AN ABSTRACT OF THE THESIS OF

Tim Hayes for Master of Science

in Biology presented on August 7, 1981

Title: A Floristic Analysis of Ross Natural History Reservation Vegetative Units

Abstract approved: Dwight L. Spencer

A vegetation study was conducted on 200 acres of the Ross Natural History Reservation (RNHR) from May 20 to July 24, 1978. The study included analysis of physical and vegetative characteristics of each of the 23 vegetation units identified on RNHR; past history of management practices employed, if any, in each unit were considered in the analysis. A species list was compiled for each unit, and abundance of each species was visually determined and expressed as a percentage of ground covered by the respective plant type. A map of RNHR showing vegetation units and their boundaries was prepared from field observations and aerial photographs. RNHR acreage was divided into native grassland units and abandoned cropland units. Native grassland units contained a greater number of grass species than did abandoned cropland units. Native grassland units also contained the highest number of woody species, especially in units in which management practices were deferred. Abandoned cropland units exhibited the least amount of woody species invasion. Absence of optimum light conditions beneath shrubby species appeared to have resulted in a change in ground flora from prairie grasses and forbs to species commonly found in woodland habitats.

A FLORISTIC ANALYSIS OF ROSS NATURAL HISTORY RESERVATION VEGETATIVE UNITS

A Thesis
Presented to
the Division of Biological Sciences
Emporia State University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by
Tim Hayes
August 1981

ACKNOWLEDGEMENTS

The author wishes to express his gratitude to Dr. Dwight L. Spencer, who served as major advisor for this study. I would also like to thank Mr. H. A. "Steve" Stephens who shared both his profound knowledge of plants and friendship throughout the course of this study, and Dr. John Ransom who served on my committee.

To the following people I wish to express my sincere appreciation and thanks: Mr. Leonard Jurgens, Lyon County Soil Conservation Service; Dr. A. W. Kuchler, The University of Kansas; and Lt. Col. Richard Daniell, Nebraska Air National Guard.

Special thanks go to my wife, Cindy, for her moral support and understanding.

The study was funded through the H. A. Stephens Ross Reservation Assistantship. The financial support was sincerely appreciated.

TABLE OF CONTENTS

PAGE

LIST OF FIGURES

INTRODUCTION

The Ross Natural History Reservation (RNHR) is a 1,040 acre tract of land made available to Emporia State University by F. B. and Rena G. Ross in November, 1958. Two hundred acres of the original tract were deeded to the State of Kansas and became part of the ESU campus in January, 1961. This 200 acre tract of land, known locally as "The Reservation" is one of the principle sites in use by the University for field research, and is the subject of this study.

Located in western Lyon County, Kansas, approximately four miles west of Americus (Figure 1), RNHR lies in two sections as follows (Spencer, 1981).

T18; R10 - The E half of the SE quarter of Section 7.

- The W half and NE quarter of the SW quarter of Section 8.

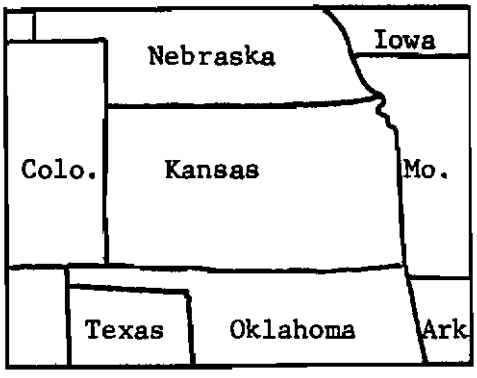

Figure 1. Approximate location of RNHR in relation to Kansas and neighboring states

RNHR is situated in a level to gently rolling bluestem prairie, broken by shallow limestone ridges and outcrops (Breukelman, et al., 1961).

Surface water is provided by a small intermittent stream, several

natural springs, and three ponds constructed to enhance wildlife habitat.

Mean climatic conditions at RNHR (Flora, 1945) are as follows:

1. Annual mean precipitation is 35.27 inches.

2. Mean length of growing season is 187 days, with 72 percent of annual precipitation occurring during this period (Wilson, 1961). October 18 and April 14 are average dates of first and last killing frosts, respectively.

3. Mean mid-day and early-evening relative humidities range from 45 to 50 percent in summer months, and up to 72 percent in winter months.

4. Annual mean temperature is 55° F., and mean temperatures for July and January are 79° F. and 31° F., respectively.

5. Elevation at RNHR ranges from 1,200 to 1,250 feet.

6. Mean wind velocity is 9.2 miles per hour.

RNHR is located in the Osage Cuestas division of the Osage Plains soil section which is bordered on the west by the Flint Hills Upland. The Osage Cuestas division is characterized by many escarpments consisting of hard limestones (Barber, 1974). Between these escarpments are gently rolling hills and plains formed by erosion of softer shales and sandstones. Soils are calcareous in nature, and usually shallow over a limestone bedrock (Figure 2 and Table 1).

RNHR vegetation is a typical remnant of the True Prairie Association described by Weaver (1954). Warm and cool season grasses are mixed with prairie forbs on hillside and gently sloping areas. Rocky areas and ravines contain woody shrubs and trees. Prior to 1960, all of the Reservation had been grazed or cultivated to some extent. Since

1960 various management practices have been employed and virtually all portions of the Reservation can be divided into one of two categories based on past land use practices: 1. native grass tracts - areas that were grazed, but never plowed. These areas now exhibit a vegetative cover composed primarily of native grasses and forbs; and 2. abandoned cropland tracts - areas that have at one time been under cultivation and now exhibit a vegetation brought about by succession or reseeding to legumes and non-native cool season grasses (Spencer, 1981).

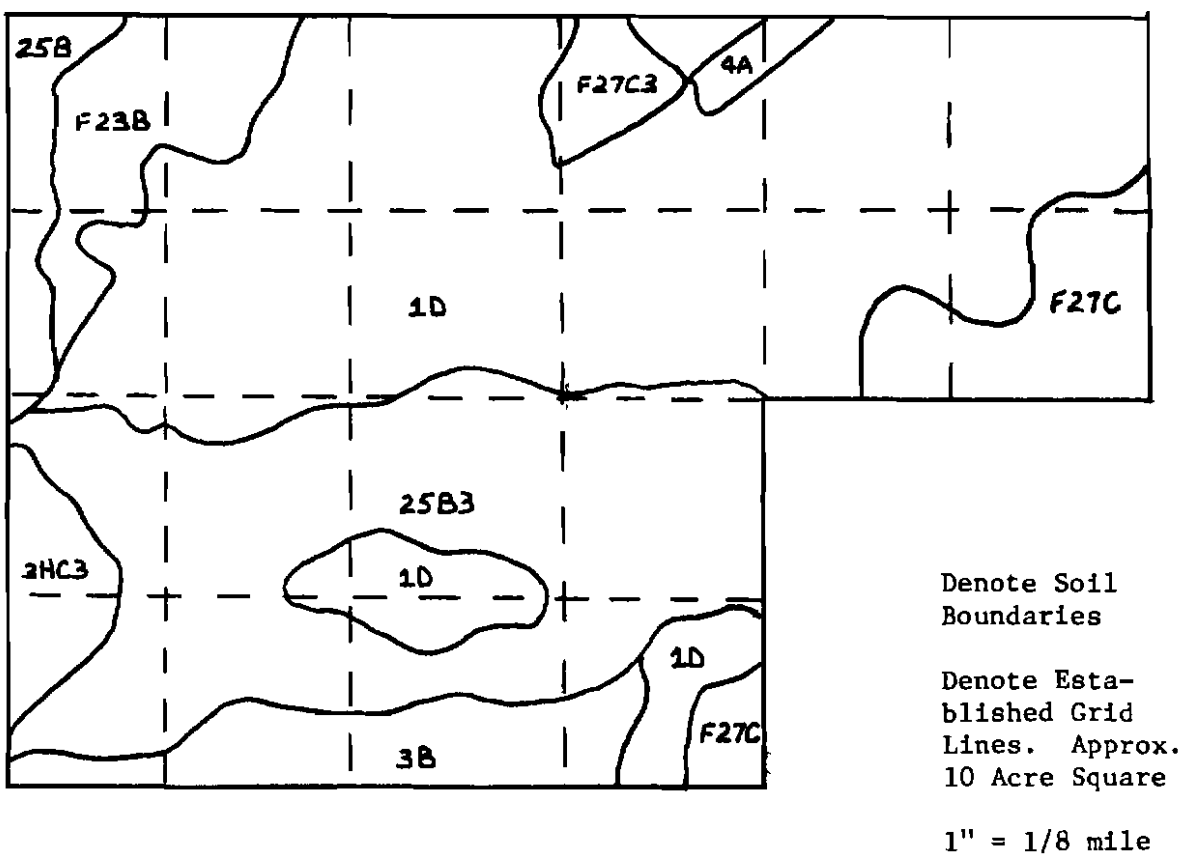

Figure 2. RNHR Soil Associations (after Neil, 1976). (See Table I for soil symbols, soil names and range site descriptions).

Table I. Soil Symbols, Soil Names, and Range Sites of the RNHR (after Barber, 1974)

Soil Symbol	Soil Name	Range Site
3B	Labette Dwight Complex	Loamy Upland-Claypan
F23B	Labette Silty Clay Loam	Loamy Upland
1D	Clime Sogn Complex	Limy Upland-Shallow Limy
3HC3	Clime Silty Clay Eroded	Limy Upland
25B	Irwin Silty Clay Loam	Clay Upland
25B3	Irwin Silty Clay Loam Eroded	Claypan
F27C	Summit Silty Clay Loam	Loamy Upland
F27C3	Summit Silty Clay Loam Eroded	Loamy Upland
4A	Ivan Silty Loam	Loamy Lowland

General descriptions of soil types common to RNHR follow Barber (1974):

3B - The Labette Dwight Complex, one to three percent slope, occurs throughout approximately five percent of RNHR, and is located above the limestone outcrops. The Labette soil is a silty clay loam which has a low to moderate water holding capacity. The Dwight Silt Loam takes in and releases water slowly to vegetation. Labette soils favor tall grass growth, whereas Dwight soils support mid and short grasses.

F23B - Labette Silty Clay Loam, one to three percent slope, comprises approximately five percent of RNHR, and is found as a narrow band with a soil depth between 15 and 20 inches. Labette soils take on water readily, but storage capability is limited by the soil depth. Limestone is the underlying parent material.

1D - Clime Sogn Complex, five to 20 percent slope, forms approximately 50 percent of the total soil area on the Reservation. Found in this complex are Clime Silty Clay, Sogn Silty Clay Loam, and rocky outcrops. Soils in this complex are subject to minor erosion, and water

permeability is dependent on vegetative cover. Soils usually average less than 10 inches in depth and exposed areas of limestone rock are common.

3HC3 - Clime Silty Clay Eroded, three to seven percent slope, comprises approximately three percent of RNHR. This association has the basic characteristics of the Clime series, however, the surface layer has been thinned due to erosion. These soils lack the productivity of the less eroded Clime soils, and surface crusting can be observed.

25B - Irwin Silty Clay Loam, one to four percent slope, forms approximately three percent of the 200 acre study site. This soil type is located near the top of an upland ridge and consists of moderately well drained, nearly level to gently sloping soils. Erosion from wind and water are common.

25B3 - Irwin Silty Clay Loam Eroded, three to seven percent slope, comprises 20 to 25 percent of the study site. These soils are found on level to gently sloping hillsides, and near the tops of upland ridges. The soil profile is similar to the Irwin series except the surface layer has been thinned by erosion. Soils are usually about five inches thick, and lack the productivity of less eroded Irwin soils. Terracing and contour farming are considered beneficial management practices on these soils, and terraces can be observed on RNHR in grid B-49 (Appendix A).

F27C - Summit Silty Clay Loam, one to three percent slope, occurs on less than five percent of the Reservation. Upland soils are deep and well drained. Soils are formed from material weathered from shale or sediments of similar nature. The Summit series is found on gentle slopes,

mostly below limestone outcrops. Water holding capacity is high, and the soil takes on water easily.

F27C3 - Summit Silty Clay Loam Eroded, two to six percent slope, is observed on less than three percent of RNHR. These soils have characteristics similar to the Summit series, except that the surface layer is somewhat thinned by erosion. Soils of this type possess a high water holding capacity, although water percolates slowly. Shallow gullies are often formed as a result of rapid runoff wherever sloping occurs in these soil types.

4A - Ivan Silty Loam, zero to two percent slope, comprises only one percent of the soil area on RNHR. This soil type is located near a small stream and is formed from silty, calcareous alluvium. Ivan soils have a moderate permeability, high water capacity, and are usually deep and well drained.

The purpose of this study was to prepare a vegetation map showing the major plant associations and their boundaries on RNHR, and the floral composition of each association.

This study was justified for the following reasons:

1. RNHR is principally composed of land that has undergone significant management practices in past years. By establishing a record of how the vegetation had reacted to these practices, their effectiveness can be evaluated.

2. By repeating in the future the procedure outlined in the METHODS AND MATERIALS section, general trends in plant succession may be observed.

3. A vegetation map and analysis of the major plant associations on RNHR would prove beneficial to visitors, and provide a reference source for future research.

METHODS AND MATERIALS

Methods used in preparing a map of vegetative units and their boundaries followed, in part, the procedure outlined by Kuchler, 1967.

Vegetative boundaries were determined by visual field observation and from aerial photographs. A vegetative boundary is a line between two vegetation types (Kuchler, 1967). In order to determine boundaries between vegetation types at any given point, visually observed differences were noted on a RNHR map by drawing a line that separated the types. Correct placement of lines (boundaries) was verified by comparing their placement on the map with vegetation differences that were visible on the aerial photographs. Aerial photographs were supplied by the Nebraska Air National Guard in June, 1977. Boundary locations were periodically checked throughout the 1978 growing season to insure proper placement.

The terms "vegetation unit" or "unit" describe the land area within an individual vegetative boundary. Analyses of vegetation units were conducted by treating each unit individually. Each vegetation unit was evaluated using the following procedures:

1. First noted were the physical features of each vegetation unit; elevation, slope, ravines and rocky outcrops were observed and recorded.

2. Areas which contained conspicuous differences in vegetation and species in relatively dense stands were noted. Since such occurrences on RNHR were usually related to past management practices, it was necessary to record man's effect on each vegetative unit. Information of this type had been recorded since the late 1940's and was obtained from Spencer (1981).

3. A general view of vegetative characteristics was obtained by traversing, on foot, each unit and noting commonly occurring species. A list of plant species and their relative abundance was prepared by repeatedly traversing each vegetative unit. The resulting species list does not represent a complete listing of all species present, but rather a list compiled after traversing each vegetative unit at approximate six foot intervals. Unknown species were tagged and later identified through the use of the RNHR herbarium, and with the help of H. A. Stephens. Plant nomenclature was obtained from the Atlas of the Flora of the Great Plains (Barker and Barkley, 1977).

4. Plant coverage was determined by visual observation and expressed as a percentage of ground covered by the respective plant type. Because of the overlayering of different species, total percent coverage for an area may exceed 100% (Chapman, 1976). This percentage was further designated by a capital letter to denote density of a particular species in a vegetation unit (Table II).

Table II. Symbols used to denote various percentage ranges of species density in vegetation units.

Symbol		Percent Range
A	=	>75%
B	=	50-75%
C	=	25-50%
D	=	6-25%
E	=	1- 5%
F	=	<1%

Preparation of a species list and determination of species coverage was carried out during the growing season from May 20 to July 24, 1978.

A map of the vegetation units and boundaries was prepared as Appendix A, Fig. 3.

RESULTS AND DISCUSSION

A total of 23 vegetation units was identified on the Ross Natural History Reservation. A list of commonly occurring plants in each unit was compiled and relative abundance of each species was estimated and recorded as a percentage of the unit's total vegetation. In the following analyses of vegetation units, a species list for each unit is presented and percent coverage of each species is noted. Following each species list is a brief history of management practices, if any, applied in the unit, and the most conspicuous plant associations and their relationships are noted.

UNIT 1

Unit 1 (Table III) included a heavily wooded area in the southern portion of grid A-43, and the southern and eastern portion of grid A-44 (Appendix A).

It seemed apparent that woody vegetation in Unit I originated from a northward emigration of woody species along a ravine located immediately south of grids A-43 and A-44. In the late 1950's, black locust, black walnut, American elm and some small shrubs were growing along the fenced southern boundary of grids A-43 and A-44.

Unit 1 appeared as a dense stand of woody vegetation immediately south of a small pond constructed in the fall of 1977.

The major portion of Unit I was dominated by mature stands of black locust and black walnut. Several small black locust trees were becoming established north of Unit 1 in the open prairie of Unit 2. It seemed apparent that black walnut growing in the shade of short-lived black locust were beginning to compete for available sunlight and would eventually replace the dominant black locust in the main portion of Unit 1.

Table III. Scientific and vernacular names of the most commonly occurring plant species in Unit 1. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Acer negundo L. - Box Elder	E
Agastache nepetoides (L.) Ktze. - Yellow Giant Hyssop	E
Ambrosia artemisiifolia L. - Common Ragweed	E
Ambrosia psilostachya DC. - Western Ragweed	E
Ambrosia trifida L. - Giant Ragweed	D
Arctium minus (Hill) Bernh. - Common Burdock	E
Asclepias viridis Walt. - Green Antelopehorn	E
Bromus inermis Leyss. - Smooth Brome	B
Bromus japonicus Thunb. - Japanese Brome	D
Celtis occidentalis L. - Hackberry	E
Cirsium altissimum (L.) Spreng. - Tall Thistle	D
Convolvulus arvensis L. - Field Bindweed	E
Cornus drummondii Meyer - Roughleaved Dogwood	D
Fraxinus pennsylvanica Marsh. var. subintegerrima (Vahl) Fern. - Green Ash	E
Galium aparine L. - Bedstraw	E
Geum canadense Jacq. - White Avens	E
Gleditsia triacanthos L. - Honey Locust	F
Helianthus maximiliani Schrad. - Maximilian Sunflower	E
Hordeum pusillum Nutt. - Little Barley	F
Juglans nigra L. - Black Walnut	E
Juniperus virginiana L. - Red Cedar	F
Maclura pomifera (Raf.) Schneid. - Osage Orange	E
Morus alba L. - White Mulberry	E
Muhlenbergia cuspidata (Torr. in Hook.) Rydb. - Plains Muhly	D
Opuntia macrorhiza Engelm. - Prickly Pear	F
Oxalis stricta L. - Yellow Wood Sorrel	E
Panicum virgatum L. - Switchgrass	E
Parietaria pennsylvanica Muhl. - Pellitory	E
Parthenocissus quinquefolia (L.) Planch. - Virginia Creeper	D
Phytolacca americana L. - Pokeweed	E
Poa compressa L. - Canada Bluegrass	E
Prunus americana Marsh. - Wild Plum	F
Psoralea tenuiflora Pursh. var. floribunda (Nutt.) Rydb. - Wild Alfalfa	E
Rhus aromatica Ait. - Fragrant Sumac	E
Rhus glabra L. - Smooth Sumac	E
Ribes missouriense Nutt. - Wild Gooseberry	E
Robinia pseudo-acacia L. - Black Locust	D
Rosa arkansana Porter. - Prairie Rose	E
Ruellia strepens L. - Wild Petunia	E

Table III. (Continued)

Percent Species	Percent Coverage
Sambucus canadensis L. - Common Elderberry	E
Sanicula canadensis L. - Black Snakeroot	D
Smilax hispida Muhl. - Bristly Greenbriar	E
Solidago missouriensis Nutt. - Goldenrod	D
Symphoricarpos orbiculatus Moench - Buckbrush	B
Teucrium canadense L. - Wood Sage	E
Thlaspi arvense L. - Field Penny Cress	E
Toxicodendron radicans (L.) O. Ktze. - Poison Ivy	E
Tragopogon dubius (L.) Scop. - Salsify	F
Ulmus americana L. - American Elm	E
Vernonia baldwini Torr. - Ironweed	E
Viola missouriensis Greene - Missouri violet	F

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

This assumption is supported by Harlow and Harrar, 1941.

The understory of Unit 1 was a mixture of small trees and shrubs. Hackberry, green ash, Osage orange, and American elm were mixed with roughleaved dogwood, buckbrush and wild plum.

The species composition of plant cover at or near ground level was dependent on the amount of light that filtered through the canopy (Humphrey, 1962). Areas where direct sunlight was present were dominated by grasses such as smooth brome and Canada bluegrass. Forbs included Maximilian sunflower and ironweed. Shaded areas exhibited pronounced growth of buckbrush, yellow giant hyssop, and black snakeroot.

The east-west fence row bordering Unit 1 was dominated by Osage orange and shrubs such as wild plum, roughleaved dogwood, buckbrush, smooth sumac, and fragrant sumac. This composition continued through the northern fence row on the east edge of grid A-44.

Several large green ash trees were located in the southeast corner of grid A-44. Their presence may be attributed to increased moisture content and lack of competition for available sunlight (Harlow and Harrar, 1958).

UNIT 2

Unit 2 (Table IV) was an open prairie area located in grids A-43, and A-44 (Appendix A). All of Unit 2 except for the eastern one-fourth, was a native grassland tract. The eastern one-fourth was plowed prior to 1950, and probably reseeded to smooth brome around 1948. Unit 2 had been protected from management practices until 1973, when procedures were implemented to inhibit the encroachment of woody vegetation into the area. Brush cutting occurred in the area in the fall of 1973, and throughout 1974. Unit 2 was burned in April of 1975, and a combination of herbicide application to woody species and grazing was employed in the spring and summer months of 1975 and 1976 to further inhibit the encroachment of woody vegetation (Spencer, 1981).

Because of these management practices, Unit 2 as of 1978, was an open grassland area, with woody species interspersed with native grasses and forbs.

Unit 2 appeared as a hillside prairie with the highest point in the north-central portion of the boundary. Gentle southeast and southwest slopes extended from the highest point in the unit. A rocky outcropping was located in the central portion of the unit, then turned abruptly north through the northwest portion of grid A-44. The lowest elevation in Unit 2 was the southeast corner.

Major grasses in Unit 2 were little bluestem and smooth brome, with tall dropseed, Indian grass, and big bluestem interspersed throughout

Table IV. Scientific and vernacular names of the most commonly occurring plant species in Unit 2. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Andropogon gerardi Vitman - Big Bluestem	D
Andropogon scoparius Michx. - Little Bluestem	C
Antennaria neglecta Greene - Pussy's Toes	E
Apocynum sibericum Jacq. - Indian Hemp	E
Artemisia ludoviciana Nutt. - White Sage	D
Asclepias viridis Walt. - Green Antelopehorn	E
Bidens frondosa (L.) BSP. - Stick Tight	E
Bouteloua curtipendula (Michx.) Torr. - Side Oats Grama	E
Bromus inermis Leyss. - Smooth Brome	C
Cacalia tuberosa Nutt. - Indian Plantain	E
Callirhoe alcaeoides (Michx.) Gray - Poppy Mallow	E
Carex lanuginosa Michx. - Sedge	D
Cirsium altissimum (L.) Spreng. - Tall Thistle	E
Cornus drummondii Meyer - Roughleaved Dogwood	E
Croton monanthogynus Michx. - Croton	E
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundle Flower	D
Desmodium canadense (L.) DC. - Tick Trefoil	D
Elymus virginicus L. - Virginia Wild Rye	E
Erigeron strigosus Muhl. - Daisy Fleabane	E
Helianthus maximiliani Schrad. - Maximilian Sunflower	D
Helianthus rigidus (Cass.) Desf. (P & S) - Rigid Sunflower	E
Lepidium densiflorum Schrad. - Pepper Grass	E
Lespedeza capitata Michx. - Lespedeza	E
Lespedeza stipulacea Maxim. - Korean Clover	E
Liatris punctata Hook. - Blazing Star	D
Monarda fistulosa L. - Horsemint	E
Opuntia macrorhiza Engelm. - Prickly Pear	E
Oxalis dillenii Jacq. - Yellow Wood Sorrel	E
Panicum oligosanthes Schult. var. scribnerianum (Nash) Fern. - Scribner's Panicum	E
Petalostemon candidum (Willd.) Michx. - White Prairie Clover	D
Physalis pumila Nutt. - Ground Cherry	E
Prunus americana Marsh. - Wild Plum	E
Rhus aromatica Ait. - Fragrant Sumac	E
Rhus glabra L. - Smooth Sumac	E
Ribes missouriense Nutt. - Wild Gooseberry	F
Robinia pseudo-acacia L. - Black Locust	F
Rosa arkansana Porter - Prairie Rose	D
Salvia pitcheri Torr. - Pitcher Sage	D
Scirpus lineatus Michx. - Bulrush	E

Table IV. (Continued)

Plant Species	Percent Coverage
Senecio plattensis Nutt. - Prairie Ragwort	E
Solanum carolinense L. - Horse Nettle	E
Solidago canadensis L. var. gilvocanescens Rydb. - Goldenrod	D
Sorghastrum avenaceum (Michx.) - Indian Grass	D
Sporobolus asper (Michx.) Kunth - Tall Dropseed	E
Sporobolus cryptandrus (Torr.) Gray - Sand Dropseed	D
Symphoricarpos orbiculatus Moench - Buckbrush	D
Tradescantia bracteata Small - Spiderwort	D
Ulmus americana L. - American Elm	F
Vernonia baldwini Torr. - Ironweed	E

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

the unit.

Dominant forbs present in Unit 2 included Maximilian sunflower, white prairie clover, white sage, and goldenrod.

Woody species which have persisted in spite of past management practices were: fragrant sumac, wild plum, rough leaved dogwood, buckbrush, and smooth sumac.

A dense stand of Indian grass occurred in approximately the eastern one-fifth of Unit 2. It appeared that Indian grass had invaded the reseeded smooth brome that formerly occupied the area. Supporting evidence indicated that Indian grass readily invaded disturbed areas and showed a preference for the increased moisture content of low lying areas (Weaver, 1954).

Established thickets of smooth sumac and rough leaved dogwood were located along a rocky outcropping found in the northcentral portion of the boundary. Establishment of these thickets along the outcropping may

be attributed to inability to adequately manage such an area by burning, and the supporting evidence of outcropping habitat preference offered by Weaver (1954).

UNIT 3

Unit 3 (Table V) consisted of grids A-37, except the southeast corner, and grids A-38, except the extreme northwest corner (Appendix A). Unit 3 was principally a native grassland tract, and had not been subjected to recent management practices. Foot trails were cleared through Unit 3 in 1975 and have been maintained yearly (Spencer, 1981).

Lack of management practices allowed this unit to develop into a shrubby, wooded area with small openings, and dense stands of woody shrubs.

Two limestone outcrops ran diagonally across Unit 3 forming a plateau from which slight southeast and northwest slopes originate. Situated on this plateau were thick stands of rough leaved dogwood, wild plum, smooth sumac, fragrant sumac, and buckbrush. Many mature trees were dispersed throughout the boundary and predominant species included American elm, red cedar, and hackberry.

Open areas located throughout Unit 3 contained prairie grasses and forbs similar to those in Unit 2. Little bluestem and Illinois bundleflower were the most frequently occurring species.

A slight change in the vegetation accompanying a change in soil type was observed in the southeastern corner of Unit 3. Many young black walnut trees, two through 10 meters in height, were becoming established north of the recent burn line of Unit 2, and within the Summit soil series. The deep, well drained Summit soils appeared to provide a more suitable habitat for the establishment of black walnuts than the shallow

Table V. Scientific and vernacular names of the most commonly occurring plant species in Unit 3. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Acer negundo L. - Box Elder	E
Achillea millefolium L. ssp. lanulosa (Nutt.) Piper - Yarrow	E
Allium canadense L. - Wild Garlic	F
Andropogon gerardi Vitman - Big Bluestem	E
Andropogon scoparius Michx. - Little Bluestem	C
Apocynum sibericum Jacq. - Indian Hemp	E
Artemisia ludoviciana Nutt. - White Sage	D
Asclepias tuberosa L. - Butterfly Milkweed	D
Astragalus crassicarpus Nutt. - Ground Plum	E
Baptisia leucophaea Nutt. - False Indigo	D
Bromus inermis Leyss. - Smooth Brome	E
Cacalia tuberosa Nutt. - Indian Plantain	D
Carex molesta Mackenz. - Sedge	E
Celtis occidentalis L. - Hackberry	E
Cirsium altissimum (L.) Spreng. - Tall Thistle	E
Cornus drummondii Meyer - Rough Leaved Dogwood	C
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundle Flower	D
Eleocharis sp.	D
Erigeron annuus (L.) Pers. - Daisy Fleabane	D
Erigeron strigosus Muhl. - Daisy Fleabane	D
Eupatorium altissimum L. - Tall Thoroughwort	E
Galium aparine L. - Bedstraw	E
Geum canadense Jacq. - White Avens	E
Helianthus maximiliani Schrad. - Maximilian Sunflower	D
Juglans nigra L. - Black Walnut	D
Juniperus virginiana L. - Red Cedar	E
Lepidium densiflorum Schrad. - Pepper Grass	D
Melilotus officinalis (L.) Lam. - Yellow Sweet Clover	D
Oenothera macrocarpa Nutt. - Missouri Primrose	D
Opuntia macrorhiza Engelm. - Prickly Pear	E
Panicum oligosanthes Schult. var. Scribnerianum (Nash) Fern. - Scribner's Panicum	E
Plantago major L. - Common Plantain	E
Polytaenia nuttallii DC. - Prairie Parsley	F
Prunus americana Marsh. - Wild Plum	D
Psoralea tenuiflora Pursh. var. floribunda (Nutt.) Rydb. - Wild Alfalfa	D
Pyrus communis L. - Pear	F
Rhus aromatica Ait. - Fragrant Sumac	D
Rhus glabra L. - Smooth Sumac	D
Rosa arkansana Porter - Prairie Rose	D
Sanicula canadensis L. - Black Snakeroot	E
Silphium lacinatum L. - Compass Plant	E

Table V. (Continued)

Plant Species	Percent Coverage
Smilax hispida Muhl. - Bristly Greenbriar	F
Sphenopholis obtusa (Michx.) - Scribn. Wedge Grass	D
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	D
Symphoricarpos orbiculatus Moench - Buckbrush	D
Teucrium canadense L. - Wood Sage	E
Toxicodendron radicans L. - Poison Ivy	E
Tradescantia bracteata Small - Spiderwort	E
Ulmus americana L. - American Elm	E
Vitis riparia Michx. - Riverbank Grape	F

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

rocky Clime soils. This assumption was further supported by Harlow and Harrar (1958).

A well established grove of mature trees was located on the plateau in the northeast portion of Unit 3. Green ash was the dominant species, and thickets of wild plum and rough leaved dogwood were also present.

Dense shade produced by shrubby thickets influenced species composition near or at the ground level (Humphrey, 1962). Where open areas were dominated by native grasses, such as little bluestem and Indian grass, shaded areas contained much poison ivy, white avens, and wood sage (Table V).

UNIT 4

Unit 4 (Table VI) was located in the extreme northwest corner of grid A-38 (Appendix A). Smooth Brome was the dominant vegetation.

Prior to 1950, Unit 4 was an abandoned cropland area and was probably reseeded to smooth brome in the late 1940's (Spencer, 1981). Fragrant sumac, smooth sumac, buckbrush, and a small honey locust tree were

Table VI. Scientific and vernacular names of the most commonly occurring plant species in Unit 4. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Asclepias viridis Walt. - Green antelopehorn	F
Baptisia leucophaea Nutt. - False Indigo	E
Bromus inermis Leyss. - Smooth Brome	B
Cornus drummondii Meyer - Rough Leaved Dogwood	E
Gleditsia triacanthos L. - Honey Locust	F
Helianthus maximiliani Schrad. - Maximilian Sunflower	E
Lactuca canadensis L. - Wild Lettuce	F
Rhus aromatica Ait. - Fragrant Sumac	F
Rhus glabra L. - Smooth Sumac	F
Solidago missouriensis Nutt. - Missouri Goldenrod	E
Symphoricarpos orbiculatus Moench - Buckbrush	E
Verbena stricta Vent. - Vervain	F
Vernonia baldwini Torr. - Ironweed	D

A = 75%
B = 50-75%
C = 25-50%
D = 6-25%
E = 1- 5%
F = 1%

found in Unit 4. One reason for the small numbers of forbs and woody species in Unit 4 may be that the sod forming capabilities of smooth brome prevented the establishment of species in the unit.

UNIT 5

Unit 5 (Table VII) was a "T" shaped open prairie area located in the northcentral portion of grid A-39 (Appendix A).

Prior to the 1950's, Unit 5 had been cultivated and was reseeded to smooth brome. The area was burned on May 1, 1967 and mowed for hay in successive summers from 1974 to 1977.

Unit 5 existed as a smooth brome community with a level to southerly sloping terrain bordered on the east and south by woody vegetation near a seasonal creek, and on the west by Unit 6 (Fig. 3).

Table VII. Scientific and vernacular names of the most commonly occurring plant species in Unit 5. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Ambrosia artemisiifolia L. - Common Ragweed	F
Ambrosia psilostachya DC. - Western Ragweed	E
Andropogon gerardi Vitman - Big Bluestem	E
Andropogon scoparius Michx. - Little Bluestem	D
Apocynum sibericum Jacq. - Indian Hemp	D
Asclepias verticillata L. - Whorled Milkweed	D
Asclepias viridis Walt. - Green Antelopehorn	D
Aster ericoides L. - Heath Aster	E
Baptisia leucophaea Nutt. - False Indigo	C
Bromus inermis Leyss. - Smooth Brome	B
Cirsium altissimum (L.) Spreng. - Tall Thistle	D
Cornus drummondii Meyer - Rough Leaved Dogwood	F
Cyperus filiculmis Vahl - Sedge	E
Descurainia pinnata (Walt.) Britt. - Tansy Mustard	E
Erigeron strigosus Muhl. - Daisy Fleabane	D
Gleditsia triacanthos L. - Honey Locust	
Glycyrrhiza lepidota (Nutt.) Pursh var. lepidota - Wild Licorice	E
Gutierrezia dracunculoides (DC.) Blake - Broomweed	E
Kuhnia eupatorioides L. - False Boneset	D
Lepidium densiflorum Schrad. - Pepper Grass	D
Oenothera speciosa Nutt. - White Evening Primrose	E
Opuntia macrorhiza Engelm. - Prickly Pear	F
Panicum oligosanthes var. scribnerianum (Nash) Fern. - Scribner's Panicum	D
Panicum virgatum L. - Switchgrass	E
Petalostemon purpureum (Vent.) Rydb. - Purple Prairie Clover	D
Psoralea tenuiflora Pursh var. floribunda (Nutt.) Rydb. - Wild Alfalfa	E
Rhus glabra L. - Smooth Sumac	E
Rosa arkansana Porter - Prairie Rose	F
Sanicula canadensis L. - Blazing Star	D
Silene antirrhina L. - Sleepy Catchfly	E
Solidago missouriensis Nutt. - Missouri Goldenrod	D
Sorghastrum avenaceum (Michx.) - Indian Grass	D
Sporobolus cryptandrus (Torr.) Gray - Sand Dropseed	E
Symphoricarpos orbiculatus Moench - Buckbrush	F
Thlaspi arvense L. - Field Pennycress	E
Vitis riparia Michx. - Riverbank Grape	E

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

The grass species present in the highest percentage in Unit 5 was smooth brome, however, a shrubby influence extended from the south and east boundary lines where rough leaved dogwood, smooth sumac, and buck-brush were becoming established. Forbs established in Unit 5 included False indigo, daisy fleabane, goldenrod, and green antelopehorn.

A shallow ravine running from east to west in the northcentral portion of Unit 5 had escaped mowing and burning and contained a variety of forb species.

UNIT 6

Unit 6 (Table VIII) formed a circular prairie community in the west-central portion of grid A-39 (Appendix A).

Unit 6 was more upland in habitat than Unit 5 and contained a more diverse aggregation of native grasses and forbs.

Due to increased slope and rocky nature of this unit, cultivation was not possible in the past, and virtually no management practices have occurred in this area (Spencer, 1981).

Dominant grasses in Unit 5 were sand dropseed and tall dropseed with scattered associations of little bluestem, Indian grass, and Kentucky bluegrass. Occurrences of well established stands of bluegrass in Unit 6 suggests that some type of disturbance occurred in this area at one time. Weaver (1954) noted that Kentucky bluegrass could not adequately compete for available sunlight with the tall grasses, and it further suffered from the build-up of plant matter by these grasses. It is therefore probable that Kentucky bluegrass was decreasing at this site.

A well established stand of Indian grass has located on the south slope in the southern portion of Unit 6. This may be attributed to increased runoff moisture provided by the slope.

Table VIII. Scientific and vernacular names of the most commonly occurring plant species in Unit 6. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Acer negundo L. - Box Elder	E
Ambrosia psilostachya DC. - Western Ragweed	D
Andropogon gerardi Vitman - Big Bluestem	F
Andropogon scoparius Michx. - Little Bluestem	E
Apocynum sibericum Jacq. - Indian Hemp	D
Asclepias verticillata L. - Whorled Milkweed	D
Asclepias viridis Walt. - Green antelopehorn	D
Aster ericoides L. - Heath Aster	E
Baptisia leucophaea Nutt. - False Indigo	D
Bromus inermis Leyss. - Smooth Brome	E
Cacalia tuberosa Nutt. - Indian Plantain	E
Cirsium altissimum (L.) Spreng. - Tall Thistle	D
Convolvulus sepium L. - Hedge Bindweed	E
Cornus drummondii Meyer - Rough Leaved Dogwood	E
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundle Flower	D
Eleocharis ssp.	D
Erigeron strigosus Muhl. - Daisy Fleabane	D
Eupatorium altissimum L. - Tall Thoroughwort	E
Gleditsia triancanthos L. - Honey Locust	F
Helianthus annus L. - Common Sunflower	D
Helianthus maximiliani Schrad. - Maximilian Sunflower	C
Maclura pomifera - Osage Orange	F
Oenothera speciosa Nutt. - White Evening Primrose	D
Panicum oligosanthes Schult. var. scribnerianum (Nash) Fern. - Scribner's Panicum	E
Panicum virgatum L. - Switchgrass	D
Poa pratensis L. - Kentucky Blue Grass	D
Rhus aromatica Ait. - Fragrant Sumac	F
Rhus glabra L. - Smooth Sumac	D
Ribes missouriense Nutt. - Wild Gooseberry	E
Scirpus filiculmis Vahl.	E
Solanum carolinense L. - Horse Nettle	E
Solidago missouriensis Nutt. - Missouri Goldenrod	C
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	D
Sporobolus asper (Michx.) Kunth - Tall Dropseed	D
Sporobolus cryptandrus (Torr.) Gray - Sand Dropseed	D
Symphoricarpos orbiculatus Moench - Buckbrush	E
Toxicodendron radicans L. - Poison Ivy	E
Triodanis perfoliata (L.) Nieuw. - Venus Looking Glass	E

Table VIII. (Continued)

Plant Species	Percent Coverage
Ulmus americana L. - American Elm	F
Vitis riparia Michx. - Riverbank Grape	E

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

Forbs commonly found throughout Unit 6 included Maximilian sunflower, goldenrod, whorled milkweed, western ragweed, common sunflower, and false indigo. The apparent increase in diversity and establishment of forbs in Unit 6 may be attributed to deferred management practices.

The western boundary line was an old stone fence which provided an avenue for encroachment of woody species from the creek area. Wild gooseberry, riverbank grape, rough leaved dogwood, and poison ivy were growing near the western border, and again near a young Osage orange tree established in the east central portion of the unit.

UNIT 7

Unit 7 (Table IX) was an open prairie area located in the northern portion of grid A-40 (Appendix A).

Prior to 1950, Unit 7 was a native grassland tract. The area was burned on May 1, 1967, and again on April 16, 1975, and mowed for prairie hay in July, 1975, and August, 1976.

Management practices implemented in Unit 7 have maintained the native tall grass prairie habitat and slowed the invasion of woody species into the open prairie community (Spencer, 1981).

Unit 7 was basically upland in nature with a southeastern slope. Dominant grasses occurring throughout Unit 7 were little bluestem, smooth brome, switchgrass and Indian grass; occasional stands of sand dropseed

Table IX. Scientific and vernacular names of the most commonly occurring plant species in Unit 7. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Amorpha canescens Pursh - Lead Plant	D
Ambrosia psilostachya DC. - Western Ragweed	E
Andropogon gerardi Vitman - Big Bluestem	F
Andropogon scoparius Michx. - Little Bluestem	C
Apocynum sibericum Jacq. - Indian Hemp	D
Artemisia ludoviciana Nutt. - White Sage	D
Asclepias sullivantii Engelm. - Milkweed	E
Asclepias tuberosa L. - Butterfly Weed	D
Asclepias verticillata L. - Whorled Milkweed	D
Baptisia leucophaea Nutt. - False Indigo	D
Bromus inermis Leyss. - Smooth Brome	D
Cacalia tuberosa Nutt. - Indian Plantain	D
Callirhoe alcaeoides (Michx.) Gray - Poppy Mallow	D
Carex annectans Bickn. - Sedge	F
Cirsium altissimum (L.) Spreng. - Tall Thistle	D
Convolvulus arvensis L. - Hedge Bindweed	E
Cornus drummondii Meyer - Rough Leaved Dogwood	E
Cyperus setigerus Torr. and Hook.	E
Descurainia pinnata (Walt.) Britt. - Tansy Mustard	E
Echinacea angustifolia DC. - Prairie Coneflower	E
Eleocharis sp.	
Elymus virginicus L. - Virginia Wild Rye	E
Eragrostis spectabilis (Pursh.) Steud. - Purple Love Grass	E
Erigeron strigosus Muhl. - Daisy Fleabane	D
Euphorbia spathulata Lam. - Spurge	E
Gaura parviflora Doug. - Velvety Gaura	E
Gleditsia triacanthos L. - Honey Locust	F
Helianthus maximiliani Schrad. - Maximilian Sunflower	D
Lepidium densiflorum Schrad. - Pepper Grass	D
Maclura pomifera (Raf.) Schneid. - Osage Orange	F
Oenothera speciosa Nutt. - White Evening Primrose	D
Oxalis dillenii Jacq. - Yellow Wood Sorrel	E
Panicum oligosanthes Schult. var. scribnerianum (Nash) Fern. - Scribner's Panicum	D
Panicum virgatum L. - Switchgrass	D
Penstemon cobaea Nutt. - Beard Tongue	D
Physalis pumila Nutt. - Ground Cherry	E
Poa pratensis L. - Kentucky Blue Grass	D
Populus deltoides Marsh. - Cottonwood	F
Prunus americana Marsh. - Wild Plum	E
Psoralea tenuiflora Pursh var. floribunda (Nutt.) Rydb. - Wild Alfalfa	D
Rhus aromatica Ait. - Fragrant Sumac	F

Table IX. (Continued)

Plant Species	Percent Coverage
Rhus glabra L. - Smooth Sumac	E
Ribes missouriense Nutt. - Wild Gooseberry	F
Rosa arkansana Porter - Prairie Rose	E
Silene antirrhina L. - Sleepy Catchfly	E
Silphium laciniatum L. - Compass Plant	E
Solidago missouriensis Nutt. - Missouri Goldenrod	E
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	D
Spermolepis inermis (Nutt.) Math & Const. - Wild Parsley	E
Sphenopholis obtusata (Michx.) Scribn. - Wedge Grass	E
Sporobolus cryptandrus (Torr.) Gray - Sand Dropseed	D
Symphoricarpos orbiculatus Moench - Buckbrush	E
Tradescantia bracteate Small - Spiderwort	E
Tragopogon dubius Scop. - Salsify	E
Triodanis leptocarpa (Nutt.) Nieuw. - Tall Venus Looking Glass	E
Ulmus americana L. - American Elm	E
Viola missouriensis Greene - Missouri Violet	E
Vernonia baldwini Torr. - Ironweed	D

A = 75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = 1%

and big bluestem were scattered throughout.

Forbs commonly occurring throughout the area were lead plant, milkweed, false indigo, daisy fleabane, Maximilian sunflower, ironweed, and wild alfalfa.

Rocky outcrops occurred in the southeast portion of Unit 7. The outcrops and adjacent draws ran diagonally from the northwest to the southeast, and became more pronounced as the southeast slope increased.

Although the ravine areas contained the same overall plant composition as the remainder of Unit 7, the apparent increase in available moisture favored the growth of spike rush, sedge, and great plains cottonwood. Dense stands of little bluestem and Indian grass produced a

thick sod on the shallow, rocky soils near the convergence of the ravines in the extreme southeast corner of this unit. The increased moisture content resulting from the slope of the unit seemed to favor the establishment of both little bluestem and Indian grass.

UNIT 8

Unit 8 (Table X) was a shrubby area located in the southeast portion of grid A-39 and the northeast portion of grid A-42 (Appendix A).

Originally a native grassland tract, Unit 8 received deferred management practices, except for a fire that burned the southern portion in July, 1960. In 1977 it was a shrubby grassland with open spaces interspersed with dense thickets of woody shrubs. A rocky outcropping formed the southern boundary, and a gentle slope extended northward toward a creek. A small spring was located in the northeast corner and flowed northward into the creek.

Open areas were prevalent in the northern portion of Unit 8 and consisted of a mixture of grasses and forbs. Little bluestem and smooth brome were the dominant grasses and goldenrod, ironweed, and wild alfalfa the dominant forbs.

The shrubby appearance of Unit 8 was attributed to dense thickets of smooth sumac, buckbrush, wild plum, and rough leaved dogwood. Several small trees were scattered throughout the unit. Those occurring most frequently were green ash, Siberian elm, and box elder.

It should be noted that the basic factors separating Unit 8 from Unit 9 were the sharp delineation which occurs along the limestone outcropping and the shorter growth form of plant life comprising Unit 8.

The spring area in the northeast portion of Unit 8 had a stream course that supported small trees and aquatic plants. American elm,

Table X. Scientific and vernacular names of the most commonly occurring plant species in Unit 8. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Acer negundo L. - Box Elder	D
Achillea millefolium L. ssp. lanulosa (Nutt.) Piper - Yarrow	E
Ambrosia artemisiifolia L. - Common Ragweed	D
Ambrosia psilostachya DC. - Western Ragweed	E
Ambrosia trifida L. - Giant Ragweed	F
Amorpha canescens Pursh - Lead Plant	D
Andropogon gerardi Vitman - Big Bluestem	D
Andropogon scoparius Michx. - Little Bluestem	C
Apocynum sibericum Jacq. - Indian Hemp	D
Artemisia ludoviciana Nutt. - White Sage	D
Asclepias verticillata L. - Shorled Milkweed	D
Baptisia leucophaea Nutt. - False Indigo	D
Bromus inermis Leyss. - Smooth Brome	C
Carex annectans Bickn. - Sedge	D
Carex hystricina Muhl. - Sedge	D
Callirhoe alcaeoides (Michx.) Gray - Poppy Mallow	D
Cirsium altissimum (L.) Spreng. - Tall Thistle	E
Convolvulus arvensis L. - Field Bindweed	E
Cornus drummondii Meyer - Rough Leaved Dogwood	D
Descurainia pinnata (Walt.) Britt. - Tansy Mustard	E
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundle Flower	D
Eleocharis sp.	D
Elymus canadensis L. - Canada Wild Rye	E
Erigeron philadelphicus L. - Fleabane	E
Erigeron strigosus Muhl. - Daisy Fleabane	D
Eupatorium altissimum L. - Tall Thoroughwort	D
Euphorbia marginata Pursh - Snow-on-the-Mountain	D
Fraxinus pennsylvanica var. subintegerrima (Vahl) Fern. - Green Ash	D
Galium aparine L. - Bedstraw	E
Geum canadense L. - White Avens	E
Gleditsia triacanthos L. - Honey Locust	D
Glycyrrhiza lepidota (Nutt.) Pursh var. lepidota - Wild Licorice	E
Hedeoma hispida Pursh - Mock Pennyroyal	E
Helianthus maximiliani Schrad. - Maximilian Sunflower	D
Juniperus virginiana L. - Red Cedar	D
Kuhnia eupatoroides L. - False Boneset	D
Lespedeza cuneata (Dumont) G. Don - Sericea Lespedeza	E
Lomatium foeniculaceum (Nutt.) C. and R. - Hairy Parsley	E

Table X. (Continued)

Plant Species	Percent Coverage
Maclura pomifera (Raf.) Schneid. - Osage Orange	D
Morus alba L. - White Mulberry	F
Nasturtium officinale R. Br. - Water Cress	F
Oenothera macrocarpa Nutt. Sims. var. missouriensis - Missouri Primrose	D
Oenothera speciosa Nutt. - White Evening Primrose	D
Oxalis dillenii Jacq. - Yellow Wood Sorrel	E
Panicum oligosanthes Schult. var. scribnerianum (Nash) Fern. - Scribner's Panicum	
Panicum virgatum L. - Switchgrass	D
Parietaria pennsylvanica Muhl. - Pellitory	D
Physalis pumila Nutt. - Ground Cherry	D
Plantago major L. - Common Plantain	D
Poa pratensis L. - Kentucky Blue Grass	E
Polygonum convolvulus L. - Wild Buckwheat	E
Populus deltoides Marsh. - Cottonwood	F
Prunus americana - Wild Plum	E
Psoralea tenuiflora Pursh var. floribunda (Nutt.) Rydb. - Wild Alfalfa	C
Rhus aromatica Ait. - Fragrant Sumac	D
Rhus glabra L. - Smooth Sumac	D
Rosa arkansana Michx. - Prairie Rose	D
Rosa multiflora Thunb. - Multiflora Rose	F
Scirpus atrovirens Willd. - Bulrush	C
Silene antirrhina L. - Sleepy Catchfly	D
Silphium integrifolium Michx. - Rosinweed	D
Solanum carolinense L. - Horse Nettle	D
Solidago missouriensis Nutt. - Missouri Goldenrod	D
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	D
Spermolepis inermis (Nutt.) Math & Const.	C
Sphenopholis obtusata (Michx.) Scribn. - Wedge Grass	C
Symphoricarpos orbiculatas Moench. - Buckbrush	C
Tradescantia brachteata Small - Spiderwort	D
Tragopogon dubius Scop. - Salsify	D
Tridens flavus (L.) Hitchc. - Purpletop	D
Typha latifolia L. - Common Cat-tail	F
Ulmus americana L. - American Elm	E
Ulmus pumila L. - Siberian Elm	F
Viola missouriensis Greene - Missouri Violet	D
Vitis riparia Michx. - Riverbank Grape	D

A = >75%	D = 6-25%
B = 50-75%	E = 1- 5%
C = 25-50%	F = <1%

Siberian elm, green ash, box elder, and plains cottonwood flourished

with the increase in available moisture.

Aquatic plants found along the stream course included cattail, sedges, water cress, and spike rush.

UNIT 9

Unit 9 (Table XI) was a combination of shrubby grassland and mature wooded areas located in the eastcentral portion of grid A-42 (Appendix A).

Prior to the 1950's, Unit 9 was primarily a native grassland tract, altered in the southwest corner by activities associated with an abandoned church site. Management practices were implemented in 1960 to establish and maintain a nature trail which bisected the unit. A limestone table and bench were erected at the former church site in the spring of 1977, and woody growth has been removed yearly in this area (Spencer, 1981).

Unit 9 was similar in many respects to Unit 8 in that both units appeared as shrubby, overgrown communities with open patches of native grasses and forbs alternating with dense thickets of trees and shrubs. The major difference between units was in the height and establishment of the woody vegetation of Unit 9. The trees located in Unit 9 were significantly taller and shrubs formed denser thickets. This may be attributed to the fact that no management practices have occurred in Unit 9.

In the open areas and peripheral edges of Unit 9, Kentucky bluegrass, little bluestem, and wedge grass made up the dominant native grasses. Forbs common in open areas were Missouri primrose, ironweed, green antelopehorn, daisy fleabane, and wild alfalfa.

The shrubby appearance of this unit may be attributed to dense thickets of wild plum, smooth sumac, fragrant sumac, and rough leaved

Table XI. Scientific and vernacular names of the most commonly occurring plant species in Unit 9. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Acalypha virginica L. - Three Seeded Mercury	D
Achillea millefolium L. ssp. lanulosa (Nutt.) Piper - Yarrow	E
Amorpha canescens Pursh. - Lead Plant	E
Andropogon gerardi Vitman - Big Bluestem	E
Andropogon scoparius Michx. - Little Bluestem	D
Artemisia ludoviciana Nutt. - White Sage	D
Asclepias tuberosa L. - Butterfly Weed	F
Asclepias verticillata L. - Whorled Milkweed	D
Asclepias viridis Walt. - Green antelopehorn	D
Baptisia leucophaea Nutt. - False Indigo	E
Bromus inermis Leyss. - Smooth Brome	D
Bromus japonicus Thunb. - Japanese Brome	D
Carex annectans Bickn. - Sedge	D
Celtis occidentalis L. - Hackberry	E
Cirsium altissimum L. - Tall Thistle	D
Cornus drummondii Meyer - Rough Leaved Dogwood	C
Descurainia pinnata (Walt.) Britt. - Tansy Mustard	E
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundle Flower	D
Elymus virginicus L. - Virginia Wild Rye	D
Eleocharis sp.	D
Eragrostis spectabilis (Pursh) Steud. - Purple Love Grass	D
Erigeron strigosus Muhl. - Daisy Fleabane	D
Eupatorium altissimum L. - Tall Thoroughwort	D
Euphorbia spathulata Lam. - Spurge	D
Fraxinus pennsylvanica Marsh. var. subintegerrima (Vahl.) Fern. - Green Ash	D
Galium aparine L. - Bedstraw	D
Geum canadense Jacq. - White Avens	D
Gleditsia triacanthos L. - Honey Locust	F
Helianthus maximiliani Schrad. - Maximillian Sunflower	D
Juncus interior Weig. - Rush	D
Juniperus virginiana L. - Red Cedar	E
Lepidium densiflorum Schrad. - Pepper Grass	E
Morus alba L. - White Mulberry	E
Oxalis dillenii Jacq. L. - Yellow Wood Sorrel	E
Oenothera macrocarpa Nutt. - Missouri Primrose	C
Panicum oligosanthes Schult var. scribnerianum (Nash) Fern. - Scribner's Panicum	D
Panicum virgatum L. - Switch Grass	D
Parthenocissus quinquefolia (L.) Planch. - Virginia Creeper	E

Table XI. (Continued)

Plant Species	Percent Coverage
Petalostemon purpureum (Vent.) Rydb. - Purple Prairie Clover	D
Plantago major L. - Common Plantain	E
Poa pratensis L. - Kentucky Blue Grass	B
Prunus americana Marsh. - Wild Plum	C
Psoralea tenuiflora Pursh var. floribunda (Nutt.) Rydb. - Wild Alfalfa	C
Rhamnus lanceolata Pursh - Buckhorn	F
Rhus aromatica Ait. - Fragrant Sumac	D
Rhus glabra L. - Smooth Sumac	D
Rosa arkansana Porter (Michx.) - Prairie Rose	E
Ruellia humilis Nutt. - Wild Petunia	E
Rumex crispus L. - Curly Dock	D
Solanum carolinense L. - Horse Nettle	E
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	D
Spermolepis inermis (Nutt.) Math & Const.	E
Sphenopholis obtusa (Michx.) Scrib. - Wedge Grass	C
Symphoricarpos orbiculatus Moench - Buckbrush	D
Toxicodendron radicans L. - Poison Ivy	E
Tradescantia bracteata Small - Spiderwort	E
Tridens flavus (L.) Hitchc. - Purpletop	E
Triodanis perfoliata (L.) Nieuw. - Venus Looking Glass	D
Ulmus americana L. - American Elm	C
Ulmus pumila L. - Siberian Elm	E
Ulmus rubra Muhl. - Slippery Elm	F
Vernonia baldwini Torr. - Ironweed	D
Vitis riparia Michx. - Riverbank Grape	E

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

dogwood. Buckbrush was found mixed in the thickets of the aforementioned shrubs, and also occurred in solitary stands, but did not attain a height comparable to other shrubs in this unit.

The mature trees of Unit 9 were clustered around the abandoned church site in the southwest corner, and were dominated by red cedar, green ash, and American elm. White mulberry, hackberry, and American elm were scattered throughout the church site and the remainder of the

unit. Of the species mentioned above, red cedar was the only species tolerant of competition for sunlight. Small red cedar trees were scattered underneath the dense canopy of mature vegetation. Other young trees were located on the periphery of the woodland community.

UNIT 10

Unit 10 (Table XII) was an open prairie community located in the western third of grid A-42, the extreme eastern edge of grid A-41, and small portion in the southwest corner of grid A-39 (Appendix A).

Prior to the late 1950's, Unit 10 was a native grassland tract. No management practices occurred in this area until the fall of 1971, at which time policies were adopted to establish Unit 10 as an open prairie community. Large trees were removed, and the area was burned in April, 1972. Unit 10 has been mowed for prairie hay in successive summers from 1972 through 1977 (Spencer, 1981).

Unit 10 existed as an open tract of tall grass prairie separated into nearly equal portions by a limestone outcrop that ran from southwest to northeast across the community. The southern portion of Unit 10 was nearly level, whereas the northern portion was a gentle north slope toward a creek.

Dominant grasses within this unit were switchgrass, Indian grass, big bluestem, little bluestem with scattered associations of smooth brome, western wheatgrass, tall dropseed, and side oats grama.

Forbs present in Unit 10 included daisy fleabane, Maximilian sunflower, Missouri primrose, and ironweed.

The rocky outcrop that bisects Unit 10 supported plant species not commonly found throughout the unit. Prickly pear, New Jersey tea, peppergrass, hairy parsley, ground cherry, and prairie rose preferred the

Table XII. Scientific and vernacular names of the most commonly occurring plant species in Unit 10. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Acer negundo L. - Box Elder	F
Achillea millefolium L. ssp. lanulosum (Nutt.) Piper - Yarrow	D
Agropyron smithii Rydb. - Western Wheatgrass	D
Amorpha canescens Pursh - Lead Plant	D
Andropogon gerardi Vitman - Big Bluestem	B
Andropogon scoparius Michx. - Little Bluestem	D
Asclepias syriaca L. - Common Milkweed	D
Asclepias verticillata L. - Whorled Milkweed	C
Baptisia leucophaea Nutt. - False Indigo	D
Bouteloua curtipendula (Michx.) Torr. - Side Oats Grama	E
Bromus inermis Leyss. - Smooth Brome	D
Ceanothus herbaceus Raf. (L.) - New Jersey Tea	D
Convolvulus arvensis L. - Field Bindweed	E
Cornus drummondii Meyer - Rough Leaved Dogwood	E
Echinacea angustifolia DC. - Purple Coneflower	D
Elymus canadensis L. - Wild Rye	F
Elymus virginicus L. - Virginia Wild Rye	E
Eragrostis spectabilis (Pursh) Steud. - Purple Love Grass	C
Erigeron strigosus Muhl. - Daisy Fleabane	C
Gleditsia triacanthos L. - Honey Locust	F
Hedeoma hispida Pursh. - Mock Penneyroyal	D
Helianthus maximiliani Schrad. - Maximilian Sunflower	C
Koeleria pyramidata (Lam.) Beauv. - Crested Hair Grass	D
Lepidium densiflorum Schrad. - Pepper Grass	E
Lomatium foeniculaceum (Nutt.) C. & R. - Hairy Parsley	C
Oenethera speciosa Nutt. - White Evening Primrose	D
Opuntia macrorhiza Engelm. - Prickly Pear	E
Panicum oligosanthes Schult var. scribnerianum (Nash) Fern. - Scribner's Panicum	D
Panicum virgatum L. - Switch grass	D
Physalis pumila Nutt. - Ground Cherry	E
Plantago major L. - Common Plantain	D
Poa pratensis L. - Kentucky Blue Grass	E
Psoralea tenuiflora Pursh var. floribunda (Nutt.) Rydb. - Wild Alfalfa	D
Rhus aromatica Ait. - Fragrant Sumac	E
Rhus glabra L. - Smooth Sumac	E
Rosa arkansana Porter - Prairie Ro-e	E
Senecio plattensis Nutt. - Prairie Ragwort	E
Silene antirrhina L. - Sleepy Catchfly	D

Table XII. (Continued)

Plant Species	Percent Coverage
Solanum carolinense L. - Horse Nettle	E
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	B
Spermolepis inermis (Nutt.) Math. & Const.	C
Sporobolous Asper (Michx.) - Tall Dropseed	D
Symphoricarpos orbiculatus Moench - Buckbrush	F
Tradescantia bracteata Small - Spiderwort	D
Tragopogon dubius Scop. - Salsify	E
Triodanis perfoliata (L.) Nieuw. - Venus Looking Glass	D
Vernonia baldwini Torr. - Ironweed	C

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

shallow rocky soil present near the outcrop.

UNIT 11

Unit 11 (Table XIII) was a broad ravine running from north to south in the northeast corner of grid A-41, and a small portion of the southeast corner of grid A-40 (Appendix A).

In the 1950's, grid A-41 was a native grassland tract. In recent years, Unit 11 management has been deferred.

The most prominent native grass in Unit 11 was little bluestem. Big bluestem, prairie three awn grass, wedge grass, and Virginia wild rye were also present in scattered associations. It was noted that prairie three awn grass did not occur in adjacent prairie communities. Its absence may be attributed to the preference of this species for a dry open habitat, which occurs along the sides of the ravine (Steyermark, 1962).

Forbs common to Unit 11 were Western ragweed, Illinois bundle flower, common sunflower, Maximilian sunflower, and ironweed.

Woody shrubs were located in isolated clumps throughout Unit 11.

Table XIII. Scientific and vernacular names of the most commonly occurring plant species in Unit 11. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Ambrosia artemisiifolia L. - Common Ragweed	D
Ambrosia psilostachya DC. - Western Ragweed	D
Amorpha canescens Pursh. - Lead Plant	D
Andropogon gerardi Vitman - Big Bluestem	D
Andropogon scoparius Michx. - Little Bluestem	C
Aristida oligantha Michx. - Prairie Three Awn Grass	E
Asclepias tuberosa L. - Butterfly Weed	E
Aster simplex Willd. - Tall White Aster	E
Baptisia leucophaea Nutt. - False Indigo	F
Bouteloua hirsuta - Hairy Grama	E
Carex muhlenbergii Schk. - Sedge	E
Ceanothus herbaceus Raf. - New Jersey Tea	E
Cirsium altissimum (L.) Spreng. - Tall Thistle	D
Convolvulus arvensis L. - Field Bindweed	F
Cornus drummondii Meyer. - Rough Leaved Dogwood	C
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundle Flower	D
Echinacea angustifolia DC. - Purple Coneflower	D
Elymus canadensis L. - Canada Wild Rye	E
Elymus virginicus L. - Virginia Wild Rye	E
Erigeron strigosus L. - Daisy Fleabane	E
Eupatorium altissimum L. - Tall Thoroughwort	D
Galium aparine L. - Bedstraw	D
Helianthus annuus L. - Common Sunflower	D
Helianthus maximiliani Schrad. - Maximilian Sunflower	D
Hypericum sphaerocarpum Michx. - Roundfruit St. John's Wort	D
Juncus interior Weig. - Rush	E
Lespedeza cuneata (Dumont) G. Don - Sericea Lespedeza	E
Melilotus officinalis (L.) Lam. - Yellow Sweet Clover	E
Oenothera speciosa Nutt. - White Evening Primrose	E
Panicum oligosanthes Schult var. scribnerianum (Nash) Fern. - Scribner's Panicum	E
Petalostemon purpureum (Vent.) Rydb. - Purple Prairie Clover	E
Pyrus communis L. - Pear	F
Prunus americana Marsh. - Wild Plum	D
Rhus aromatica Ait. - Fragrant Sumac	C
Rhus glabra L. - Smooth Sumac	C

Table XIII. (Continued)

Plant Species	Percent Coverage
Rosa arkansana Porter (Michx.) - Prairie Rose	E
Solanum carolinense L. - Horse Nettle	E
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	E
Spheopholis obtusata (Michx.) Scribn. - Wedge Grass	D
Symphoricarpos orbiculatus Moench - Buckbrush	D
Triodanis leptocarpa (Nutt.) Nieuw. - Tall Venus Looking Glass	E
Vernonia baldwini Torr. - Ironweed	C
Viola missouriense Greene - Missouri Violet	E
Vitis riparis Michx. - Riverbank Grape	E

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

Rough leaved dogwood, smooth sumac, fragrant sumac, wild plum, buckbrush, and lead plant formed the basic constituents of shrubby growth in areas where management practices had not been employed to control their existence.

UNIT 12

Unit 12 (Table XIV) was a triangular shaped open prairie tract located in the northeast portion of grid A-41 (Appendix A).

Prior to the 1950's, grid A-41 was a native grassland tract. Procedures were implemented in the 1970's to preserve portions of grid A-41, primarily Unit 12, as a native grassland area. The clearing of brush and rotary mowing were attempted in the fall of 1976, and herbicide application on selected species employed in the summer months of 1976. Burning and subsequent mowing of the unit for prairie hay began in the summer months of 1977 (Spencer, 1981).

Unit 12 appeared as a tall grass prairie community situated on a

Table XIV. Scientific and vernacular names of the most commonly occurring plant species in Unit 12. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Achillea millefolium L. ssp. lanulosum (Nutt.) Piper - Yarrow	D
Ambrosia artemisiifolia L. - Common Ragweed	D
Ambrosia psilostachya DC. - Western Ragweed	D
Amorpha canescens Pursh. - Lead Plant	D
Andropogon gerardi Vitman - Big Bluestem	F
Andropogon scoparius Michx. - Little Bluestem	B
Apocynum sidericum Jacq. - Indian Hemp	D
Asclepias tuberosa L. - Butterfly Weed	D
Asclepias verticillata L. - Whorled Milkweed	D
Asclepias viridis Walt. - Green Antelopehorn	D
Astragalus crassicarpus Nutt. - Ground Plum	C
Baptisia leucophaea Nutt. - False Indigo	D
Bromus inermis Leyss. - Smooth Brome	D
Cacalia tuberosa Nutt. - Indian Plantain	E
Ceanothus herbaceus Raf. - New Jersey Tea	E
Conyza canadensis (L.) Cronq. - Horseweed	E
Cornus drummondii Meyer - Rough Leaved Dogwood	D
Delphinium virescens Nutt. - Prairie Larkspur	C
Descurainia pinnata (Walt.) Britt. - Tansy Mustard	E
Echinacea angustifolia DC. - Purple Coneflower	D
Elymus canadensis L. - Canada Wild Rye	E
Elymus virginicus L. - Virginia Wild Rye	D
Erigeron strigosus Muhl. - Daisy Fleabane	C
Euphorbia spathulata Lam. - Spurge	E
Gaura parviflora Doug. - Velvety Gaura	D
Helianthus maximiliani Schrad. - Maximilian Sunflower	D
Lomatium foeniculaceum (Nutt.) C. & R. - Hairy Parsley	E
Melilotus officinalis (L.) Lam. - Yellow Sweet Clover	C
Oenothera macrocarpa Nutt. - Missouri Primrose	D
Panicum oligosanthes Schult var. scribnerianum (Nash) Fern. - Scribner's Panicum	D
Plantago major L. - Common Plantain	C
Prunus americana Marsh. - Wild Plum	E
Psoralea tenuiflora Pursh var. floribunda (Nutt.) Rydb. - Wild Alfalfa	D
Rhus aromatica Ait. - Fragrant Sumac	E
Rosa arkansana Porter (Michx.) - Prairie Rose	E
Silphium integrifolium Michx. - Rosin Weed	D
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	D

Table XIV. (Continued)

Plant Species	Percent Coverage
Spermolepis inermis (Nutt.) Math. & Const.	E
Sphenopholis obtusata (Michx.) Scribn. - Wedge Grass	C
Sporobolus cryptandrus (Torr.) A. Gray - Sand Dropseed	D
Tragopogon dubius Scop. - Salsify	F
Triodanis leptocarpa (Nutt.) Nieuw. - Tall Venus Looking Glass	E
Triodanis perfoliata (L.) Nieuw. - Venus Looking Glass	
Vernonia baldwini Torr. - Ironweed	D

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

gentle north-sloping hillside. Little bluestem was the dominant grass with wedge grass common in scattered associations. Little woody vegetation was noted on this site. Ground plum, prairie larkspur, daisy fleabane, yellow sweet clover, and Indian plantain were noted to occur over 25 to 50 percent of the total area (Table 2).

UNIT 13

Unit 13 (Table XV) was a prairie area with woody shrubs and established mature trees and was located in the central and southwest portion of grid A-41 (Appendix A).

In the 1950's, Unit 13 was primarily open native grassland, except in the southwest portion where, in an abandoned parsonage site, several large trees were located. In recent years, attempts have been made to clean out some of the shrubby vegetation and small trees which have invaded the area. In the spring of 1973, several small seedlings of honey locust and red cedar were removed from the stand of mature trees. Many woody species were removed by cutting with saws and rotary mowers

Table XV. Scientific and vernacular names of the most commonly occurring plant species in Unit 13. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Acer negundo L. - Box Elder	F
Acer saccharinum - Silver Maple	F
Achillea millefolium L. ssp. lanulosum (Nutt.) Piper - Yarrow	E
Agropyron smithii Rydb. - Western Wheatgrass	D
Ambrosia artemisiifolia L. - Common Ragweed	C
Ambrosia psilostachya DC. - Western Ragweed	E
Ambrosia trifida L. - Giant Ragweed	D
Amorpha canescens Pursh. - Lead Plant	D
Andropogon gerardi Vitman - Big Bluestem	D
Andropogon scoparius Michx. - Little Bluestem	B
Artemisia ludoviciana Nutt. - White Sage	D
Asclepias tuberosa L. - Butterfly Weed	E
Asclepias verticillata L. - Whorled Milkweed	D
Asclepias viridis Walt. - Green Antelopehorn	D
Asparagus officinalis L. - Asparagus	F
Aster oblongifolius Nutt. - Oblong-Leaf Aster	E
Aster simplex Willd. - Tall White Aster	C
Baptisia leucophaea Nutt. - False Indigo	D
Bromus inermis Leyss. - Smooth Brome	C
Bromus japonicus Thunb. - Japanese Brome	C
Cacalia tuberosa Nutt. - Indian Plantain	E
Callirhoe alcaeoides (Michx.) Gray - Poppy Mallow	D
Carex annectans Bickn. - Sedge	E
Ceanothus herbaceus Raf. - New Jersey Tea	D
Cirsium altissimum L. - Tall Thistle	E
Cornus drummondii Meyer - Rough Leaved Dogwood	D
Descurainia pinnata (Walt.) Britt. - Tansy Mustard	F
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundle Flower	D
Elymus canadensis L. - Canada Wild Rye	
Elymus virginicus L. - Virginia Wild Rye	D
Eragrostis spectabilis (Pursh.) Steud. - Purple Love Grass	D
Erigeron strigosus Muhl. - Daisy Fleabane	D
Eupatorium altissimum L. - Tall Thoroughwort	D
Galium aparine L. - Bedstraw	E
Gleditsia triacanthos L. - Honey Locust	F
Helianthus maximiliani Schrad. - Maximilian Sunflower	C
Juniperus virginiana L. - Red Cedar	F
Koeleria pyramidata (Lam.) Beauv. - Crested Hair Grass	E
Lepidium densiflorum Schrad. - Pepper Grass	D
Lespedeza cuneata (Dumont) G. Don - Sericea Lespedeza	F

Table XV. (Continued)

Plant Species	Percent Coverage
Lomatium foeniculaceum (Nutt.) C. & R. - Hairy Parsley	E
Maclura pomifera (Ref.) Schneid. - Osage Orange	F
Melilotus officinalis (L.) Lam. - Yellow Sweet Clover	C
Oenothera macrocarpa Nutt. - Missouri Evening Primrose	E
Opuntia macrorhiza Engelm. - Prickly Pear	F
Panicum oligosanthes Schult var. scribnerianum (Nash) Fern. - Scribner's Panicum	D
Panicum virgatum L. - Switch Grass	E
Plantago major L. - Common Plantain	E
Poa pratensis L. - Kentucky Blue Grass	C
Prunus americana Marsh. - Wild Plum	D
Psoralea tenuiflora Pursh var. floribunda - Wild Alfalfa	D
Ratibida columnifera (Nutt.) Woot. & Standl. - Prairie Coneflower	F
Rhus aromatica Ait. - Fragrant Sumac	D
Rhus glabra L. - Smooth Sumac	D
Rumex altissima Wood - Pale Dock	E
Salvia reflexa Hornem. - Salvia	D
Silene antirrhina L. - Sleepy Catchfly	E
Silphium integrifolium Michx. - Rosin Weed	D
Solidago missouriensis Nutt. - Missouri Goldenrod	C
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	D
Spermolepis inermis (Nutt.) Math. & Const.	D
Sphenopholis obtusata (Michx.) Scribn. - Wedge Grass	D
Spirea prunifolia Sieb. & Zucc. var. olena Schneid. - Bridal Wreath	F
Sporobolus asper (Michx.) Kunth - Tall Dropseed	C
Symphoricarpos orbiculatus Moench - Buckbrush	D
Toxicodendron radicans L. - Poison Ivy	F
Tragopogon dubius Scop. - Salsify	E
Triodanis perfoliata (L.) Nieuw. - Venus Looking Glass	D
Ulmus americana L. - American Elm	F
Vernonia baldwini Torr. - Ironweed	D

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

in the fall of 1976. Herbicide was applied in the spring of 1976 to further discourage the growth of woody species in portions of Unit 13.

Unit 13 existed as a native prairie with several species of woody shrubs scattered in thickets throughout the unit. Mature trees were present in the southwest, central, and extreme eastern portions of the unit.

Unit 13 was located on a fairly level exposure, with a gradual northern slope occurring on approximately the northern third of the unit. A rocky outcropping was located approximately in the center of the unit, and several thickets of woody vegetation were associated with the outcropping.

A solitary thicket of bridal wreath was located near the southern boundary line. The introduction date of this species was not known.

Prairie elements of Unit 13 were scattered associations of grasses and forbs in and around numerous thickets of woody species. The dominant grasses found in these areas were little bluestem with smooth brome, Japanese brome, Kentucky blue grass, western wheatgrass, tall dropseed, switchgrass, and Indian grass occurring in scattered associations.

Forbs common to the open areas of Unit 13 were common ragweed, Western ragweed, tall white aster, Maximilian sunflower, and Missouri goldenrod.

Located in the northcentral portion of Unit 13 (Appendix A) were dense thickets of wild plum, rough leaved dogwood, and fragrant sumac, in which young box elder, American elm, and red cedar were interspersed. The thickets were located on a small rocky outcropping, an association frequently found on RNHR. This association may be attributed to the fact that vegetation on rocky outcrops cannot be effectively managed by mowing or burning. Yellow sweet clover occurred in dense stands on the extreme east and west ends of the thicket. That particular species'

shows an affinity for shallow, rocky soil is supported by Steyermark (1962). Two mature silver maples were located on the west side of the thicket area.

UNIT 14

Unit 14 (Table XVI) was an overgrown shrubby area associated with an intermittent stream which meanders through grids A-40, A-39, the extreme southeast corner of grid B-33, and immediately below the dam of Gladfelter pond in grid B-48 (Appendix A).

Prior to the late 1950's, Unit 14 was essentially native grassland. In 1959, Gladfelter pond was constructed in grid B-48, and several woody and herbaceous plant species were introduced into the area immediately below the dam. Although some of the introduced species failed to become established, red cedar, Russian olive, wild plum, Nanking cherry, and weeping willow had flourished. Black walnut had been introduced and survived in the upper northeast portion of the unit. Arrow arum was observed growing on the creek bank below the dam. It was assumed that this species is introduced but no record of its introduction exists. Unit 14 has been allowed to progress towards a woodland community and management practices have not been employed to impede such progress (Spencer, 1981).

Unit 14 was an extremely dense, thicket area with infrequent openings. As a result of the creek running the length of the unit, the low lying areas collected water runoff from adjacent prairie communities and the additional moisture seemed to enhance the growth of the many woody species.

Unit 14 was dominated by wild plum and rough leaved dogwood forming dense, often impenetrable thickets. Associated with these thickets were several species of trees in different stages of maturity. Box elder,

Table XVI. Scientific and vernacular names of the most commonly occurring plant species in Unit 14. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Acer negundo L. - Box Elder	E
Achillea millefolium L. ssp. lanulosum (Nutt.) Piper - Yarrow	E
Agropyron smithii Rydb. - Western Wheatgrass	E
Alisma plantago-aquatica L. - Water Plantain	E
Ambrosia artemisiifolia L. - Common Ragweed	C
Ambrosia psilostachya DC. - Western Ragweed	E
Ambrosia trifida L. - Giant Ragweed	E
Amorpha canescens Pursh. - Lead Plant	E
Amorpha fruticosa L. - False Indigo	E
Andropogon scoparius Michx. - Little Bluestem	D
Artemisia ludoviciana Nutt. - White Sage	E
Asclepias viridis Walt. - Green Antelopehorn	D
Aster oblongifolius Nutt. - Oblong Leaf Aster	E
Baptisia leucophaea Nutt. - False Indigo	E
Bromus inermis Leyss. - Smooth Brome	C
Carex annectans Bickn. - Sedge	E
Celastrus scandens L. - American Bittersweet	F
Celtis occidentalis L. - Hackberry	E
Cirsium altissimum L. - Tall Thistle	F
Cornus drummondii Meyer - Rough Leaved Dogwood	C
Eleagnus angustifolia L. - Russian Olive	
Eleocharis sp.	F
Elymus canadensis L. - Canada Wild Rye	E
Elymus virginicus L. - Virginia Wild Rye	E
Erigeron strigosus Muhl. - Daisy Fleabane	E
Fraxinus pennsylvanica Marsh. var. subintegerrima (Vahl) Fern. - Green Ash	F
Galium aparine L. - Bedstraw	D
Geum canadense Jacq. - White Avens	E
Gleditsia triacanthos L. - Honey Locust	F
Helianthus maximiliani Schrad. - Maximilian Sunflower	E
Juglans nigra L. - Black Walnut	F
Juniperus virginiana L. - Red Cedar	E
Maclura pomifera (Raf.) Schneid. - Osage Orange	E
Morus alba L. - White Mulberry	F
Nepeta cataria L. - Catnip	E
Panicum virgatum L. - Switch Grass	E
Parietaria pennsylvanica Muhl. - Pellitory	C
Peltandra virginica (L.) Schott & Encl. - Arrow Arum	F
Phalaris arundinacea L. - Canary Reed Grass	F
Phytolacca americana L. - Pokeweed	E
Populus deltoides Marsh. - Cottonwood	F

Table XVI. (Continued)

Plant Species	Percent Coverage
Prunus americana Marsh. - Wild Plum	A
Prunus tomentosa Thunb. - Nanking Cherry	F
Psoralea tenuiflora Pursh var. floribunda (Nutt.) Rydb. - Wild Alfalfa	E
Rhamnus lanceolata Pursh. - Buckthorn	E
Rhus aromatica Ait. - Fragrant Sumac	D
Rhus glabra L. - Smooth Sumac	D
Ribes missouriense Nutt. - Missouri Gooseberry	E
Rosa arkansana Porter - Prairie Rose	F
Rosa multiflora Thunb. - Multiflora Rose	F
Rubus occidentalis L. - Black Raspberry	F
Salix babylonica L. - Weeping Willow	F
Salix caroliniana Michx. - Ward's Willow	F
Salix interior Rowlee - Sandbar Willow	E
Salix nigra Marsh. - Black Willow	F
Sanicula canadensis L. - Black Snakeroot	C
Schrankia nuttallii (DC.) Standl. - Catclaw Sensitive Briar	E
Scirpus atrovirens Willd. - Common Bulrush	E
Silphium integrifolium Michx. - Rosin Weed	E
Smilax hispida Muhl. - Bristly Greenbriar	F
Solidago missouriensis Nutt. - Missouri Goldenrod	C
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	E
Sphenopholis obtusata (Michx.) Scribn. - Wedge Grass	E
Sporobolus asper (Michx.) Kunth - Tall Dropseed	E
Sporobolus cryptandrus (Torr.) Gray - Sand Dropseed	D
Symphoricarpos orbiculatus Moench - Buckbrush	E
Teucrium canadense L. - Wood Sage	C
Thlaspi arvense L. - Field Penny Cress	F
Toxicodendron radicans L. - Poison Ivy	D
Tradescantia bracteata Small - Spiderwort	E
Typha latifolia L. - Common Cat-tail	F
Ulmus americana L. - American Elm	F
Ulmus pumila L. - Siberian Elm	F
Vernonia baldwini Torr. - Ironweed	C
Vitis cinerea Engelm. - Grayback Grape	F
Vitis riparia Michx. - Riverbank Grape	F

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

hackberry, red cedar, Osage orange, black willow, sandbar willow, American elm, and Siberian elm were scattered throughout. Some previously mentioned introduced trees were located in the southwest portion of Unit

14, immediately below the pond dam (Appendix A). The remaining mature woody vegetation was located in the upper northeast corner of the unit. Mature trees of white mulberry, American elm, black walnut, green ash, box elder, and plains cottonwood occurred in this area. Many young box elder, American elm, and green ash were also present.

The ground cover of Unit 14 had non-woody areas which occurred on the boundary, and woody areas located underneath the dense, shrubby vegetation.

Non-woody areas in Unit 14 were composed of smooth brome and little bluestem as principal grasses. Forbs included Maximilian sunflower, common ragweed, Missouri goldenrod, and ironweed.

Woody areas contained bed straw, white Avens, pellitory, black snakeroot, and wood sage. In the absence of direct sunlight underneath thicketed areas, there results a change of ground flora (Humphrey, 1962).

UNIT 15

Unit 15 (Table XVII) was an open prairie area encompassing most of grid B-34, except the southwest corner, and grid B-33 (Appendix A).

In the early 1950's, Unit 15 was a native grassland tract, except for a strip of cultivated land approximately 50 feet wide on the west edge of grid B-34. During much of the 1960's, Unit 15 was undisturbed. In the fall of 1969, a rotary mower was used to cut woody vegetation established on a rocky outcrop, and vegetation encroaching from the south and east. In the fall of 1970, accessible areas in Unit 15 were mowed and by 1975 it was apparent that mowing slowed the encroachment of smooth sumac and small red cedar seedlings (Spencer, 1981). In 1975 and 1976, Unit 15 was burned, and mowed for hay. Haying operations were repeated in 1976 and 1977. Light grazing of the unit by two horses in 1975 and 1976, and

Table XVII. Scientific and vernacular names of the most commonly occurring plant species in Unit 15. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Achillea millefolium L. ssp. lanulosum (Nutt.) Piper - Yarrow	E
Agropyron smithii Rydb. - Western Wheatgrass	D
Agrostis hyemalis Walt. BSP - Crested Hair Grass	D
Ambrosia artemisiifolia L. - Common Ragweed	D
Ambrosia psilostachya DC. - Western Ragweed	E
Amorpha canescens Pursh. - Lead Plant	C
Amorpha fruticosa L. - False Indigo	F
Andropogon gerardi Vitman - Big Bluestem	D
Andropogon scoparius Michx. - Little Bluestem	B
Apocynum sibericum Jacq. - Indian Hemp	E
Aristida oligantha Michx. - Prairie Three Awn Grass	E
Artemisia ludoviciana Nutt. - White Sage	C
Asclepias tuberosa L. - Butterfly Weed	E
Asclepias verticillata L. - Whorled Milkweed	C
Asclepias viridis Walt. - Green Antelopehorn	D
Aster oblongifolius Nutt. - Oblong Leaf Aster	D
Aster simplex Willd. - Tall White Aster	F
Bromus inermis Leyss. - Smooth Brome	F
Bromus japonicus Thunb. - Japanese Brome	E
Cacalia tuberosa Nutt. - Indian Plantain	E
Callirhoe alcaeoides (Michx.) Gray - Poppy Mallow	E
Carex annectans Bickn. - Sedge	E
Carex heliophila Mackenz. - Sedge	E
Cirsium altissimum (L.) Spreng. - Tall Thistle	D
Cornus drummondii Meyer - Rough Leaved Dogwood	E
Cyperus setigerus Torr. and Hook. - Umbrella Sedge	F
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundleflower	E
Desmodium canadense (L.) DC. - Tick Trefoil	E
Echinacea angustifolia DC. - Purple Coneflower	F
Elymus virginicus L. - Virginia Wild Rye	C
Eragrostis spectabilis (Pursh.) Steud. - Purple Love Grass	C
Erigeron strigosus Muhl. - Daisy Fleabane	D
Eupatorium altissimum L. - Tall Thoroughwort	D
Gaura parviflora Doug. - Velvety Gaura	F
Gutierrezia dracunculoides (DC.) Blake - Broomweed	F

Table XVII. (Continued)

Plant Species	Percent Coverage
Helianthus maximiliani Schrad. - Maximilian Sunflower	D
Juncus torreyi Coville - Rush	F
Koeleria cristata (L.) Pers. - Crested Hair Grass	D
Kuhnia eupatoriodes L. - False Boneset	E
Lepidium densiflorum Schrad. - Pepper Grass	D
Maclura pomifera (RAF.) Schneid. - Osage Orange	F
Monarda fistulosa L. - Horse Mint	E
Oenothera macrocarpa Nutt. - Missouri Evening Primrose	F
Oenothera speciosa Nutt. - White Evening Primrose	F
Opuntia macrorhiza Engelm. - Prickly Pear	E
Panicum oligosanthes Schult var. scribnerianum (Nash) Fern. - Scribner's Panicum	E
Panicum virgatum L. - Switchgrass	E
Petalostemon purpureum (Vent.) Rydb. - Purple Prairie Clover	E
Physalis pumila Nutt. - Ground Cherry	E
Plantago major L. - Common Plantain	E
Poa pratensis L. - Kentucky Blue Grass	C
Prunus americana L. - Wild Plum	E
Psoralea tenuiflora Pursh var floribunda (Nutt.) Rydb. - Wild Alfalfa	D
Rhus aromatica Ait. - Fragrant Sumac	F
Rosa arkansana Porter - Prairie Rose	E
Rumex crispus L. - Curly Dock	E
Salix nigra Marsh. - Black Willow	F
Sanicula canadensis L. - Black Snakeroot	F
Schrankia nuttallii (DC.) Standl. - Catclaw Sensitive Brier	E
Scirpus atrovirens Willd. - Bulrush	E
Scirpus lineatus Michx. - Bulrush	F
Solanum carolinense L. - Horse Nettle	F
Solidago missouriensis Nutt. - Missouri Goldenrod	E
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	D
Spermolepis inermis (Nutt.) Math & Const. - Wild Parsley	D
Sphenopholis obtusata (Michx.) Scribn. - Wedge Grass	E
Sporobolus asper (Michx.) Kunth - Tall Dropseed	D
Symphoricarpos orbiculatus Moench - Buckbrush	E
Tragopogon dubius Scop. - Salsify	F
Triodanus leptocarpa (Nutt.) Nieuw. - Venus Looking Glass	F

Table XVII. (Continued)

Plant Species	Percent Coverage
Ulmus americana (L.) - American Elm	F
Verbena simplex Lehm. - Vervain	E
Verbena stricta Vent. - Vervain	E
Vernonia baldwini Torr. - Ironweed	D
Xanthium strumarium L. - Cocklebur	F

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

three head of cattle in 1977, completed the management practices that have occurred in Unit 15 (Spencer, 1981).

Unit 15 consisted of a well established stand of native tall grasses and forbs situated on a gentle south-sloping hillside. A small draw running southeast from the pond in the northeast corner of grid B-33, and a rocky outcropping running diagonally from north to south in grid B-33, supported a more shrubby growth than the rest of the unit. This was apparently due to failure to adequately manage these areas by burning or mowing.

The open prairie portion of Unit 15 was dominated by well established stands of little bluestem, big bluestem, tall dropseed, Indian grass, Virginia wild rye, purple love grass, and western wheatgrass occurring in scattered associations throughout the unit. Kentucky bluegrass was a co-dominant with little bluestem in Unit 15 and appeared to be increasing in abundance (Spencer, 1981). Since Kentucky bluegrass cannot adequately compete with the taller grasses for sunlight (Weaver, 1954), the light grazing pressure that occurred in this unit may have provided more open areas for the establishment of Kentucky bluegrass.

Forbs commonly encountered in Unit 15 were white sage and whorled

milkweed.

The ravine immediately below the pond in the northeast corner of Unit 15 contained vegetation that commonly occurs in low lying moisture - laden areas. Species found in the draw included two sedges, umbrella sedge, bulrush, curly dock, and a rush. Shrubby species such as buck-brush, wild plum, and rough leaved dogwood were becoming established near the draw.

The rocky outcrop in the southeast corner of grid B-34, provided a shallow, rocky, soil type suitable for the establishment of prairie rose and prickly pear.

UNIT 16

Unit 16 (Table XVIII) is a shrubby prairie area comprising all of grid B-47, except the northcentral area and northeast corner, grid B-48 except the north central area and northwest corner, the upper third of grids B-50 and B-49, and the southwest corner of grid B-34 (Appendix A).

Prior to the 1960's, Unit 16 was a native grassland tract, except for a narrow strip of land in the western portion of the unit, which was an abandoned cropland area. In November, 1959, a large pond, known as Gladfelter pond, was constructed in the northeast portion of grid B-48 and forms the upper northeast boundary of the unit. Plant species planted in rows immediately west of Gladfelter pond were red cedar, Russian olive, wild plum, multiflora roase, and Austrian Pine forming dense, well established thickets. A row of multiflora rose had become established south of the pond in a row running southwest and terminating near the southcentral portion of the unit. Unit 16 was relatively undisturbed from 1961 to 1967, but in April, 1967, a fire burned

Table XVIII. Scientific and vernacular names of the most commonly occurring plant species in Unit 16. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Achillea millefolium L. ssp. lanulosum (Nutt.) Piper - Yarrow	E
Agropyron smithii Rydb. - Western Wheatgrass	D
Ambrosia artemisiifolia L. - Common Ragweed	C
Ambrosia psilostachya DC. - Western Ragweed	E
Ambrosia trifida L. - Giant Ragweed	D
Amorpha canescens Pursh. - Lead Plant	E
Andropogon gerardi Vitman - Big Bluestem	D
Andropogon scoparius Michx. - Little Bluestem	C
Apocynum cannabinum L. - Indian Hemp	C
Apocynum sibericum Jacq. - Indian Hemp	D
Artemisia ludoviciana Nutt. - White Sage	D
Asclepias tuberosa L. - Butterfly Weed	E
Asclepias verticillata L. - Whorled Milkweed	D
Asclepias viridis Walt. - Green Antelopehorn	E
Aster ericoides L. - Heath Aster	E
Aster oblongifolius Nutt. - Oblong-leaf Aster	D
Aster simplex Willd. - Tall White Aster	E
Baptisia leucophaea Nutt. - False Indigo	D
Bidens frondosa L. - Beggar's Tick	E
Bromus inermis Leyss. - Smooth Brome	C
Bromus japonicus Thunb. - Japanese Brome	E
Cacalia tuberosa Nutt. - Indian Plantain	E
Callirhoe alcaeoides (Michx.) Gray - Poppy Mallow	E
Carex annectans Bickn. - Sedge	F
Carex hystricina Muhl. - Sedge	F
Carex lanuginosa Michx. - Sedge	F
Ceanothus herbaceus Raf. - New Jersey Tea	E
Celtis occidentalis L. - Hackberry	F
Cirsium altissimum L. - Tall Thistle	E
Convolvulus arvensis L. - Field Bindweed	F
Cornus drummondii Meyer - Rough Leaved Dogwood	D
Delphinium virescens Nutt. - Prairie Larkspur	E
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundleflower	D
Echinacea augustifolia DC. - Purple Coneflower	E
Eleagnus argustifolia L. - Russian Olive	F
Eleocharis sp.	F
Elymus canadensis L. - Canada Wild Rye	F
Elymus virginicus L. - Virginia Wild Rye	F
Eragrostis spectabilis (Pursh.) Steud. - Purple Love Grass	F

Table XVIII. (Continued)

Plant Species	Percent Coverage
Erigeron strigosus Muhl. - Daisy Fleabane	E
Fraxinus pennsylvanica Marsh. var. subintegerrima (Vahl) Fern. - Green Ash	F
Gaura parviflora Doug. - Velvety Gaura	E
Geum canadense Jacq. - White Avens	D
Gleditsia triacanthos L. - Honey Locust	E
Glycyrrhiza lepidota Pursh. - Wild Licorice	E
Hedeoma hispida Pursh. - Mock Pennyroyal	E
Helianthus annus L. - Common Sunflower	F
Helianthus maximiliani Schrad. - Maximilian Sunflower	D
Hordeum pusillum Nutt. - Little Barley	E
Juncus toreyii Coville - Rush	F
Juniperus virginiana L. - Red Cedar	E
Koeleria pyramidata (Lam.) Beauv. - Crested Hair Grass	E
Kuhnia eupatoriodes L. - False Boneset	E
Lepidium densiflorum Schrad. - Pepper Grass	F
Lespedeza capitata Michx. - Bur Head Clover	E
Lythrum dacotanum Nieuwland (Shinners) - Loosestrife	F
Maclura pomifera (Raf.) Schneid. - Osage Orange	E
Morus alba L. - White Mulberry	F
Oenothera macrocarpa Nutt. - Missouri Evening Primrose	F
Oenothera speciosa Nutt. - White Evening Primrose	E
Opuntia macrorhiza Engelm. - Prickly Pear	F
Panicum virgatum L. - Switchgrass	E
Petalostemon purpureum (Vent.) Rydb. - Purple Prairie Clover	E
Phalaris arundinacea L. - Canary Reed Grass	F
Phyla lanceolata (Michx.) Greene - Fog Fruit	F
Pinusnigna Arnold - Austrian Pine	F
Poa pratensis L. - Kentucky Blue Grass	D
Populus deltoides Marsh. - Cottonwood	F
Potemogeton nodusus Poir. - Long Leaved Pondweed	F
Prunus americana Marsh. - Wild Plum	C
Psoralea tenuiflora Pursh var. floribunda (Nutt.) Rydb. - Wild Alfalfa	E
Pyrus communis L. - Pear	F
Rhus aromatica Ait. - Fragrant Sumac	D
Rhus glabra L. - Smooth Sumac	E
Rosa arkansana Porter - Prairie Rose	E
Rosa multiflora Thunb. - Multiflora Rose	F
Ruellia humilis Nutt. - Wild Petunia	F
Rumex crispus L. - Curly Dock	F

Table XVIII. (Continued)

Plant Species	Percent Coverage
Salix nigra Marsh. - Black Willow	F
Salvia pitcheri Torr. - Blue Sage	F
Scirpus atrovirens Willd. - Bulrush	F
Scirpus pendulus Muhl. - Rush	F
Solidago missouriensis Nutt. - Missouri Goldenrod	D
Sorghastrum avenaceum (Michx.) Nash . - Indian Grass	D
Sphenopholis obtusata (Michx.) Scribn. - Wedge Grass	F
Symphoricarpos orbiculatus Moench - Buckbrush	C
Teucrium canadense L. - Wood Sage	E
Toxicodendron radicans L. - Poison Ivy	E
Tradescantia bracteata Small - Spiderwort	F
Tragopogon dubius Scop. - Salsify	F
Triodanis leptocarpa (Nutt.) Nieuw. - Tall Venus Looking Glass	F
Triodanis perfoliata (L.) Nieuw. - Venus Looking Glass	F
Typha latifolia L. - Common Cattail	F
Ulmus americana L. - American Elm	F
Verbena simplex Lehm. - Vervain	F
Verbena stricta Vent. - Vervain	F
Vernonia baldwini Torr. - Ironweed	D
Vitis riparia Mich. - Riverbank Grape	F

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

approximately five acres of the western edge of grid B-47. In the spring of 1976, a fire burned almost all of Unit 16 west of the pond. In September 1976, a strip running north and south near the center of the unit was cleared and mowed to increase habitat diversity (Spencer, 1981).

Recent management practices which have occurred in Unit 16 have done little to alter succession toward a woodland community. The unit existed as a shrubby community with well established thickets of woody vegetation, and sparse, open areas of native grasses and forbs. Two

ravines were located in the northern and southern portions and moisture runoff drained into Gladfelter pond. The topography was generally level, with a slight slope toward the two draws. In 1961, only a few trees were present along these ravines (Spencer, 1981), in contrast with the situation in 1977.

Wild plum, fragrant sumac, rough leaved dogwood, and buckbrush comprised the dominant woody vegetation of Unit 16. Trees in the unit included Osage orange, green ash (particularly abundant along the western portion), hackberry, honey locust, white mulberry, plains cottonwood, pear and American elm.

Dominant grasses of Unit 16 were big bluestem, little bluestem, Indian grass and smooth brome. Smooth brome was most abundant in the northwest corner and along the southern periphery where it had encroached from adjacent units. Western wheatgrass and Kentucky bluegrass occurred in scattered associations throughout the unit.

Dominant forbs of Unit 16 were common and western ragweed and Indian hemp. When compared to other units, Unit 16 contained one of the highest percentages of forbs (Table XVIII). It appeared that invading woody species in Unit 16 had reduced the amount of native grasses present. Competition for available sunlight will change the composition of the vegetation below the taller, woody shrubs (Humphrey, 1962).

UNIT 17

Unit 17 (Table XIX) was an open prairie community located in the central and westcentral portions of grid B-50 (Appendix A).

Prior to the late 1950's, Unit 17 was a cropland tract which was

Table XIX. Scientific and vernacular names of the most commonly occurring plant species in Unit 17. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Achillea millefolium L. ssp. lanulosum (Nutt.) Piper - Yarrow	E
Ambrosia artemisiifolia L. - Common Ragweed	C
Ambrosia psilostachya - Western Ragweed	E
Andropogon gerardi Vitman - Big Bluestem	E
Andropogon scoparius Michx. - Little Bluestem	B
Apocynum sibericum Jacq. - Indian Hemp	E
Aristida oligantha Michx. - Prairie Three Awn Grass	D
Asclepias syriaca L. - Common Milkweed	C
Aster ericoides L. - Heath Aster	C
Aster oblongifolius Nutt. - Oblong Leaf Aster	D
Bromus inermis Leyss. - Smooth Brome	C
Bromus japonicus Thunb. - Japanese Brome	F
Cacalia tuberosa Nutt. - Indian Plantain	F
Cirsium altissimum (L.) Spreng. - Tall Thistle	F
Cornus drummondii Meyer - Rough Leaved Dogwood	F
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundleflower	D
Elymus canadensis L. - Canada Wild Rye	E
Elymus virginicus L. - Virginia Wild Rye	D
Eragostis spectabilis (Pursh.) Steud. - Purple Love Grass	E
Erigeron strigosus Muhl. - Daisy Fleabane	E
Helianthus maximiliani Schrad. - Maximilian Sunflower	C
Helianthus rigidus (Cass.) Desf. - Rigid Sunflower	E
Liatris punctata Hook. - Gay Feather	D
Maclura pomifera (Raf.) Schneid. - Osage Orange	F
Oenothera speciosa Nutt. - White Evening Primrose	D
Opuntia macrorhiza Engelm. - Prickly Pear	E
Panicum virgatum L. - Switchgrass	E
Petalostemon purpureum (Vent.) Rydb. - Purple Prairie Clover	D
Poa pratensis L. - Kentucky Blue Grass	E
Prunus americana L. - Wild Plum	E
Psoralea tenuiflora Pursh var. floribunda (Nutt.) Rydb. - Wild Alfalfa	F
Rhus aromatica Ait. - Fragrant Sumac	F
Rosa arkansana Porter - Prairie Rose	D
Solidago missouriensis Nutt. - Missouri Goldenrod	D

Table XIX. (Continued)

Plant Species	Percent Coverage
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	D
Sporobolus asper (Michx.) Kunth - Tall Dropseed	C
Symphoricarpos orbiculatus Moench - Buckbrush	F
Ulmus americana L. - American Elm	F
Vernonia baldwini Torr. - Ironweed	E
Xanthium strumarium L. - Cocklebur	E

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

not reseeded. It was allowed to undergo succession back to a heterogeneous mixture of native grasses and forbs. By 1978 it was a level to slightly sloping tract of open prairie, with the highest elevation occurring in the southwest corner where remnants of terraces were located.

The dominant grass occurring in Unit 17 was little bluestem. Tall dropseed was also abundant. These grasses were established in dense bunches, with areas of bare ground between. Smooth brome was migrating northward from Unit 18 and becoming established in barren areas among the dominant grasses.

Common forbs in Unit 17 included Western ragweed and Maximilian sunflower.

Unit 17 contained few established woody species when compared to Unit 16. It appeared that low soil fertility might be a major factor in limiting invasion of woody species into the area.

UNIT 18

Unit 18 (Table XX) was an open prairie area comprising all of grid B-63, except for a narrow strip on the eastern edge, plus the south and southeast protion of grid B-50 (Appendix A).

Table XX. Scientific and vernacular names of the most commonly occurring plant species in Unit 18. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Achillea millefolium L. ssp. lanulosum (Nutt.) Piper - Yarrow	E
Agropyron smithii Rydb. - Western Wheatgrass	C
Ambrosia artemisiifolia L. - Common Ragweed	E
Ambrosia psilostachya DC. - Western Ragweed	E
Amorpha canescens Pursh. - Lead Plant	E
Andropogon gerardi Vitman - Big Bluestem	E
Andropogon scoparius Michx. - Little Bluestem	C
Aristida oligantha Michx. - Prairie Three Awn Grass	E
Artemisia ludoviciana Nutt. - White Sage	E
Asclepias syriaca L. - Common Milkweed	D
Aster ericoides L. - Heath Aster	D
Aster oblongifolius Nutt. - Oblong Leaf Aster	F
Bouteloua curtipendula (Michx.) Torr. - Side Oats Grama	D
Bromus inermis Leyss. - Smooth Brome	C
Bromus japonicus Thunb. - Japanese Brome	D
Cacalia tuberosa Nutt. - Indian Plantain	E
Carex annectans Bickn. - Sedge	F
Ceanothus herbaceus Raf. - New Jersey Tea	E
Celtis occidentalis L. - Hackberry	F
Cirsium altissimum (L.) Spreng. - Tall Thistle	F
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundleflower	E
Elymus canadensis L. - Canada Wild Rye	E
Elymus virginicus L. - Virginia Wild Rye	E
Erigeron strigosus Muhl. - Daisy Fleabane	E
Gaura parviflora Doug. - Velvety Gaura	F
Glycyrrhiza lepidota Pursh. - Wild Licorice	F
Hedeoma hispida Pursh. - Mock Penneyroyal	E
Helianthus annus L. - Common Sunflower	D
Helianthus maximiliani Schrad. - Maximilian Sunflower	D
Juncus torreyi Coville - Rush	F
Liatris punctata Hook. - Gay Feather	E
Oenothera speciosa Nutt. - White Evening Primrose	E
Oxalis dillenii Jacq. - Yellow Wood Sorrel	E
Panicum virgatum L. - Switchgrass	E
Petalostemon purpureum (Vent.) Rydb. - Purple Prairie Clover	E
Populus deltoides Marsh. - Cottonwood	F

Table XX. (Continued)

Plant Species	Percent Coverage
Psoralea tenuiflora Pursh var. floribunda (Nutt.) Rydb. - Wild Alfalfa	E
Rosa arkansana Porter - Prairie Rose	F
Rumex crispus L. - Curly Dock	F
Scirpus atrovirens Willd. - Bulrush	E
Solidago missouriensis Nutt. - Missouri Goldenrod	F
Solidago rigida L. - Stiff Goldenrod	D
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	C
Sporobolus asper (Michx.) Kunth. - Tall Dropseed	E
Symphoricarpos orbiculatus Moench - Buckbrush	F
Tragopogon dubius Scop. - Salsify	F
Vernonia baldwini Torr. - Ironweed	D
Xanthium strumarium L. - Cocklebur	F

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

Unit 18 was originally a cropland area that had been reseeded to smooth brome prior to 1950. Remnants of two eroded terraces were still visible in the northwest corner of the unit. In the spring of 1962, the western one-half of this unit became the site of a revegetation study conducted by the U. S. Soil Conservation Service and ESU. The area was divided into plots that were planted with a mixture of native grasses and a legume. The study tract was burned in the spring of 1974, and mowed for prairie hay in successive summers from 1974 to 1977 (Spencer, 1981).

In 1978 Unit 18 was an open prairie community, with the highest elevation occurring in the northwest corner and gentle slopes draining toward the southeast. Little invasion from woody species had occurred in this unit except for a few shrubs in the southwest and northeast corners. One reason for this occurrence may be due, in part, to the poor soils in the unit.

Dominant grasses encountered in Unit 18 were little bluestem and Indian grass. Smooth brome, Western wheatgrass, side oats grama, and tall dropseed were frequently encountered.

Forbs abundant in Unit 18 were heath aster, common sunflower, Maximilian sunflower, stiff goldenrod, and ironweed. A solitary community of wild licorice approximately 80 meters wide was located in the southcentral portion of this unit.

UNIT 19

Unit 19 (Table XXI) was an open prairie area comprising all of grid B-64, and the southern two-thirds of grid B-49, except for the hedgerow that bordered the eastern edge of these grids (Appendix A). A small area in the eastcentral portion of grid B-50 and a narrow strip of land in the extreme eastern edge of grid B-63 were also included in Unit 19 (Fig. 3).

Prior to the 1950's, Unit 19 was a cropland area, which was abandoned and reseeded to smooth brome. Two terraces were located in the northcentral portion of this unit, and appeared to have been constructed before the area was reseeded (Spencer, 1981). A weather station, erected in the early 1960's, and an observation tower, constructed in 1973, were located on the plateau area in the eastcentral portion of the unit. A narrow strip of land on the plateau area had been maintained by mowing in the summer months from the early 1960's until the present.

Unit 19 was spared management practices until 1974 when policies were implemented to maintain the unit as a non-native, cool season grassland tract. With the exception of a mature green ash tree growing along the western border and woody vegetation in the southwest portion of the

Table XXI. Scientific and vernacular names of the most commonly occurring plant species in Unit 19. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Acer negundo L. - Box Elder	F
Ambrosia artemisiifolia L. - Common Ragweed	E
Andropogon gerardi Vitman - Big Bluestem	F
Andropogon scoparius Michx. - Little Bluestem	D
Apocynum cannabinum L. - Indian Hemp	E
Aristida oligantha Michx. - Prairie Three Awn Grass	D
Artemisia ludoviciana Nutt. - White Sage	D
Asclepias tuberosa L. - Butterfly Weed	D
Asclepias verticillata L. - Whorled Milkweed	D
Asclepias viridis Walt. - Green Antelopehorn	D
Aster ericoides L. - Heath Aster	E
Aster oblongifolius Nutt. - Oblong-leaf Aster	E
Aster simplex Willd. - Tall White Aster	C
Bromus inermis Leyss. - Smooth Brome	A
Cacalia tuberosa Nutt. - Indian Plantain	E
Cirsium altissimum (L.) Spreng. - Tall Thistle	E
Celtis occidentalis L. - Hackberry	F
Cornus drummondi Meyer - R. L. Dogwood	D
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundleflower	E
Erigeron strigosus Muhl. - Daisy Fleabane	E
Elymus virginicus L. - Virginia Wild Rye	E
Eupatorium altissimum L. - Tall Thoroughwort	E
Gaura parviflora Doug. - Velvety Gaura	F
Gleditsia triacanthos L. - Honey Locust	F
Hedeoma hispida Pursh. - Mock Penneyroyal	F
Helianthus annus L. - Common Sunflower	D
Helianthus maximiliani Schrad. - Maximilian Sunflower	D
Helianthus rigidus Cass. and Desf. - Rigid Sunflower	D
Juniperus virginiana L. - Red Cedar	F
Kuhnia eupatoroides L. - False Boneset	E
Lespedeza capitata Michx. - Burhead Clover	E
Liatris punctata Hook. - Gay Feather	E
Maclura pomifera (Raf.) Schneid. - Osage Orange	F
Mirabilis nyctaginea (Michx.) MacM. - Wild Four O'Clock	E
Morus alba L. - White Mulberry	F
Opuntia macrorhiza Engelm. - Prickly Pear	F
Petalostemon purpureum (Vent.) Rydb. - Purple Prairie Clover	E

Table XXI. (Continued)

Plant Species	Percent Coverage
Populus deltoides Marsh. - Cottonwood	F
Psoralea tenuiflora Pursh var. floribunda (Nutt.) Rydb. - Wild Alfalfa	E
Rhus aromatica Ait. - Fragrant Sumac	E
Rosa arkansana Porter - Prairie Rose	D
Rumex crispus L. - Curly Dock	E
Scirpus sp.	E
Solidago missouriensis Nutt. - Missouri Goldenrod	F
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	E
Sporobolus asper (Michx.) Kunth - Tall Dropseed	C
Symphoricarpos orbiculatus Moench - Buckbrush	F
Toxicodendron radicans L. - Poison Ivy	F
Ulmus americana L. - American Elm	F
Ulmus pumila L. - Siberian Elm	F
Vernonia baldwini Torr. - Ironweed	D
Vitis riparia Michx. - Riverbank Grape	F
Xanthium strumarium L. - Cocklebur	F

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

unit, all trees and shrubs were removed from the prairie area and the unit was burned in February, 1974. The northern and southern portions of the unit were again mowed for hay in 1975. Mowing has not occurred since that time.

Unit 19 existed as an open prairie area with the highest elevation occurring in the eastcentral portion. Small gullies, now stabilized by the vegetation were located below the terraces in the south. A rocky ravine was located in the wooded area near the southwest corner of the unit.

The dominant vegetation consisted of smooth brome, with tall dropseed replacing the brome grass as the dominant species in the area immediately south of the terraces. Indian grass was present in low

lying areas in the southeast portion of the unit. It appeared that the Indian grass associations correlated with areas that received a greater abundance of moisture.

The most abundant forb located in Unit 19 was tall white aster, with increasing concentrations of Maximilian sunflower, Illinois bundle flower, and purple prairie clover in the southwest corner.

The woody area in the southwest portion of the unit contained mature specimens of cottonwood, American elm, Siberian elm, Osage orange, and white mulberry. The shrubby growth in this area consisted of thickets of rough leaved dogwood, fragrant sumac, small red cedar, honey locust, and American elm trees. Plant species growing in the shade offered by the taller vegetation were poison ivy and riverbank grape.

Terraces were observed in the north portion of Unit 19, Smooth brome was the dominant species on the terrace crowns (Table XXI). Dominant species in the troughs of the terraces were prairie three awn grass, tall dropseed, little bluestem, and smooth brome.

UNIT 20

Unit 20 (Table XXII) was an established hedgerow located along the eastern edges of grids A-39, A-42, B-49, A-57, B-64 and the northern edges of grids A-56, and A-55, A-58, and the eastern half of grid A-57 (Appendix A). A wooded area in the southwest corner of grid A-57 was also included in Unit 20.

No record existed as to when Unit 20 was initially planted, but the hedge rows were well established by the late 1940's (Spencer, 1981).

The dominant species throughout Unit 20 was Osage orange. Although the heights of the trees range from approximately eight to 12 meters,

Table XXII. Scientific and vernacular names of the most commonly occurring plant species in Unit 20. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Acer negundo L. - Box Elder	F
Ambrosia artemisiifolia L. - Common Ragweed	F
Bromus inermis Leyss. - Smooth Brome	E
Celtis occidentalis L. - Hackberry	D
Cirsium altissimum L. - Spreng. - Tall Thistle	F
Cronus drummondii Meyer - Rough Leaved Dogwood	E
Fraxinus pennsylvanica Marsh. var. subintegerrima (Vahl) Fern. - Green Ash	F
Geum canadense Jacq. - White Avens	E
Gleditsia triacanthos L. - Honey Locust	F
Maclura pomifera (Raf.) Schneid. - Osage Orange	A
Morus alba L. - White Mulberry	F
Populus deltoides Marsh. - Cottonwood	F
Prunus americana Marsh. - Wild Plum	E
Rhus aromatica Ait. - Fragrant Sumac	F
Rhus glabra L. - Smooth Sumac	F
Ribes missouriense Nutt. - Wild Gooseberry	E
Smilax hispida Muhl. - Bristly Greenbrier	F
Symphoricarpos orbiculatus Moench - Buckrush	F
Toxicodendron radicans L. - Poison Ivy	F
Ulmus americana L. - American Elm	F
Vernonia baldwini Torr. - Ironweed	E

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

evidence existed that certain parts of the unit had been cut back at least once in recent years (Spencer, 1981). Hackberry and American elm have become established and are scattered throughout the unit.

Understory vegetation was usually lacking throughout Unit 20, except in scattered areas where woody shrubs such as smooth sumac, wild plum, rough leaved dogwood, and buckbrush have become established.

The wooded area in the southwest corner of grid A-57 (Appendix A) was essentially a dense thicket dominated by wild plum and mature specimens of green ash, hackberry, white mulberry, and honey locust. Two

mature cottonwood trees were located in the extreme southwest corners of the unit near an adjacent road.

UNIT 21

Unit 21 (Table XXIII) consisted of an open prairie area with sparsely scattered trees and woody shrubs, and included most of grid A-55, except the southern one-fourth and the hedgerow along the east and north borders, and the north and northeast portion of grid A-56, except for the hedgerow along the north border (Appendix A). The remainder of grid A-56 contains the Headquarters and research areas.

Unit 21 was an abandoned cropland tract on nearly level terrain. It was last cultivated in 1948, when the area was reseeded to smooth brome and Korean lespedeza. The only management practices occurring in this unit were intermittant grazing by cattle, terminated in 1960, and maintenance of the nature trail and foot paths.

The original stand of smooth brome has been partially replaced by a variety of native tall grasses. Indian grass appears in a higher percentage than smooth brome (Table XXIII) with little bluestem, western wheatgrass, and tall dropseed present in scattered associations throughout the unit.

Woody species which have invaded the area were few in number. Perhaps this was due to the low fertility of the previously cultivated soils, as compared to open, native grassland tracts (Spencer, 1981). The principle invading woody species in Unit 21 was red cedar, with Osage orange, green ash, honey locust, and white mulberry scattered throughout. Fragrant sumac was the principle invading shrub.

Table XXIII. Scientific and vernacular names of the most commonly occurring plant species in Unit 21. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Achillea millefolium L. ssp. lanulosum (Nutt.) Piper - Yarrow	F
Agropyron smithii Rydb. - Western Wheatgrass	D
Ambrosia artemisiifolia L. - Common Ragweed	E
Ambrosia psilostachya DC. - Western Ragweed	E
Amorpha canescens Pursh. - Lead Plant	E
Andropogon gerardi Vitman - Big Bluestem	E
Andropogon scoparius Michx. - Little Bluestem	D
Artemisia ludoviciana Nutt. - White Sage	E
Asclepias tuberosa L. - Butterfly Weed	E
Asclepias verticillata L. - Whorled Milkweed	D
Asclepias viridis Walt. - Green Antelopehorn	D
Aster ericoides L. - Heath Aster	D
Aster oblongifolius Nutt. - Oblong-Leaf Aster	E
Bromus inermis Leyss. - Smooth Brome	D
Carex annectans Bickn. - Sedge	E
Celtis occidentalis L. - Hackberry	F
Cornus drummondii Meyer - Rough Leaved Dogwood	F
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundleflower	D
Elymus virginicus L. - Virginia Wild Rye	D
Erigeron strigosus Muhl. - Daisy Fleabane	D
Fraxinus pennsylvanica Marsh. var. subintegerrima (Vahl) Fern. - Green Ash	F
Gleditsia triacanthos L. - Honey Locust	F
Glycyrrhiza lepidota Pursh. - Wild Licorice	E
Gutierrezia dracuniculoides (DC.) Blake - Broomweed	E
Helianthus annus L. - Common Sunflower	D
Helianthus maximiliani Schrad. - Maximilian Sunflower	D
Juniperus virginiana L. - Red Cedar	E
Lepidium densiflorum Schrad. - Pepper Grass	E
Maclura pomifera (Raf.) Schneid. - Osage Orange	F
Morus alba L. - White Mulberry	F
Opuntia macrorhiza Engelm. - Prickly Pear	F
Petalostemon purpureum (Vent.) Rydb. - Purple Prairie Clover	E
Psoralea tenuiflora Pursh var. floribunda (Nutt.) Rydb. - Wild Alfalfa	E
Rhus aromatica Ait. - Fragrant Sumac	E
Rhus glabra L. - Smooth Sumac	F
Rosa arkansana Porter - Prairie Rose	E
Solidago missouriensis Nutt. - Missouri Goldenrod	D

Table XXIII. (Continued)

Plant Species	Percent Coverage
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	D
Sporobolus asper (Michx.) Kunth - Tall Dropseed	D
Symphoricarpos orbiculatus Moench - Buckbrush	F
Triodanis leptocarpa (Nutt.) Nieuw. - Tall Venus Looking Glass	F
Vernonia baldwini Torr. - Ironweed	E

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

UNIT 22

Unit 22 (Table XXIV) was an open prairie area located in the eastern portion of grid A-57 (Appendix A).

Prior to the 1950's, Unit 22 was a cultivated tract. When cultivation ceased, the area was not reseeded, and normal plant succession occurred.

In 1963, species of native grasses which normally occur on the Reservation were planted in a demonstration plot. Stands of Indian grass, switchgrass, big and little bluestem, and Canada wild rye occurred in the south half of the unit. Red cedar trees were planted in a row on the west side of the unit in 1967. Eastern redbud and multiflora rose were planted in the southwest corner the same year. The unit was burned in April, 1974, and again in 1976. In August, 1976, the unit was mowed and the hay was baled and removed.

Unit 22 existed as an open area on level terrain, with relatively dense stands of grasses situated in scattered associations throughout the unit. Dominant grasses which occur throughout Unit 22 were smooth brome and little bluestem. Gama grass had been planted near the

Table XXIV. Scientific and vernacular names of the most commonly occurring plant species in Unit 22. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Achillea millefolium L. ssp. lanulosum (Nutt.) Piper - Yarrow	E
Agropyron smithii Rydb. - Western Wheatgrass	D
Andropogon gerardi Vitman - Big Bluestem	E
Andropogon scoparius Michx. - Little Bluestem	D
Apocynum sibericum Jacq. - Indian Hemp	D
Aristida oligantha Michx. - Prairie Three Awn Grass	F
Asclepias syriaca L. - Common Milkweed	E
Bouteloua curtipendula (Michx.) Torr. - Side Oats Grama	D
Bromus inermis Leyss. - Smooth Brome	D
Carex muhlenbengii Schk. - Carex	E
Conyza canadensis (L.) Cronq. - Horseweed	F
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundleflower	F
Elymus canadensis L. - Canada Wild Rye	E
Elymus virginicus L. - Virginia Wild Rye	D
Erigeron strigosus Muhl. - Daisy Fleabane	D
Gaura parviflora Doug. - Velvety Gaura	D
Geranium carolinianum L. - Cranesbill	E
Helianthus maximiliani Schrad. - Maximilian Sunflower	E
Juncus interior Wieg. - Rush	E
Juniperus virginiana L. - Red Cedar	E
Lactuca serriola L. - Wild Lettuce	F
Panicum virgatum L. - Switchgrass	F
Psoralea tenuiflora Pursh var. floribunda (Nutt.) Rydb. - Wild Alfalfa	F
Rosa arkansana Porter - Prairie Rose	F
Rosa multiflora Thunb. - Multiflora Rose	F
Ruellia humilis Nutt. - Wild Petunia	E
Rumex crispis L. - Curly Dock	E
Solidago rigida L. - Stiff Goldenrod	F
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	E
Sporobolus asper (Michx.) Kunth - Tall Dropseed	D
Tripsacum dactyloides L. - Gama Grass	F
Vernonia baldwini Torr. - Ironweed	D

A = >75%
B = 50-75%
C = 25-50%
D = 6-25%
E = 1- 5%
F = <1%

westcentral boundary line and existed in scattered clumps.

Forbs occurring throughout Unit 22 were ironweed, velvety gaura, Indian hemp, and daisy fleabane. A prominent stand of Illinois bundle flower occurred in the northcentral portion of the unit.

UNIT 23

Unit 23 (Table XXV) was a prairie area with trees and shrubby thickets intermittently scattered throughout. Unit 23 comprised all of grid A-58, except the tree row which borders the west edge of the unit (Appendix A).

Prior to the late 1950's, Unit 23 was a native grassland tract. From 1961 to 1971, management was deferred and the open prairie aspect of the unit became a shrubby habitat, influenced primarily by the wooded area along the east edge of the unit.

In the spring of 1971, an experiment was conducted which involved six tracts of land each approximately 55 feet wide and running from north to south. Tract one was located on the east side of the tree row at the western edge of the boundary. Tract one was to remain in an unaltered state. Tract two was located immediately east of tract one and was cleared of woody growth in May, 1971. The tract was mowed for prairie hay in July, 1971, and a program was intitiated to repeat this procedure annually. Tract three was established as an unaltered plot. Tract four was cleared of woody vegetation in May, 1971, and a program was initiated to burn this plot as needed for management purposes. Tract five was unaltered, and tract six was cleared of woody vegetation in June, 1971, when herbicides were used to control the encroachment of woody species (Spencer, 1981).

Table XXV. Scientific and vernacular names of the most commonly occurring plant species in Unit 23. Relative abundance of each species is expressed by symbol as percent coverage.

Plant Species	Percent Coverage
Agastache nepetoides (L.) Ktze. - Yellow Giant Hyssop	F
Ambrosia artemisiifolia L. - Common Ragweed	D
Amorpha canescens Pursh. - Lead Plant	D
Andropogon gerardi Vitman - Big Bluestem	E
Andropogon scoparius Michx. - Little Bluestem	B
Apocynum sibericum Jacq. - Indian Hemp	E
Artemisia ludoviciana Nutt. - White Sage	D
Asclepias tuberosa L. - Butterfly Weed	E
Asclepias verticillata L. - Whorled Milkweed	E
Asclepias viridis Walt. - Green Antelopehorn	E
Aster oblongifolius Nutt. - Oblong Leaf Aster	D
Baptisia leucophaea Nutt. - False Indigo	E
Bouteloua curtipendula (Michx.) Torr. - Side Oats Grama	D
Bromus inermis Leyss. - Smooth Brome	D
Bromus japonicus Thunb. - Japanese Brome	D
Carex annectans Bickn. - Sedge	E
Celtis occidentalis L. - Hackberry	F
Cirsium altissimum (L.) Spreng. - Tall Thistle	E
Conyza canadensis (L.) Cronq. - Mare's Tail	E
Cornus drummondii Meyer - Rough Leaved Dogwood	E
Desmanthus illinoensis (Michx.) MacM. - Illinois Bundleflower	D
Elymus canadensis L. - Canada Wild Rye	E
Elymus virginicus L. - Virginia Wild Rye	E
Erigeron strigosus Muhl. - Daisy Fleabane	D
Eupatorium altissimum L. - Tall Thoroughwort	E
Fraxinus pennsylvanica var. subintegerrima (Vahl) Fern. - Green Ash	F
Gaura parviflora Doug. - Velvety Gaura	E
Gleditsia triacanthos L. - Honey Locust	F
Gutierrezia dracunculoides (DC.) Blake - Broomweed	D
Hedeoma hispida Pursh. - Mock Penneyroyal	E
Helianthus annus L. - Common Sunflower	C
Helianthus maximiliani Schrad. - Maximilian Sunflower	D
Helianthus rigidus Cass. and Desf. - Rigid Sunflower	E
Juglans nigra L. - Black Walnut	F
Juncus sp.	
Juniperus virginiana L. - Red Cedar	F

Table XXV. (Continued)

Plant Species	Percent Coverage
Maclura pomifera (Raf.) Schneid - Osage Orange	E
Oenothera macrocarpa Nutt. - Missouri Evening Primrose	D
Oenothera speciosa Nutt. - White Evening Primrose	E
Opuntia macrorhiza Engelm. - Prickly Pear	E
Panicum virgatum L. - Switchgrass	E
Poa pratensis L. - Kentucky Blue Grass	D
Polygonum ramosissimum Michx. - Bushy Knotweed	F
Populus deltoides Marsh. - Cottonwood	F
Prunus americana L. - Wild Plum	E
Psoralea tenuiflora Pursh var. floribunda (Nutt.) Rydb. - Wild Alfalfa	E
Rhus aromatica Ait. - Fragrant Sumac	E
Rhus glabra L. - Smooth Sumac	F
Rosa arkansana Porter - Prairie Rose	D
Rumex crispus L. - Curly Dock	F
Salix nigra Marsh. - Black Willow	F
Schrankia nuttallii (DC.) Standl. - Catclaw Sensitive Briar	F
Solanum carolinense L. - Horse Nettle	E
Solidago missouriensis Nutt. - Missouri Goldenrod	E
Sorghastrum avenaceum (Michx.) Nash - Indian Grass	D
Sporobolus asper (Michx.) Kunth - Tall Dropseed	E
Symphoricarpos orbiculatus Moench - Buckbrush	D
Thlaspi arvense L. - Field Penneycress	E
Ulmus americana L. - American Elm	F
Ulmus pumila L. - Siberian Elm	F
Vernonia baldwini Torr. - Ironweed	D
Vitis riparia Michx. - Riverbank Grape	F

A = >75% D = 6-25%
B = 50-75% E = 1- 5%
C = 25-50% F = <1%

During 1972 each tract received identical management practices, but in 1974, the entire unit was burned, and the experiment was abandoned. Tracts two, four, and six were mowed for prairie hay in July, 1974. No management practices occurred during 1975, when a small pond was constructed in the fall of that year. In 1976, the entire unit was again burned, and prairie hay was mowed from tracts two, four, and six and the

northeast portion of the unit. The area was again mowed in July, 1977.

The burning which occurred in 1974 and 1976 had little effect on the woody species present in the east and southeast portion of the unit.

The experiment was designed to illustrate that by selective use of management practices such as mowing, burning and herbicides, woody species can be controlled in an open prairie. The experiment was a mixed success.

Unit 23 appeared as two different types of habitat, separated by a limestone outcropping which runs diagonally from the southcentral boundary line. The remaining habitat separation occurred in the tracts of managed and unaltered land located in the west portion of the unit.

Tracts one, three, and five comprised the unaltered strips which were part of the experimental plots initiated in the spring of 1971. Dominant vegetation approximately 10 meters high scattered throughout these tracts were honey locust, American elm, and Siberian elm. Thickets of wild plum and rough leaved dogwood formed a scattered association.

The northcentral portion of Unit 23 as well as open prairie tracts two, four, and six were open prairie areas dominated by little bluestem, with Kentucky bluegrass prevalent in the southern portion of the unit. A ravine running from west to east and emptying into the pond, provided an increase in moisture and a suitable habitat for Virginia wild rye and sedge.

Common sunflower, Maximilian sunflower, evening primrose, daisy fleabane and butterfly milkweed were the dominant forb growth in this unit.

Little bluestem remained the dominant grass, but shrubby species such as smooth sumac, wild plum, rough leaved dogwood, buckbrush, and

fragrant sumac were rapidly becoming established. Green ash, Osage orange, hackberry, black walnut, and American elm have encroached into the open prairie from the wooded area which forms the eastern boundary line of Unit 23.

The pond is the central portion of Unit 23 supported cottonwood and willow seedlings along the shoreline. The face of the pond dam supported established stands of side oats grama and prairie rose. Steyermark (1962) supported the assumption that these species are established due to the broken soil brought about by construction of the pond dam.

Unit 23 contained a densely wooded area immediately east of the pond and along the east boundary line. Black walnut and green ash were the dominant trees occurring in this area with smooth sumac, rough leaved dogwood, and buckbrush present as dominants in the understory.

Each of the 23 vegetative units of RNHR has been manipulated to some extent through various management practices, in an effort to preserve a segment of the Tall Grass Prairie ecosystem. Such a diversity of plant species is due, in part, to past management techniques employed to slow encroachment of woody species. It is imperative that these procedures be allowed to continue, in order to maintain the species diversity found in the Tall Grass Prairie. It is the hope of the author that RNHR will remain an area where education, conservation, and preservation can be practiced and appreciated by everyone.

SUMMARY

1. RNHR vegetation was a typical remnant of the True Prairie Association, with warm and cool season grasses mixed with prairie forbs and shrubs. Acreage was divided into two categories: Native Grassland Tracts - areas that were grazed but never plowed; Abandoned Cropland Tracts - areas once under cultivation, and whose present vegetation was the result of succession or reseeding to legumes and non-native grasses.
2. Twenty-three vegetation units were analyzed during the growing season from May 20 to July 24, 1978. Each unit was analyzed according to the following criteria:
   A. Physical Features - Topography, slope, occurrence of ravines and rocky outcrops, and unique features, if any, of each unit.
   B. Brief History of Past Management Practices - Management practices, if any, that were employed and speculation as to how the practices contributed to the present vegetative composition.
   C. Vegetative Features - Dense stands of vegetation and conspicuous differences between vegetation types were noted. A species list was compiled for each unit, and the abundance of each species was visually determined and expressed as the percentage of ground covered by the respective plant type.
3. A map of RNHR showing vegetative units and their boundaries was prepared from field observation and aerial photographs.
4. After evaluating the species lists from both the native grassland and abandoned cropland units, the following three conditions were noted to occur:

A. Native grassland units exhibited the greatest species diversity per unit. This may be attributed to the higher soil fertility of native grassland units. Sod forming capabilities of smooth brome grass used in reseeding operations also appeared to inhibit the establishment of native grasses and forbs.

B. Native grassland units frequently contained the highest number of grass species.

C. Native grassland units contained the highest number of woody species in units subjected to deferred management practices. Areas which employed past management practices exhibited fewer numbers of woody species. Abandoned cropland units exhibited the least amount of woody species invasion.

5. Because management practices for each unit have been varied according to technique and time in use, no conclusion can be made as to the most effective technique for controlling the invasion of woody species.

LITERATURE CITED

LITERATURE CITED

Barber, Wesley L. 1974. Soil survey of Morris County, Kansas. United States Soil Conservation Service.

Barker, William T. and Theodore Mitchell Barkley. 1977. Atlas of the Flora of the Great Plains. Iowa State University Press, Ames, Iowa, 600 pgs.

Breukelman, John, Thomas A. Eddy, and Emily L. Hartman. 1961. "The F.B. and Rena G. Ross Natural History Reservation." The Kansas School Naturalist, Vol. 7, 4:15.

Chapman, S.D. 1976. Methods of Plant Ecology. John Wiley and Sons, New York.

Flora, S.D. 1948. "Climate of Kansas." Kansas State Board of Agriculture. Vol. LXVII, 285:320.

Harlow, William M. and Elwood S. Harrar. 1971. Textbook of Dendrology. McGraw-Hill Book Co., New York, 542 pgs.

Humphrey, Robert R. 1962. Range Ecology. Ronald Press, New York.

Kuchler, A.W. 1947. "A Geographic System of Vegetation." Geographical Review, 37:233-240.

_____. 1956. "Classification and Purpose in Vegetation Maps." Geographical Review, XLVI:155-167.

_____. 1967. Vegetation Mapping. Ronald Press Company, New York, 472 pgs.

Spencer, Dwight. 1981. Ross Natural History Reservation, The First Twenty Years. Emporia State Press, Emporia, Kansas.

Steyermark, Julian A. 1962. Flora of Missouri. Iowa State University Press, Ames, Iowa, 1725 pgs.

Weaver, J.E. 1954. North American Prairie. Johnson Publishing Company. Lincoln, Nebraska, 348 pgs.

_____ and F.W. Albertson. 1956. Grasslands of the Great Plains. Johnson Publishing Company, Lincoln, Nebraska.

Wilson, James S. 1961. Flowering Plants of the Ross Natural History Reservation, Lyon and Chase Counties, Kansas. Emporia State Research Studies. XI(4), 91 pgs.

APPENDIX A