 of 6
<i>Fraxinus sp.</i>	3	2	1										5 of 6
<i>Juglans nigra</i>	0	0	0	0	1	3	0	0	0	1	3		2 of 6
<i>Quercus rubra</i>	1	2	0	2	0	0	1	3	0	1	3	0	4 of 6
<i>Quercus muhlenb.</i>	1	3	1	0	0	3	10	7	1	3	0		5 of 6
<i>Quercus sp.</i>	1	3											
<i>Ulmus rubra</i>	4	2	1	2									5 of 6
<i>Ostrya virginiana</i>	10	3	2	1									3 of 6
<i>Carya ovata</i>	1	2	1	0	2	1	3	3					2 of 6 local
<i>Tilia americana</i>	2	2	3	1	0	0							1 of 6 very local
<i>Urtica sp.</i>	6	20	0										5 of 6
<i>Morus rubra</i>	0	1	3										1 of 6
Total	136	138	82	53	23	22	16	6	9				
Oaks	9	10	3	7		10	10	6	3				

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 7-B, 17 # of Plots 4 (x5)

Species	DBH											Comments		
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+					
<i>Ulmus americana</i>	10	10	25	10	1	5								4 of 4
<i>Celtis occidentalis</i>	2			1										3 of 4
<i>Juglans nigra</i>	3	7	10	3	0	1	5							4 of 4
<i>Fraxinus sp.</i>	3	15	5		0	0	0							2 of 4
<i>Gleditsia triacanthos</i>	0	0	0	1	0	1	5	2	10	3	1	5		2 of 4
<i>Maclura pomifera</i>	0	2	10	0	0	0	0	0	0	0	0	0		2 of 4
<i>Vitis sp.</i>	6	30	15	0	0	0	0	0	0	0	0	0		3 of 4
<i>Juniperus virginiana</i>	1	5	10	0	0	0	0	0	0	0	0	0		2 of 4
<i>Quercus muhlen.</i>	1	5	20	0	0	0	0	0	0	0	0	0		2 of 4
<i>Quercus velutina</i>	1	5	5	0	0	0	0	0	0	0	0	0		1 of 4
<i>Quercus cuba</i>	0	0	5	0	0	0	0	0	0	0	0	0		1 of 4
<i>Morus rubra</i>	1	5	10	0	0	0	0	0	0	0	0	0		2 of 4
<i>Platanus occidentalis</i>	0	0	0	0	0	1	5	0	0	0	0	0		1 of 4
<i>Carya ovata</i>	2	10	0	0	0	0	0	0	0	0	0	0		2 of 4
<i>Prunus serotina</i>	0	1	5	0	0	0	0	0	0	0	0	0		1 of 4
Total	110	135	45	35	5	15	5	16	20	10	20	10		
<i>Gleditsia + Maclura</i>	10	5	5	15	5	10	15	5	15	5				

Fixed Area Plot Summaries # / Size Class / Species / Acre

Stand # 9-C # of Plots 5 (x4)

Species	DBH											Comments
	1-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16+			
<i>Quercus stellata</i>	0	0	0	14	28	0	16	28	0	0	0	5 of 5
<i>Quercus velutina</i>	0	14	0	0	14	0	0	28	14	0	0	2 of 5
<i>Quercus alba</i>	10	40	0	0	0	0	0	0	0	0	0	2 of 5 - local
<i>Quercus macilardica</i>	0	0	0	0	0	14	0	0	0	0	0	1 of 5
<i>Juglans nigra</i>	0	0	0	0	14	0	14	0	0	0	0	2 of 5
<i>Carya ovata</i>	17	68	28	28	0	0	0	0	0	0	0	4 of 5
<i>Carya tan. / tex</i>	28	14	28	0	0	0	0	0	0	0	0	5 of 5
<i>Carya cordiformis</i>	28	14	0	14	0	0	0	0	0	0	0	3 of 5
<i>Morus rubra</i>	28	28	14	0	0	0	0	0	0	0	0	3 of 5
<i>Ulmus americana</i>	14	0	0	14	28	14	0	0	0	0	0	3 of 5
<i>Ulmus rubra</i>	14	312	0	0	14	0	0	0	0	0	0	2 of 5
<i>Celtis occident.</i>	28	0	0	0	0	0	0	0	0	0	0	2 of 5
<i>Prunus serotina</i>	28	12	0	0	0	0	0	0	0	0	0	3 of 5
<i>Juniperus virgin.</i>	3	12	0	0	0	14	0	0	0	0	0	4 of 5
<i>Gleditsia triac.</i>	0	14	14	0	0	0	0	0	0	0	4	2 of 5
white Black Grape	16	4	16	0	0	0	0	0	0	0	0	1 of 5 each
<i>Sassafras</i>	0	3	12	0	4	4	0	0	0	0	0	1 of 5

Total	184	92	24	16	32	16	20	16	8			
Oak	40	12	4	12	4	16	16	4				

APPENDIX 4. Species List for Limestone Glades East of Wilson's
Creek

<u>Latin Name</u>	<u>Common Name</u>
<i>Achillea millefolium</i>	Milfoil, Yarrow
<i>Ambrosia artemisiifolia</i>	Common Ragweed
<i>Amorpha canescens</i>	Lead Plant
<i>Anemone virginiana</i>	Thimbleweed
<i>Arabis</i> sp.	Rock Cress
<i>Asclepias tuberosa</i>	Butterfly Milkweed
<i>Asclepias verticillata</i>	Whorled Milkweed
<i>Asplenium platyneuron</i>	Ebony Spleenwort
<i>Baptisia leucantha</i>	White Wild Indigo
<i>Bouteloua curtipendula</i>	Sideoats Grama
<i>Callirhoe digitata</i>	Fringed Poppy Mallow
<i>Chrysanthemum leucanthemum</i>	Ox-eye Daisy
<i>Comandra richardsonii</i>	Bastard Toadflax
<i>Croton</i> sp.	Croton
<i>Desmodium</i> sp.	Beggar's Lice
<i>Dianthus armeria</i>	Depthford Pink
<i>Erigeron strigosus</i>	Daisy Fleabane
<i>Euphorbia</i> sp.	Spurge
<i>Fraxinus americana</i>	White Ash
<i>Heuchera richardsonii</i>	Alum Root
<i>Houstonia nigricans</i>	Houstonia, Bluets
<i>Juniperus virginiana</i>	Eastern Red Cedar
<i>Lespedeza</i> sp.	Lespedeza
<i>Medicago lupulina</i>	Black Medick
<i>Mirabilis albida</i>	A Wild Four-o'clock
<i>Monarda</i> sp.	Horsemint, Wild Bergamot
<i>Opuntia compressa</i>	Prickly Pear Cactus
<i>Oxalis dillenii</i>	Yellow Wood Sorrel
<i>Pellaea atropurpurea</i>	Purple Cliff-brake
<i>Penstemon pallidus</i>	Pale Beard-Tongue
<i>Petalostemum purpureum</i>	Purple Prairie Clover
<i>Potentilla recta</i>	Rough-fruited Cinquefoil
<i>Ptelea trifoliata</i>	Water Ash, Hoptree
<i>Quercus muhlenbergia</i>	Chinquapin Oak
<i>Rhus aromatica</i>	Fragrant Sumac
<i>Ruellia humilis</i>	Wild Petunia
<i>Satureja arkansana</i>	Calamint
<i>Schizachyrium scoparium</i>	Little Bluestem
<i>Scutellaria parvula</i>	A Skullcap
<i>Sedum pulchellum</i>	Widow's Cross
<i>Taenidia integerrima</i>	Yellow Pimpernel
<i>Torilis japonica</i>	Hedge Parsley
<i>Tradescantia tharpaii</i>	A Spiderwort
<i>Tragia urticifolia</i>	Tragia

Latin Name

Common Name

Verbena canadensis
Vernonia baldwinii
Viburnum prunifolium
Viburnum rufidulum

Rose Verbena
Ironweed
Black Haw
Southern Black Haw

Appendix 5. Materials Pertaining to Contracting for Custom Farm Work on Bois D'Arc W.A. (MDC)



MISSOURI DEPARTMENT OF CONSERVATION

1675 East Seminole, Suite 100
 Springfield, Missouri 65804 • Phone 417/881-5102
 LARRY R. GALE, Director

September 10, 1986

Dear Sir:

Listed below are different types of farm custom work on the Bois D'Arc Wildlife Area, 10 miles northwest of Springfield. If you are interested on bidding on any of this work please fill in the blanks with a dollar per acre or per hour amount. Then sign at the bottom and fill in your social security number. Please mail this form in the enclosed envelope to me within 5 business days. If you are the low bidder you will be notified. If you are not the low bidder you will be notified.

The following custom farm work is listed below:

Moldboard Plowing per acre	\$ _____
Disk Only per acre	\$ _____
Harrow only per acre	\$ _____
Disk & Harrow per acre	\$ _____
Cultipack per acre	\$ _____
Small grain Drill per acre	\$ _____
Spraying Chemicals w/truck or tractor per acre	\$ _____
Cutting brush - Brushhog per acre	\$ _____
Mowing Weeds & grass per acre	\$ _____
Combining small grain per acre	\$ _____
Combining grass or other seed crops per acre	\$ _____
Combine corn & haul to nearest market per acre	\$ _____
Rock Roller - 10 ton or larger roller per acre	\$ _____
No-till drill per acre	\$ _____

 Signature

 Social Security No.

 Address

COMMISSION

JEFF CHURAN
 Chillicothe

JOHN POWELL
 Rolla

JOHN B. MAHAFFEY
 Springfield

RICHARD T. REED
 East Prairie

On all the listed custom work the contractor will be required to furnish all the equipment, labor and fuel. The contractor will not be entitled to any of the agriculture crop. All work must be completed within a reasonable time period as agreed upon between the Contractor and the Wildlife District Supervisor or his representative. If you are unable to perform this custom work within a reasonable time the next lowest bidder will be awarded the job.

I estimate there will be 800 acres of herbicide spraying this fall and another 800 acres next spring. I estimate there will be 100 acres of discing and mowing next spring. For your information I'm enclosing a copy of 1983 Average rates for custom farm work in Missouri. This list was summarized by Missouri Extension specialists. Please contact me if you have any questions or comments.

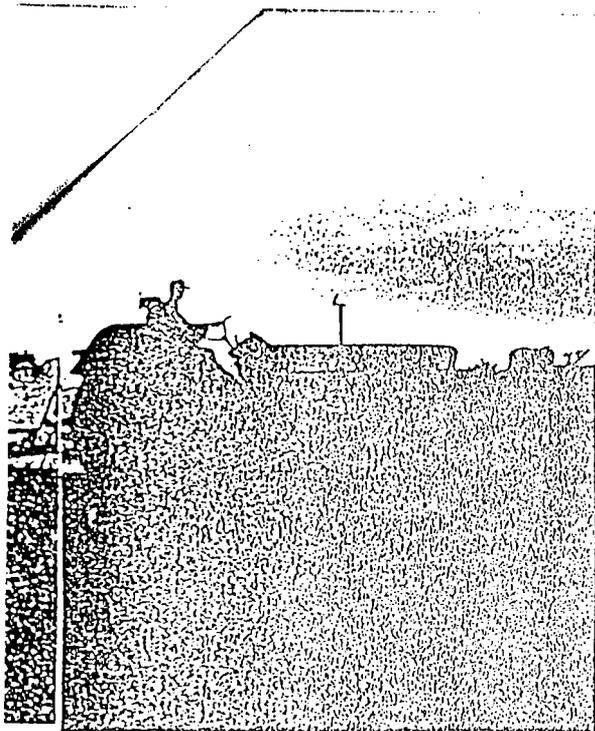
Sincerely,

William I. Phillips
William I. Phillips
Wildlife District Biologist

WIP/cf

Enclosures

cc: Porath
Haas
Wilson
Skelton



The average custom rate for disk and harrow operations in Missouri last year, according to a recent University of Missouri-Columbia survey, is \$6.12 per acre. That's up from \$5.79 per acre just two years ago.

Average rates for custom farm work in Missouri

Custom Work	Unit	Rate
Tillage:		
Plow Moldboard—Normal Soil	Acre	9.36
Heavy Soil	Acre	11.06
Plow, Chisel—Normal Soil	Acre	7.60
Heavy Soil	Acre	8.35
Disk only	Acre	5.38
Harrow only	Acre	3.15
Disk and Harrow	Acre	6.12
Rotary Hoe	Acre	3.31
Cultivate rows	Acre	4.62
Cultipack	Acre	4.18
Cut stalks	Acre	5.46
Planting (No materials):		
Corn, plant only	Acre	5.98
Corn, plant & fert.	Acre	7.13
Corn, plant & fert. & chem.	Acre	8.32
Corn, no-till planting	Acre	9.53
Soybeans, plant only	Acre	6.57
Small grain, drill only	Acre	5.52
Small grain, drill & fert.	Acre	7.15
Small grain, drill & fert. & grass seed	Acre	7.48

Fortilizing (No materials) Farmer rates:

Apply Anhy Ammonia	Acre	5.31
Spread dry fertilizer	Acre	2.71
Apply liquid fertilizer	Acre	3.28
Apply liquid fert. & chem.	Acre	3.40
Dry fert. application & seed	Acre	3.61

Spraying (No Materials) Farmer rates:

Chemicals with truck	Acre	3.35
Tractor sprayer	Acre	3.20
Highboy sprayer	Acre	4.06
Flotation sprayer	Acre	3.66

Miscellaneous Farm Jobs:

Fence building, repairing	Hour	5.89
Post hole digging	Hole	.81
	Hour	15.50
Post driving	Post	1.02
Cutting brush—brush hog	Hour	9.65
Mowing weeds	Hour	14.35
	Acre	5.62
Clean septic tanks	Tank	33.33
Saw firewood with chainsaw (2 ft.)	Hour	1.00

Harvesting:

Combining small grains	Acre	13.83
	Bushel	.45
Grass & other seed crops	Acre	19.65
Soybeans—with flexible cutter bar	Acre	20.90
	Bushel	.51
Soybeans—no flexible cutter bar	Acre	20.13
	Bushel	.52
Grain sorghum—straight charge	Acre	19.94
Corn—straight charge	Acre	21.04
	Bushel	.24
Corn—combination charge	Acre &	17.73
	Bushel	.11
Corn—with picker	Acre	19.50
Corn—pick, haul & crib	Acre	25.00
Cotton—picked by machine	Cwt.	3.75

Harvesting Hay:

Mowing only	Acre	4.68
	Bale	.14
Conditioning only	Acre	6.53
	Bale	.15
Mowing and conditioning	Acre	7.05
	Bale	.20
Raking only	Acre	7.72
	Bale	.03
Baling, square—wire tie	Bale	.32
twine tie	Bale	.32
Baling, small round	Bale	.30
Complete hay harvest	Bale	.82
Haul and store bales	Bale	.29

Large Package Machines:

Round bales under 1,000 pounds	Bale	5.79
over 1,000 pounds	Bale	6.02
Moving large bales	Bale	1.84
Hay stacking, two to four tons	Stack	20.00

Harvesting Silage:

Corn—field chop only	Acre	24.50
	Ton	3.42
Sorghum—field chop only	Acre	24.00
	Ton	4.00
Small grain & grass—field chop	Ton	3.63

Earth Moving & Water Management:

Building terraces—conventional	Cu. yd.	.65
	Lin. ft.	.48
Building diversion terraces	Cu. yd.	.67
	Lin. ft.	.71

Appendix 5. (cont.)

Operators Submitting Bids for Custom Farm Work on Bois D'Arc W.A.

Gerald Brown
Route 1, Box 175
Bois D'Arc, MO. 65612
Ph. 742-2180

David Delong
33 East Locust
Aurora, MO. 65605
Ph. 678-4285

Luther Dowdy
Route 2, Box 144
Rogersville, MO. 65742

Glen Hancock
Route 1
Bois D'Arc, MO. 65612
Ph. 742-4468

James Murray
Route 2, Box 143
Ash Grove, MO. 65604
Ph. 672-2154

Marvin Probert
Box 144
Golden City, MO. 64748

Ed Richter
Route 1, Box 467
Ash Grove, MO. 65604

Daniel Sare
Route 2
Willard, MO. 65781
Ph. 742-2909

Doug Scott
Route 1, Box 465
Ash Grove, MO. 65604
Ph. 672-2252

Mike Stacey
Route 2
Ash Grove, MO. 65604

Austin Tipton
Route 1, Box 1195
Bois D'Arc, MO. 65612

Appendix 6. Vascular Plant
Species List for La Petite
Gemme Prairie

MISSOURI PRAIRIE JOURNAL VOL 6 NO 1
VASCULAR PLANT SPECIES LIST SEP 84
LA PETITE GEMME PRAIRIE
POLK COUNTY, MISSOURI

By

Wallace R. Weber, Dept of
Biology, SMSU, Springfield, MO,
Paul Nelson, Mo. Department of
Natural Resources, P.O. Box 176,
Jefferson City, MO, and Raymond
Budde, Dept. of Biochemistry,
Univ. of Nebraska, Lincoln, NE.

The following list was
compiled by examining the SMSU
Herbarium for specimens collected
at La Petite Gemme Prairie. For
each species included, a voucher
specimen is cited including the
collector(s), collection
numbers(s), and dates(s) of
collection. The nomenclature
follows Steyermark (1963), except
for several species where other

names are currently in wide
usage. In each instance where a
deviation occurs, the name used
by Steyermark is listed in
parenthesis.

LITERATURE CITED

Steyermark, J. 1963. Flora of
Missouri. Iowa State University
Press, Ames.

Achillea millefolium L. Yarrow. Nelson & Weber (67), 5/22/75;
Redfearn (38896), 6/24/75. COMPOSITAE.

Agrimony parviflora Ait. Swamp agrimony. Weber (5594),
9/8/75. ROSACEAE.

Agrostis alba L. Redtop. Budde (P32), 7/7/78; Redfearn (38879),
6/24/75. POACEAE.

Agrostis hyemalis (Walt.) BSP Hairgrass. Nelson & Weber (59 &
72), 5/13/75, 5/22/75; Budde (P8), 6/3/78. POACEAE.

Allium canadense L. Wild Garlic. Nelson & Weber (78), 6/22/75.
LILIACEAE.

Ampelopsis cordata Michx. Raccoon Grape. Weber (6427), 6/5/83.
VITACEAE.

Andropogon gerardi Vitman. Big Bluestem. Budde, 9/1/78. POACEAE.

✓ Apocynum cannabinum L. Indian Hemp. Nelson & Weber (68, 99),
5/22/75, 6/15/75. APOCYNACEAE. *

Aristida longespica Poir. Poverty Grass. Budde, 9/7/78, 10/1/78. *weedy*
POACEAE.

✓ Aristida oligantha Michx. Prairie Three-awned Grass. Budde. *weedy*
9/7/78, 10/1/78. POACEAE.

* Polk County Record

Clark
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 Arctostaphylos
 9/11/78, 10/1/78. POACEAE.

- Castilleja coccinea (L.) Spreng. f. coccinea. Indian Paintbrush. Nelson & Weber (13), 4/20/75; Reinking & Hilton (83), 4/25/77. SCROPHULARIACEAE. *
- Castilleja coccinea (L.) Spreng. f. lutescens. Yellow Indian Paintbrush. Weber (35), 5/6/75. SCROPHULARIACEAE. *
- Celtis tenuifolia Nutt. Dwarf Hackberry. Weber (6397), 6/5/83. ULMACEAE.
- Celastrus scandens L. Bittersweet. Weber (6408), 6/5/83. CELASTRACEAE.
- ✓ ~~Ceanothus ovatus~~ Desf. var. pubescens T. & G. ex Wats. New Jersey Tea. Reinking & Hilton (88), 4/25/77. RHAMNACEAE.
- Chrysanthemum leucanthemum L. Ox-eye Daisy. Nelson & Weber (61), 5/13/75. COMPOSITAE.
- Cirsium vulgare (Savi) Tenore. Bull Thistle. Weber (5600), 9/8/78. COMPOSITAE.
- Claytonia virginica L. Spring Beauty. Nelson & Weber (10), 5/20/75; PORTULACACEAE.
- Coreopsis grandiflora Hogg. Tickseed. Nelson & Weber (86), 5/22/75; Redfearn (38883), 6/24/75. COMPOSITAE.
- Coreopsis lanceolata L. Tickseed Coreopsis. Reinking & Hilton (623), 4/16/77. COMPOSITAE.
- Cornus drummondii Meyer. Rough-leaved Dogwood, Nelson & Weber (82), 5/22/75. CORNACEAE.
- Cornus obliqua Raf. Swamp Dogwood. Weber (6419), 6/5/83. CORNACEAE.
- Cornus racemosa Lam. Gray Dogwood. Weber (6419a), 6/5/83. CORNACEAE. *
- Desmanthus illinoensis (Michx.) MacM. Illinois Bundleflower, Prairie Mimosa. Redfearn (32739) & Weber. LEGUMINOSAE.
- ✓ Desmodium sessilifolium (Torr.) T. & G. Tick Trefoil. Weber (5597), 9/8/78. LEGUMINOSAE.
- Digitalis ischaemum (Schreb.) Muhl. Crabgrass. Budde (P44), Summer, 1978. POACEAE. *
- Asclepias tuberosa L. Butterfly-weed. Nelson & Weber (103), 6/15/75; Redfearn (38902), 5/24/75. ASCLEPIADACEAE.
- Asclepias verticillata L. Whorled Milkweed. Redfearn (38891), 6/24/75. ASCLEPIADACEAE.
- Asclepias viridiflora Raf. var. lanceolata (Ives) Torr. Green Milkweed. Nelson & Weber (52), 5/13/75; Redfearn (38882, 38902), 6/24/75. ASCLEPIADACEAE. *
- Aster X amethystinus Nutt. Aster. Weber (5615), 9/8/78. COMPOSITAE. *
- Aster azureus Lindl. var. azureus. Azure Aster. Redfearn (32743) & Weber, 9/17/81. COMPOSITAE. *
- Aster vimineus Lam. var. subdumosus Wieg. Frost Flower. Weber (5601), 9/8/78. COMPOSITAE. *
- Antirrhinum mexicanum A. D.C. var. trichocalyx Plum. Nelson (15), 4/27/75. LEGUMINOSAE.
- Baptisia leucantha T. & G. White false Indigo. Nelson & Weber (75), 6/15/75. LEGUMINOSAE.
- Baptisia leucophaea Nutt. var. leucophaea. Cream Long-bracted Wild Indigo. Nelson (19), 4/27/83. LEGUMINOSAE.
- Bidens polyplepis Blake. Tickseed Sunflower. Weber (5593), 9/8/78. COMPOSITAE. * WAT
- Bouteloua curtipendula (Michx.) Torr. Side Oats Grama. Budde (P40) Summer, 1978. POACEAE.
- Bromus comutatus Schrad. Hairy Chess. Budde, Summer, 1978. POACEAE.
- Bromus japonicus Thunb. Japanese Brome. Budde (P20) 6/3/78. POACEAE.
- ✓ Buchnera americana L. Blue Hearts. Weber (5614), 9/8/78; Redfearn (38895), 6/24/75. SCROPHULARIACEAE. *

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 Arctostaphylos

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 Arctostaphylos

- Dodecatheon canadense* L. Shooting Star. Nelson & Weber (17), 4/27/75; Reinking & Hilton (85,86), 4/25/77. PRIMULACEAE.
- Oxalis* ~~*Echinacea parviflora*~~ (Norton) Britt. Yellow Coneflower. Nelson & Weber (97), 6/15/75. COMPOSITAE.
- Echinacea pallida* Nutt. Pale Purple Coneflower. Redfearn (38698), 6/24/75; Nelson & Weber (106), 6/15/75. COMPOSITAE.
- Eleocharis compressa* Sulliv. Flatstem Spike Rush, Nelson & Weber (63), 5/13/75. CYPERACEAE.
- Silybum laciniatum* L. Wild Rye. Budde (P27), 6/23/78. POACEAE.
- Eragrostis spectabilis* (Pursh) Steud. Purple Love Grass. Budde, 9/1/78. POACEAE.
- Eriogonum strigosum* Muhl. var. *strigosum* Redfearn (38904), 6/24/75. COMPOSITAE.
- Eryngium yuccifolium* Michx. var. *yuccifolium* Rattlesnake Master. Nelson & Weber (106), 6/15/75; Eubatorium *serotinum* Michx. Late Boneset. Weber (5608), 9/8/78. COMPOSITAE.
- Festuca elatior* L. Meadow Fescue. Nelson & Weber (50), 5/3/75; Budde (P10), 6/3/78. POACEAE.
- Festuca parviflora* Desv. Fescue. Budde (P33), 7/7/78. POACEAE. *
- Fragaria virginiana* Duchesne. Wild Strawberry. Nelson (27), 4/27/75. ROSACEAE. *
- Galium aparine* L. Bedstraw, Cleavers. Weber (6399), 6/5/83. RUBIACEAE.
- Galium obtusum* Bigel. Bedstraw. Weber (6398), 6/5/83. RUBIACEAE. *
- Gaura biennis* L. var. *biennis*. Biennial Gaura. Weber (5595), 9/8/78. ONAGRACEAE.
- Gentiana puberula* Michx. Downy Gentian. Timme (642), 12/2/80. GENTIANACEAE. *
- Gerardia tenuifolia* Vahl. Gerardia. Weber (5596), 9/8/78. SCROPHULARIACEAE. *
- Geum vernum* (Ref.) T. & G. Early Water Avens. Nelson (20), 4/7/75. ROSACEAE.
- Gleditsia triacanthos* L. Honey Locust. Weber (6411), 6/5/83. LEGUMINOSAE.
- Glyceria striata* Fowl Meadow Grass. Nelson & Weber (70), 5/22/75; Budde (P17), 6/3/78. POACEAE.
- Gutierrezia dracunculoides* (DC) Nutt. Broom Snakeroot. Redfearn (32741) & Weber, 9/17/81. COMPOSITAE.
- Habenaria lasera* (Michx.) Lodd var. *lasera*. Ragged Orchid. Weber (6393), 6/5/83. ORCHIDACEAE. *
- Helenium autumnale* L. var. *parviflorum* (Nutt.) Fern. Autumn Sneezeweed. Weber (5591), 9/8/78. COMPOSITAE. *
- Helianthus grosseserratus* Martens. Sawtooth Sunflower. Weber (5592), 9/8/78. COMPOSITAE.
- Helianthus occidentalis* Riddell. Sunflower. Weber (5603), 9/8/78. COMPOSITAE.
- Hypericum perforatum* L. Common St. John's Wort. Redfearn (38877), 6/24/75. HYPERICACEAE. *
- Hypericum punctatum* L. St. John's Wort. Nelson & Weber (98), 6/15/75. HYPERICACEAE.
- Hydroxys hirsuta* (L.) Coville. Yellow Star-grass. Nelson (30), 4/27/75. AMARYLLIDACEAE.
- Juncus acuminatus* Michx. Knotty-leaved Rush. Nelson & Weber, 5/13/75. JUNCACEAE. *
- Juncus brachycaucus* Engelm. Short-fruited Rush. Nelson & Weber (88) 5/22/75; Redfearn (38880), 6/24/75. JUNCACEAE.
- Juncus dudleyi* Wieg. Rush. Nelson & Weber (38), 5/13/75. JUNCACEAE.
- Juncus interior* Wieg. Rush. Nelson & Weber (77), 5/22/75. JUNCACEAE.
- Juniperus virginiana* L. Red Cedar. Weber (6409), 6/5/83. CUPRESSACEAE.
- Koeleria cristata* (L.) Pers. Crested Hair Grass. Nelson & Weber (71), 5/22/75; Budde, Summer, 1978. POACEAE. *

- ✓ *Kuhnia eugatorioides* L. False Boneset. Weber (5602), 9/8/78. COMPOSITAE.
- Leersia coryzoides* (L.) Sw. Ricecut Grass. Budde, 9/7/78. POACEAE.
- Leersia virginica* Willd. White Grass. Budde, 9/1/78. POACEAE.
- Lepidoloma cognatum* (Schultes) Chase Fall Witch Grass. Budde (P30), 7/7/78. POACEAE.
- Lespedeza cuneata* (Dumont) G. Don. Sericea Lespedeza. Weber (5606), 9/8/78. LEGUMINOSAE.*
- Liatris aspera* Michx. Prairie Blazing-star. Weber (5612), 9/8/78; Redfearn (32742) & Weber, 9/17/81. COMPOSITAE.
- Liatris scynostachya* Michx. Prairie Blazing-star. Weber (5590), 9/8/78. COMPOSITAE.
- Linum sulcatum* Riddell. Flax. Redfearn (38906), 6/24/75; Weber (5607), 9/8/78. LINACEAE.
- Lithospermum canescens* (Michx.) Lehm. Orange Puccoon. Nelson & Weber (2), 4/12/75; Reinking & Hilton (82), 4/25/75. BORAGINACEAE.
- Lobelia siphilitica* L. Blue Cardinal Flower. Weber (5618), 9/8/78. LOBELIACEAE.
- Lobelia spicata* Lam. Spike Lobelia. Nelson & Weber (46), 5/13/75; Redfearn (3893), 6/24/75. LOBELIACEAE.
- Lolium multiflorum* Lam. Italian Rye-grass. Nelson & Weber (89), 2/22/75. *
- Lonicera japonica* Gray. Honeysuckle. Weber (6407), 6/5/83. CAPRIFOLIACEAE. *
- Lythrum alatum* Pursh. Winged Loosestrife. Nelson & Weber (102), 6/15/75. LYTHRACEAE.
- Morus alba* L. White Mulberry. Weber (6413), 6/5/83. MORACEAE. *
- Myosotis virginica* (L.) BSP. Forget-me-not. Nelson & Weber (62), 5/13/75. BORAGINACEAE.
- Nothoscordum bivalve* (L.) Britton. False Wild Garlic. Nelson & Weber (1), 4/12/75. LILIACEAE.
- Oenothera linifolia* Nutt. Sundrops. Nelson & Weber (56), 5/13/75. ONAGRACEAE.
- Oenothera racemosa* Nutt. (Oenothera missouriensis Sims) Missouri Evening Primrose. Nelson & Weber (66), 5/22/75. ONAGRACEAE.
- Orbanche uniflora* L. Broom rape. Weber (37), 5/6/75. ORBANCHACEAE
- Oxalis violacea* L. Purple Oxalis. Nelson (33), 5/1/75. OXALIDACEAE
- Panicum agrostoides* Spreng. Panic Grass. Budde, 8/9/78, 9/7/78. POACEAE.
- Panicum anceps* Michx. Panic Grass. Budde, (P 39, 50), Summer, 1978. POACEAE.
- Panicum flexile* (Gattinger) Scribn. (anic Grass. Budde (P 65), 9/1/80. POACEAE.
- Panicum lanuginosum* Ell. Woolly Panic Grass. Budde (P70), 10/1/78. POACEAE.
- Panicum linearifolium* Scribn. Narrow-leaved Panic Grass. Nelson & Weber (54), 5/13/75. POACEAE.
- Panicum sclibnetianum* Panic Grass. Budde (P9), 6/3/78. POACEAE.
- Panicum sphaerocarpon* Ell. Roundseed Panic Grass. Redfearn (38886) 6/24/75; Budde (P 7) 6/3/78. POACEAE.
- Panicum virgatum* L. Switchgrass. Budde (P47), Summer, 1978. POACEAE.
- Parthenium hispidum* Raf. American Feverfew. Nelson & Weber (55), 5/13/75; Redfearn (38900), 6/24/75.
- Paspalum laeve* Michx. Field Paspalum. Budde (P43), Summer, 1978. POACEAE.
- Pedicularis canadensis* L. Prairie Betony. Nelson & Weber (31), 4/27/75; Reinking & Hilton (84), 4/25/77. SCROPHULARIACEAE. *
- Pentstemon tubaeformis* Nutt. Beard-tongue. Nelson & Weber (79), 5/22/75. SCROPHULARIACEAE.
- Petalostemon candidum* (Willd.) Michx. White Prairie Clover. Redfearn (38889), 6/24/75. LEGUMINOSAE.

- Phleum pratense* L. Timothy. Budde (P12), 6/3/78. POACEAE.
Physalis virginica Mill. Ground Cherry. Weber (6417), 6/5/83. SOLANACEAE.
~~*Physostegia angustifolia* Fern. Dragonhead. Redfearn (38890), 6/24/75. LABIATAE. *~~
~~*Physostegia virginiana* (L.) Benth. False Dragonhead. Nelson & Weber (94), 6/15/75. LABIATAE.~~
~~*Plantago aristata* Michx. Bracted Plantain. Redfearn (38888), 6/24/75. PLANTAGINACEAE.~~
~~*Plantago virginica* L. Hoary Plantain. Nelson & Weber (40), 5/14/75. PLANTAGINACEAE.~~
~~*Poa compressa* L. Canada Bluegrass. Budde (P11), 6/3/78. POACEAE.~~
~~*Polygala incarnata* L. Milkwort. W.R. Weber & Phil and Esther Barnhart, 9/5/82. POLYGALACEAE. *~~
~~*Polygala sanguinea* L. Milkwort. Redfearn (38894), 6/24/75. POLYGALACEAE.~~
~~*Polytaenia nuttallii* D.C. Prairie Parsley. Nelson & Weber (64), 5/13/75. APIACEAE.~~
~~*Potentilla cecta* L. Rough-fruited Cinquefoil. Weber (6396), 6/5/83. ROSACEAE.~~
~~*Potentilla simplex* Michx. Cinquefoil. Nelson & Weber (48), 5/13/75. ROSACEAE.~~
~~*Prenanthes aspera* Michx. Rough White Lettuce. Weber (5598), 9/8/78; Redfearn (32740) & Weber, 9/17/81. COMPOSITAE. *~~
~~*Prunella vulgaris* L. Self-heal. Nelson & Weber (91), 5/22/75. LABIATAE.~~
~~*Prunus americana* Marsh. Wild Plum. Nelson (24), 5/27/75. ROSACEAE.*~~
~~*Prunus serotina* Ehrh. Wild Black Cherry. Weber (6414), 6/5/83. ROSACEAE.~~
~~*Psoralea esculenta* Pursh. Prairie Turnip. Nelson & Weber (73), 5/22/75. LEGUMINOSAE. *~~
- ~~*Psoralea descalioides* (Walt.) Cory. var. *glandulosa* (Elli.) Freeman. Sampson's Snakeroot. Nelson & Weber (83), 5/22/75. LEGUMINOSAE.~~
~~*Psoralea tenuifolia* Pursh. var. *floribunda* (Nutt.) Rydb. Scurfy Pea. Weber (6422), 6/5/83. LEGUMINOSAE. *~~
~~*Pycus communis* L. Pear. Nelson (25), 4/27/75. ROSACEAE.*~~
~~*Ranunculus abortivus* L. Small-flowered Crowfoot. Nelson & Weber (12), 4/20/75. RANUNCULACEAE.~~
~~*Ranunculus fascicularis* Muhl. Prairie Buttercup. Nelson (28), 4/27/75. RANUNCULACEAE.~~
~~*Ratibida pinnata* (Vent.) Barnh. Grayhead Coneflower. Redfearn (38875), 6/24/75. COMPOSITAE.~~
~~*Rhamnus caroliniana* Walt. Carolina Buckthorn. Weber (6415), 6/5/83. RHAMNACEAE.~~
~~*Rhamnus lanceolata* Pursh. Buckthorn. Weber (6416), 5/6/83. RHAMNACEAE.~~
~~*Rhus copallina* L. Winged or Dwarf Sumac. Weber (6404), 6/5/83. ANACARDIACEAE.~~
~~*Rhus glabra* L. Smooth Sumac. Weber (6412), 6/5/83. ANACARDIACEAE.~~
~~*Ribes missouriense* Nutt. Missouri Gooseberry. Weber (6410), 6/5/83. SAXIFRAGACEAE.~~
~~*Rosa carolina* L. Wild Pasture Rose. Nelson & Weber (75), 5/22/75. ROSACEAE.~~
~~*Rosa multiflora* Thunb. Japanese Rose. Nelson & Weber (81), 5/22/75. ROSACEAE. *~~
~~*Rosa setigera* Michx. Prairie Rose. Nelson & Weber (93), 6/15/75. ROSACEAE.~~
~~*Rubus enslenii* Tratt. Dewberry. Weber (6394), 6/5/83. ROSACEAE. *~~
~~*Rubus* sp. Bramble. Nelson & Weber (47), 5/13/75. ROSACEAE.~~
~~*Rudbeckia fulvida* Ait. var. *speciosa* Coneflower. Weber (5616), 9/8/78. COMPOSITAE.~~

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- Schrankia uncinata* Willd. Sensitive Brier. Nelson & Weber (74), 5/22/75; Redfearn (38903), 6/24/75. LEGUMINOSAE. *Solanum carolinense* L. Horse Nettle. Weber (5613), 9/8/78. SOLANACEAE.
- Scirpus atrovirens* Willd. Bulrush. Nelson & Weber (58, 105), 5/13/75, 6/15/75. CYPERACEAE. *Solidago altissima* L. Tall Goldenrod. Weber (5611), 9/8/78. COMPOSITAE. *
- Scirpus lineatus* Michx. Bulrush. Redfearn (38885) ✓ 6/24/75. CYPERACEAE. *Solidago gymnospermoides* (Greene) Fern. Goldenrod. Weber (5604), 9/8/78. COMPOSITAE.
- Scleria triglomerata* Michx. Nutrush. Nelson & Weber (90), 5/22/75. CYPERACEAE. *Solidago missouriensis* Nutt. Missouri Goldenrod. Weber (5610), 9/8/78. COMPOSITAE.
- Scutellaria parvula* Michx. Small Skullcap. Nelson & Weber (44), 5/13/75. LABIATAE. *Solidago nemoralis* Ait. Gray Goldenrod. Weber (5009), 9/8/78. COMPOSITAE.
- Senecio diatensis* Nutt. Prairie Ragwort. Reinking (87) & Hilton, 4/25/77. COMPOSITAE. *Solidago rigida* L. Stiff Goldenrod. Weber (5589, 5617), 9/8/78. COMPOSITAE.
- Setaria geniculata* (Lam.) Beauv. Prairie Foxtail. Redfearn (38876), 6/24/75; Budde (P 25), 6/23/78. Poaceae. *Sorghastrum nutans* (L.) Nash. Indian Grass. Budde (P 74), 10/1/78. POACEAE.
- Sisyrinchium campestris* Bickn. Blue-eyed Grass. Nelson (18), 5/27/75. IRIDACEAE. *Spartina dectinata* Link. Slough Grass. Budde (P41), 7/29/78. POACEAE.
- Silchium laciniatum* L. Compass Plant. Redfearn & Weber, 5/25/83. COMPOSITAE. *Sphenopholis obtusata* (Michx.) Scribn. Wedge Grass. Budde (P24a), 6/9/78. POACEAE.
- Ruellia humilis* Nutt. var. *longiflora* (Gray) Fern. Wild Petunia. Redfearn (38887), 6/24/75. ACANTHACEAE. * *Sporobolus asper* (Michx.) Kunth. Tall Dropseed. Budde (P 71), 10/1/78. POACEAE.
- Rumex acetosella* L. Sheep Sorrel. Nelson (16), 5/27/75. POLYGONACEAE. *Sporobolus heterolepis* Gray. Prairie Dropseed. Budde, (6406), 6/5/83. CARYOPHYLLACEAE.
- Rumex crispus* L. Sour Dock. Nelson & Weber (84), 5/22/75. POLYGONACEAE. *Symphoricarpos orbiculatus* Moench. Buckbrush. Weber & Weber (80), 5/22/75. ANACARDIACEAE.
- Sassafras albidum* (Nutt.) Nees. Sassafras. Nelson & Weber (5), 5/20/75. LAURACEAE. *Thaspium trifoliatum* (L.) Gray var. *flavum* Blake. Meadow Parsnip. Weber (35), 5/6/75; Nelson & Weber (39), 5/13/75. APIACEAE.
- Sanicula canadensis* L. Black Snakeroot. Weber (6423), 6/5/83. APIACEAE. *Toxicodendron radicans* (L.) Kuntze. Poison Ivy. Nelson & Weber (80), 5/22/75. ANACARDIACEAE.
- Schizachyrium scoparium* (Michx.) (Andropogon scoparius). Little Bluestem. Budde (P72), 10/1/78. POACEAE. *Tridens flavus* Purpletop. Budde (P 73), 10/1/78. POACEAE.

