1976

The Vascular Flora of Ordway Prairie McPherson County, South Dakota

Barry L. Hertz

THE VASCULAR FLORA OF ORDWAY PRAIRIE

MCPHERSON COUNTY, SOUTH DAKOTA

BY

BARRY L. HERTZ

A thesis submitted
in partial fulfillment of the requirements for the
degree Master of Science, Major in
Biology, South Dakota
State University
1976

THE VASCULAR FLORA OF ORDWAY PRAIRIE

MCPHERSON COUNTY, SOUTH DAKOTA

This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Science, and is acceptable as meeting the thesis requirements for this degree, but without implying that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Thesis Adviser Date

Head, Botany-Biology Department Date

ABSTRACT

The vascular vegetation of Ordway Prairie, a preserve maintained by The Nature Conservancy as an example of virgin prairie in McPherson county, South Dakota, was studied to determine its present composition. The sample comprised representatives of each species recognized in each of the 13 square-mile sections within the prairie, collected in 1975 and 1976. Three hundred nine different species, representing 170 genera in 55 plant families were found. One thousand six hundred forty-five permanent herbarium specimens, serving as vouchers for their distribution, are now in the herbarium of South Dakota State University.

ACKNOWLEDGMENTS

I would like to express my appreciation to Professor C. A. Taylor for his help and encouragement and to Dr. Gerald A. Myers for the confidence shown me during the time of this research.

I must also thank my wife Kathy for her patience and understanding and Monte M. Heintz whose friendship and help with fieldwork proved vital to the completion of this project.

Finally, a word of thanks to The Nature Conservancy by whose decision and partial financial support this study was made possible.

BLH

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

The protection of endangered species, the main focal point of the Endangered Species Act of 1973, requires preservation of their habitats and of the natural biotic communities to which they belong. Research into the habitat requirements of various floras and faunas has thus become of major importance. Environmental Impact Statements (EIS) are results of such research.

The decimation of species should be of concern to every human being. We share a common heritage with these organisms and they provide us with inspiration and beauty. In practical terms, loss of any species would deplete our resource-base in species which may someday be needed for genetic and chemical research, plant breeding, or biomedical research (Harcombe et al., 1976).

The preservation of habitat for the protection of our native flora is exemplified in the Samuel H. Ordway, Jr. Memorial Prairie. Evidently, native prairies are among the most complex plant-communities in the continental United States. It also appears that the complexity is a necessary condition of their survival, for their integrity apparently requires survival of every link in the network of chains of biotic interdependence. This tract of land could eventually provide biologists with the information needed to delineate the habitat requirements of these species and guide their management policies.

The objectives of this study were: (1) to add to our knowledge of distribution of plants found in South Dakota; (2) to observe and record the kinds of plants composing the present flora of the preserve

as a whole at the present time, as a base-line study (as close to date of purchase of the ranch as possible), by which to detect changes occurring subsequently; (3) to furnish information that will be of assistance to The Nature Conservancy (TNC, see "Recent History") in choosing subsequent management options; and (4) to locate and identify colonies of plants of particular interest or rarity.

DESCRIPTION OF STUDY AREA

Location

Ordway Prairie is located in the east-central part of South Dakota with its northeast corner lying along U.S. Highway 10, six miles west of the town of Leola in McPherson county. The study area includes parts of townships 125-126 north latitude and ranges 68-69 west longitude. At the present time, the total land area amounts to 7,720 acres or about 12 square miles (Fig. 1). Six hundred acres had been cultivated but in 1975 320 of those acres were in alfalfa. The remainder was grazed prairie (Lokemoen et al., 1975).

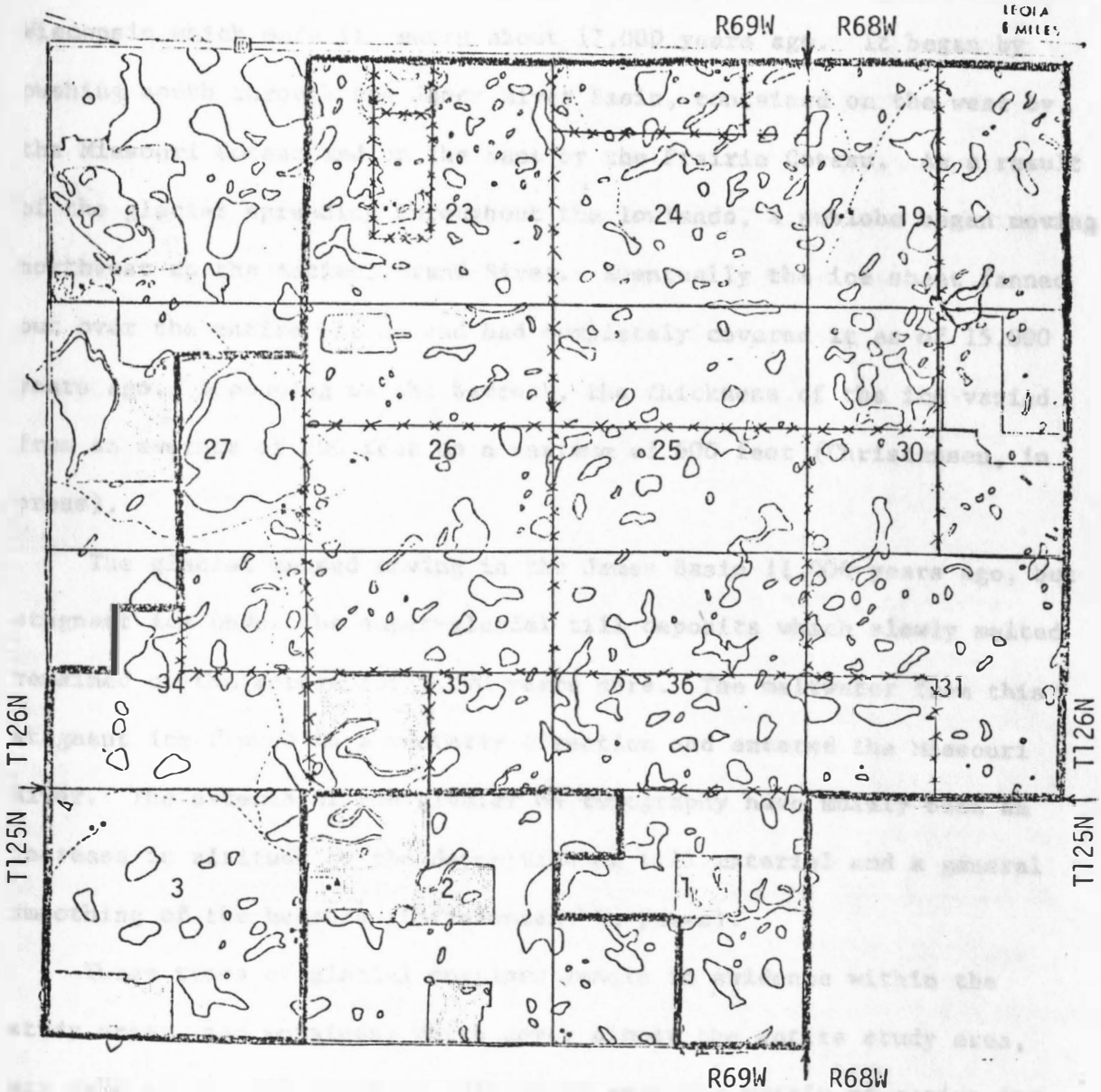
Geological and Topographical Aspects

The study area lies near the eastern edge of the Missouri Coteau, an extensive highland region stretching 200 miles north and south across South Dakota and parts of North Dakota. The coteau is 75 miles wide at the northern border of McPherson county and 25 miles wide at the southern edge of South Dakota in Charles Mix county. It is bounded by lowlands of the Missouri River and the James River, gently undulating to somewhat flat areas 200 to 300 feet lower than the coteau. The eastern edge of the coteau proper is approximately 1600 feet above sea level (Flint, 1955; Christensen, in press).

The uppermost bedrock formation is composed of Cretaceous Pierre Shale. Prior to glaciation, the topography of the coteau was characterized by a northwest to southeast slope as a result of the erosional action of the main drainage system, the Ancient Grand River, which was

FIGURE 1

SAMUEL H. ORDWAY, JR. MEMORIAL PRAIRIE



LEGEND

- Plowed
- Prairie
- Wetlands
- Boundary
- Trails
- Deserted Farms
- Scale: 1 cm=0.45 km
- Fenceline
- Section Line

located in northwestern South Dakota and flowed southeast (Christensen, in press).

The only glacial sheet to cover this area was that of the Late Wisconsin which made its entry about 17,000 years ago. It began by pushing south through the James River Basin, contained on the west by the Missouri Coteau and on the east by the Prairie Coteau. As a result of the glacier spreading throughout the lowlands, a sublobe began moving northwest up the Ancient Grand River. Eventually the ice sheet fanned out over the entire coteau and had completely covered it as of 15,000 years ago. Depending on the bedrock, the thickness of the ice varied from an average of 200 feet to a maximum of 600 feet (Christensen, in press).

The glacier ceased moving in the James Basin 11,000 years ago, but stagnant ice under the super-glacial till deposits which slowly melted remained on the coteau for 5,000 years more. The meltwater from this stagnant ice flowed in a westerly direction and entered the Missouri River. The effects of the glacier on topography have mainly been an increase in altitude by the deposition of till material and a general smoothing of the bedrock (Christensen, in press).

Three types of glacial moraines remain in evidence within the study area: end moraines, which cover almost the entire study area, are made up of till deposits left at or near the margin of active ice and may show a relief of 100 feet or more; ground moraine, a lobe of which protrudes in a southwesterly direction across the northeast corner of the prairie, consists of till deposited directly from the

advance and retreat of the ice sheet and appears as "unsystematic swells and swales"; and stagnation moraine, which cuts across the southeast edge of the study area and is characterized by hummocky topography made up of a mixture of boulders, sand, silt, and clay. Christensen made no lithological analysis but cited an analysis in North Dakota by Clayton, in which the tills of the coteau were shown to contain approximately equal amounts of sand, silt, and clay and about 5% pebbles, cobbles, and boulders. The pebbles were found to be about 55% local rock (shale), 25% limestone and dolomite and 20% igneous and metamorphic rock. It is believed that the outwash consists of approximately the same composition (Flint, 1955; Christensen, in press).

Soils

Information taken from a recent comprehensive survey of Ordway Prairie shows that the most common soil type present is the Vida-Williams loam, a fairly deep loam on uplands with 6 to 15% slope, which is a characteristic soil of glacial till plains. Its composition is of mixed mineralogy and may have a thin layer of lime on the surface. Wind and water erosion on these soils is considered severe. Soils found on hilly uplands are those of Vida-Zahill loam. With a 15 to 25% slope, these deep to moderately deep loamy soils sometimes contain segregations of calcium carbonate and lime crusts on stones and are also subject to severe erosion. Parnell silty clay loams are those most often found in the wetland areas. With this type of soil, the water table may be at or near the surface. It is a black soil characteristic of glacial depressions. Other soil types commonly found throughout the area

include the Williams-Bowbells loams and the Williams-Bowbells-Parnell complex. The eastern edge is dominated by the Williams-Bowbells-Nishon complex. More detailed information may be obtained by contacting the Soil Conservation Service in Leola (U.S.D.A., Soil Conservation Service, 1976; U.S.D.A., 1971).

Climate

The climate is of the continental type with no large bodies of water in the immediate area to influence weather conditions. The temperature extremes for the three reporting points nearest the study area are given below. The data for Roscoe and Eureka was obtained from observations of the United States Weather Service. The city of Aberdeen is located 40 miles southeast on the James River Lowland. Eureka is 30 miles west on the Missouri Coteau, and Roscoe, 35 miles southwest, also on the coteau. The coldest month of the year is January while the hottest is July (Spuhler, 1966). Most of the precipitation occurs from May through August with June providing the greatest monthly rainfall and January the largest amount of snow (see Table I summarizing temperature and precipitation data).

TABLE I

Temperature and Precipitation Values
for the Vicinity of Ordway Prairie

	Aberdeen (1896-1964)	Eureka (1906-1975)	Roscoe (1941-1970)
Temperature			
Maximum	115° F	114° F	109° F
Minimum	-46° F	-45° F	-33° F
	Aberdeen (1930-1964)	Eureka (1941-1970)	Roscoe (1941-1970)
Average annual precipitation	19.18 in.	16.80 in.	17.17 in.

The probability that plants of Ordway prairie have had to survive extremes of temperature and rainfall beyond those recorded in this short time span cannot be excluded. The data shows that the study area gets approximately 17 inches of rainfall per year, about 2 inches less than the average in the lowland station at Aberdeen. Had the records covered more time, the study area might have shown a lower average precipitation.

Information on wind velocity was available only for Aberdeen with winds out of the south averaging 11 miles per hour for the summer months and northwesterly winds during the winter averaging 12 miles per hour. Strong winds during seasonal storms and the passage of cold fronts occasionally reach 50 miles per hour (Spuhler, 1966).

Drainage

Post-glacial drainage of the area is interior with no well-defined surface drainage pattern, although during the wet season grassy waterways connect local depressions in the topography.

There are about 400 recognizable lakes or sloughs within the area with the largest body of water covering nearly 120 acres (Lokemoen et al., 1975).

Recent History

About 1950, Tom Boylan bought most of the land now included by Ordway Prairie. Boylan was a rancher who used modern grazing techniques in an attempt to re-establish some of the plant species native to the area. He used a combination of resting, then reseeding to green-needle grass (Stipa viridula) and resting again up to two years. He would rest all of his rangeland once every five years and between 500 to 700 acres were completely deferred each year. Besides deferred grazing, Boylan also used water development in the form of artificial stock-watering ponds and cross-fencing as part of his range improvement plan. Through the use of these methods, the range condition did improve along with the carrying capacity for Boylan's cattle operation (Stensland, 1960; Pozarnsky, 1966).

Approximately five or six years ago, Senator Leroy Hoffman purchased the Boylan Ranch. Hoffman used a recently devised system called the "Hormay rest-rotation grazing system" as his main management tool. In general, this amounted to grazing heavily for part of the year and then resting for a full season. The idea was to simulate the

grazing effects of the native herbivores, more specifically the insects, rodents, lagomorphs, antelope and bison (Lokemoen et al., 1975).

On July 10, 1975 the tract of land now known as the Samuel H. Ordway, Jr. Memorial Prairie was purchased from Leroy Hoffman by The Nature Conservancy (TNC), a nonprofit national organization which acquires ecologically and environmentally significant land for preservation and for the continuance of educational and scientific study. In early 1976, the midwest regional branch of TNC hired a permanent manager who has the main responsibility for maintenance and improvements as well as the development of future research guidelines.

Potential Natural Vegetation

Kuechler (1964) categorized the vegetation of the United States according to dominants and considered potential natural vegetation as vegetation that would be present under any particular climate if the effects of man were removed. In his opinion, the study area falls inside the boundaries of a large expanse of prairie dominated by an Agropyron-Stipa association. Its physiognomy is that of a moderately dense, short or medium tall prairie. The dominant plants are Agropyron smithii, Bouteloua gracilis, Stipa comata, and Stipa viridula. Other plants that might be present include Agropyron trachycaulum, Antennaria spp., Artemisia frigida, Carex spp., Koeleria cristata, Mertensia spp., Oryzopsis hymenoides, Penstemon spp., Andropogon scoparius, Artemisia dracunculus, Artemisia ludoviciana, Aster ericoides, Echinacea pallida, Liatris punctata, Psoralea agrophylla, Solidago spp., and Stipa spartea.

Vouchers from the study area show that all of these species are present except for Mertensia spp. and Oryzopsis hymenoides.

PROCEDURE OF THE STUDY

Examination of Previous Collections in the Study Area

No published records of previous collections have been made specific to the study area. Similar research was carried out by Roberts (1974) in northeastern Day county. Over (1932), Winter et al. (1959), and Van Bruggen (1976), published floristic lists or manuals of the entire state. Since distribution was usually expressed in regional terms, i.e., "eastern S. D.", "southeastern S. D.", etc., only on rare occasions was there a reference to a specific county and no direct reference was made to this study area.

Selection and Coverage of Collection Sites

In 1975, a preliminary reconnaissance of the study area was made. Locations of collection sites were determined by accessibility and the desire to sample as many different habitat types as possible. Collecting was done along the legal boundaries as well as along sloughs, potholes, fencelines, and old trails.

During the collecting period of 1976, each section was crossed three times along different line traverses, once each during late spring, mid-summer, and early fall. For the first two trips, diagonal transects were followed. An imaginary square-inside-a-square a quarter of a mile within the boundaries of each section with its boundaries parallel to those of the section, was traversed in the fall. Adjustments along the transects were made for wetlands and grazing cattle.

Any species that had not previously been documented for a specific section was then collected. From spring 1975 to fall 1976, there were a total of 48.5 days spent in the field.

Methods of Collection and Presentation

A hotel in nearby Leola and the unoccupied ranchhouse on the preserve served as living quarters and preparation space for pressing and drying during the collecting periods of 1975. A house owned by a neighboring rancher was rented for pressing and drying the following year.

Plants collected along the outer boundaries and roadsides were usually pressed immediately. On extended field trips away from roads, a vasculum and moist plastic bags were used for transportation and protection of the specimens prior to pressing and drying. When each specimen was collected, notes were made describing its relative abundance, plant associates, general soil-type, slope, moisture, as well as location and date of collection.

The press-dried specimens were chemically treated with 10% mercuric chloride in ethanol to prevent damage by museum pests, mounted on white herbarium paper, and stored in the South Dakota State University herbarium. Representative vouchers to illustrate the prairie's characteristic species will later be moved to the research center at the preserve. The specimens were identified by use of current manuals and comparison with reliably-named specimens in the herbarium of South Dakota State University. Most specimens were identified in the

field by the author. The remainder were identified by Professor C. A. Taylor who also verified all identifications.

Nomenclature cited here follows the International Code of Botanical Nomenclature.

RESULTS AND OBSERVATIONS

The main focus of the study was to tabulate the diversity of species presently inhabiting Ordway Prairie and to list the sections in which each species was found.

General Species Listing

A total of 55 families, 170 genera, and 309 species are represented here. Because of disagreement of phylogenetic relationships among plant taxonomists, the taxa are listed alphabetically rather than phylogenetically. The section number in which each species was found is given and whether or not the plant was introduced. A species reported for only one section may be considered rare but only in regard to the study area itself. Where the word "ubiquitous" is cited, it should be understood that the particular species is found in all sections. Supplementary information regarding habitat is furnished in some cases.

ALISMATACEAE, the Water-plantain Family

Alisma gramineum Gmelin

Ponds in sect. 3, 24, 26.

A. plantago-aquatica L.

Edge of wetlands in sect. 1, 3, 23, 26, 31, 36.

Sagittaria cuneata Sheldon

Wetlands in sect. 3, 23, 26.

S. montevidensis Chamisso and Schlechtendahl

Edge of pond in sect. 26.

AMARANTHACEAE, the Amaranth Family

Amaranthus graecizans L.

Disturbed soils, sect. 19, 31, 34.

A. retroflexus L.

Disturbed soils, sect. 1, 23, 31. Introduced.

APIACEAE, the Parsley Family

Lomatium orientale Coulter and Rose

Sect. 3, 25.

Sium suave Walter

Edge of marsh, sect. 3.

APOCYNACEAE, the Dogbane Family

Apocynum cannabinum L.

Sect. 23, 30.

A. sibiricum Jacquin

Moist site, sect. 23.

ASCLEPIADACEAE, the Milkweed Family

Asclepias lanuginosa Nuttall

Disturbed gravel, sect. 31.

A. ovalifolia Decaisne

Disturbed gravel, sect. 23.

A. pumila (A. Gray) Vail

Sandy loam, sect. 19.

A. speciosa Torrey

Moist site, sect. 23.

A. syriaca L.

Sect. 24, 35.

A. verticillata L.

Disturbed gravel, sect. 19.

A. viridiflora Rafinesque-Schmaltz

Sect. 3, 24, 35.

ASTERACEAE (COMPOSITAE), the Composite Family

Achillea millefolium L.

Sect. 1, 3, 19, 23, 24, 34, 36. Introduced.

Agoseris glauca Pursh

Sect. 1, 24, 25, 31.

Ambrosia artemisiifolia L.

Sect. 31, 34, 35.

A. psilostachya De Candolle

Apparently tolerant of variations in soil and moisture. Sect. 1, 3, 19, 23, 24, 25, 26, 27, 30, 31, 34, 36. Introduced.

A. trifida L.

Disturbed soils, sect. 31.

Antennaria neglecta Greene

Chiefly well-drained sites, sect. 1, 3, 19, 23, 24, 25, 26, 31, 36.

A. parvifolia Nuttall

Well-drained sites, sect. 23.

Artemisia abrotanum L.

Disturbed soils, sect. 34. Introduced.

A. absinthium L.

Sect. 3, 19, 23, 24, 27. Introduced.

A. biennis Willdenow

Sect. 31, 35. Introduced.

A. campestris L.

Apparently tolerant of variations in soil and moisture. Sect. 1, 19, 23, 24, 26, 27, 30, 31, 36.

A. dracunculus L.

Sect. 3, 25.

A. frigida Willdenow

Ubiquitous.

A. ludoviciana Nuttall

Ubiquitous.

Aster brachyactis Blake

Wet saline seep, sect. 3.

A. ericoides L.

Sect. 3, 23, 26, 27, 31.

A. hesperius A. Gray

Sect. 19, 30.

A. oblongifolius Nuttall

Rocky hilltop, sect. 24.

A. ptarmicoides (Nees ab Esenbeck) Torrey and Gray

Sect. 3, 19, 24, 25, 26.

A. simplex Willenow

Sect. 3, 19, 30, 31.

Bidens cernua L.

Edges of marshes, Sect. 3, 19.

B. vulgata Greene

Sect. 1, 19, 23, 30, 31.

Boltonia asteroides (L.) L'Héritier

Moist sites of low areas, sect. 3, 26, 30, 31.

Chrysopsis villosa (Pursh) Nuttall

Well-drained sites, sect. 19, 23, 26, 30, 35.

Cirsium arvense (L.) Scopoli

Sect. 3, 23. Introduced.

C. flodmanii (Rydberg) Arthur

Sect. 3, 23, 24, 26, 31, 34.

C. undulatum (Nuttall) Sprengel

Sect. 27, 30, 31, 35, 36.

Conyza canadensis (L.) Cronquist

Sect. 19, 24, 30, 35.

Echinacea pallida Nuttall

Ubiquitous.

Erigeron strigosus Muhlenberg

Ubiquitous.

Gaillardia aristata Pursh

Well-drained sites, sect. 23, 24, 31, 34, 36.

Grindelia squarrosa (Pursh) Dunal

Uniquitous. Introduced.

Gutierrezia sarothrae (Pursh) Britton and Rusby

Sect. 23, 26, 27, 35.

Haplopappus spinulosus (Pursh) De Candolle

Sect. 19, 23, 31.

Helianthus annuus L.

Sect. 23, 30.

H. laetiflorus Persoon

Apparently tolerant of variations in soil and moisture. Sect. 3, 19, 23, 24, 25, 26, 27, 30, 31, 35.

H. maximiliani Schrader

Apparently tolerant of variations in soil and moisture. Sect. 3, 19, 23, 24, 27, 30, 31.

Iva xanthifolia Nuttall

Chiefly of disturbed soils, sect. 1, 23, 31.

Kuhnia eupatorioides L.

Sect. 1, 3, 19, 27, 30, 36.

Lactuca pulchella (Pursh) De Candolle

Sect. 3, 19, 23, 24, 31, 35, 36.

L. serriola L.

Disturbed soils, sect. 1. Introduced.

Liatris aspera Michaux

Sect. 19, 24, 27, 30, 34.

L. punctata Hooker

Well-drained sites, sect. 1, 3, 19, 23, 24, 25, 26, 27, 30, 31, 35, 36.

Lygodesmia juncea (Pursh) D. Don

Chiefly well-drained sites, sect. 1, 3, 19, 23, 24, 26, 27, 31, 35, 36.

Ratibida columnifera (Nuttall) Wooton and Standley

Ubiquitous.

Senecio integerrimus Nuttall

Sect. 3, 35, 36.

Silphium laciniatum L.

Rocky knoll, sect. 23.

Solidago canadensis L.

Apparently tolerant of variations in soil and moisture. Sect. 1, 3, 19, 23, 24, 25, 26, 27, 31, 34.

S. missouriensis Nuttall

Ubiquitous.

S. mollis Bartling

Sect. 3, 24, 26, 31, 36.

S. rigida L.

Sect. 3, 24, 25, 27, 31.

Sonchus uliginosus Bieberstein

Sect. 23, 24. Introduced.

Tanacetum vulgare Linnaeus

Abandoned farm-yard, sect. 3. Introduced.

Taraxacum laevigatum (Willdenow) De Candolle

Ubiquitous. Introduced.

T. officinale Weber

Ubiquitous. Introduced.

Tragopogon dubius Scopoli

Sect. 3, 24, 31, 35, 36. Introduced.

Vernonia fasciculata Michaux

Sect. 26, 30, 31, 34.

Xanthium strumarium L.

Disturbed soils, sect. 23, 24. Introduced.

BORAGINACEAE, the Borage Family

Lappula echinata Gilibert

Chiefly of disturbed soils, sect. 3, 19, 23, 24. Introduced.

Lithospermum incisum Lehmann

Sect. 25, 26, 36.

Onosmodium molle Michaux

Sect. 3, 23, 24, 34.

BRASSICACEAE (CRUCIFERAE), the Mustard Family

Arabis hirsuta (L.) Scopoli

Well-drained site, sect. 19.

Brassica kaber (De Candolle) L. C. Wheeler

Disturbed soil, sect. 31. Introduced.

Capsella bursa-pastoris (L.) Medicus

Disturbed soils, sect. 30. Introduced.

Descurainia sophia (L.) Webb

Disturbed soils, sect. 3, 19, 23, 24, 26, 30. Introduced.

Draba nemorosa L.

Well-drained sites, sect. 23, 25, 31.

Erysimum asperum (Nuttall) De Candolle

Ubiquitous on well-drained sites.

E. inconspicuum (S. Watson) Mac Millan

Well-drained sites, sect. 1, 19, 23.

Lepidium densiflorum Schrader

Chiefly of disturbed soils, sect. 3, 19, 24, 35. Introduced.

Lesquerella ludoviciana (Nuttall) S. Watson

Well-drained sites, sect. 19, 23, 24, 25, 30, 31.

Rorippa islandica (Oeder) Borbás

Edge of wetlands, sect. 1, 3, 19, 24, 36.

Sisymbrium altissimum L.

Well-drained site, sect. 23. Introduced.

Thlaspi arvense L.

Chiefly of disturbed soils, sect. 30. Introduced.

CACTACEAE, the Cactus Family

Mammillaria vivipara (Nuttall) Haworth

Rocky loam, sect. 25. Also sect. 23, 24 but no vouchers were made.

CALLITRICHACEAE, the Water Starwort Family

Callitriche verna L.

Open water of ponds, sect. 1, 3.

CAPRIFOLIACEAE, the Honeysuckle Family

Symphoricarpos occidentalis Hooker

Sect. 1, 19, 24, 30, 35, 36.

CARYOPHYLLACEAE, the Pink Family

Cerastium arvense L.

Ubiquitous on well-drained sites.

Lychnis drummondii (Hooker) S. Watson

Gravel ridge, sect. 23.

Silene cucubalus Wibel

Sect. 23. Introduced around gravel pit.

CERATOPHYLLACEAE, the Hornwort Family

Ceratophyllum demersum L.

Submerged aquatic of ponds, sect. 3, 19, 24, 26.

CHENOPODIACEAE, the Goosefoot Family

Atriplex argentea Nuttall

Moist site, sect. 3. Introduced.

A. patula L.

Edges of marshes, sect. 3, 27, 34.

Chenopodium album L.

Moist sites of low areas, sect. 1, 19, 23, 24, 34, 35. Introduced.

C. desiccatum Aven Nelson

Sect. 30, 35.

C. glaucum L.

Moist sites of low areas, sect. 3. Introduced.

C. rubrum L.

Moist sites of low areas, sect. 3, 31.

Kochia scoparia (L.) Schrader

Disturbed soils, sect. 19, 23, 31, 34. Introduced.

Salsola kali L.

Chiefly of disturbed soils, sect. 19, 23, 24, 27, 31, 34, 35. Introduced.

COMMELINACAEAE, the Spiderwort Family

Tradescantia bracteata Small

Moist site, sect. 24.

T. occidentalis (Britton) Smyth

North slope, sect. 30.

CUPRESSACEAE, the Cypress Family

Juniperus virginiana L.

Hilltop, sect. 3.

CONVOLVULACEAE, the Morning-glory Family

Convolvulus arvensis L.

Disturbed soils, sect. 1, 23, 31. Introduced.

CYPERACEAE, the Sedge Family

Carex atherodes Sprengel

Moist sites, sect. 23, 24.

C. aurea Nuttall

Moist site, sect. 23.

C. brevior (Dewey) Mackenzie

Sect. 1, 3, 19, 23, 30, 35.

C. crawei Dewey

Moist site, sect. 23.

C. eleocharis Bailey

Well-drained sites, sect. 23, 30, 34, 36. Introduced.

C. filifolia Nuttall

Well-drained sites, sect. 19, 31, 35.

C. laeviconica Dewey

Low areas, sect. 1, 19, 23, 25, 35.

C. lanuginosa Michaux

Low areas, sect. 3, 23, 24, 27, 31, 34, 36.

C. praegracilis W. Boott

Sect. 23, 35, 36.

C. vulpinoidea Michaux

Edges of marshes, sect. 3, 19, 23, 24.

Eleocharis acicularis (L.) Roemer and Schultes

Edge of wetlands, sect. 3, 23, 24, 26.

E. calva Torrey

Sect. 23, 35.

E. compressa Sullivant

Low areas, sect. 23, 31.

E. palustris (L.) Roemer and Schultes

Edge of wetlands, sect. 1, 3, 19, 23, 24, 31, 34, 36.

E. parvula (Roemer and Schultes) Link

Edge of marsh, sect. 31.

Scirpus acutus Muhlenberg

Wetlands, sect. 23, 24, 34, 35, 36.

S. americanus Persoon

Edge of wetlands, sect. 23, 24, 25, 27, 34.

S. atrovirens Willdenow

Edge of marsh, sect. 23, 25.

S. fluviatilis (Torrey) A. Gray

Moist sites of low areas, sect. 3, 35.

S. maritimus (L.) Greene

Edges of marshes, sect. 3, 23. Introduced.

S. validus Vahl

Edge of wetlands, sect. 1, 3, 23, 24, 26. Introduced.

ELAEAGNACEAE, the Oleaster Family

Elaeagnus angustifolia L.

Sect. 27. Introduced.

EQUISETACEAE, the Horsetail Family

Equisetum laevigatum A. Braun

Moist soils of wetlands, sect. 19, 23, 26, 36.

EUPHORBIACEAE, the Spurge Family

Euphorbia esula L.

Sect 3. Introduced.

E. glyptosperma Engelmann

Disturbed soils, sect. 19, 23, 34.

E. serpyllifolia Persoon

Disturbed soil, sect. 31.

FABACEAE (LEGUMINOSAE), the Bean Family

Amorpha canescens Pursh

Well-drained sites, sect. 1, 19, 23, 24, 25, 31, 34, 36.

A. nana Nuttall

Sect. 23, 24, 35.

Astragalus adsurgens Pallas

Well-drained sites, sect. 23, 24, 31, 35.

A. agrestis Douglas

Well-drained sites, sect. 3, 19, 23, 24, 26, 31, 36.

A. crassicarpus Nuttall

Apparently tolerant of variations in soil and moisture. Sect. 19, 23, 24, 25, 30, 31, 34, 35, 36.

A. flexuosus Douglas

Sect. 23, 24, 26.

A. gilviflorus Sheldon

Rare, sect. 23.

Glycyrrhiza lepidota Pursh

Ubiquitous in moist, low areas.

Lotus purshianus Clements and Clements

Sect. 3, 24, 31, 34.

Medicago falcata L. x M. sativa L.

Disturbed soils, sect 23. Introduced.

M. lupulina L.

Sect. 23. Introduced.

M. sativa L.

Disturbed soils, sect. 3, 23, 24. Introduced.

Melilotus alba Desrousseaux

Disturbed soils, sect. 1, 3, 19, 23, 24, 34. Introduced.

M. officinalis (L.) Lamarck

Disturbed soils, sect. 1, 3, 19, 23, 24, 34, 35. Introduced.

Oxytropis lambertii Pursh

Well-drained sites, sect. 1, 3, 23, 24, 26, 31, 36.

Petalostemum candidum (Willdenow) Michaux

Sect. 23.

P. occidentale (A. Gray) Fernald

Sect. 34.

P. purpureum (Ventenat) Rydberg

Apparently tolerant of variations in soil and moisture. Sect. 1, 3, 23, 24, 26, 27, 31, 34, 35, 36.

Psoralea argophylla Pursh

Apparently tolerant of variations in soil and moisture. Sect. 1, 3, 19, 23, 24, 26, 27, 31, 34, 35, 36.

P. esculenta Pursh

Well-drained sites, sect. 1, 24, 31, 34, 36.

Trifolium repens L.

Sect. 23. Introduced.

Vicia americana Muhlenberg

Sect. 19, 25, 26.

HALORAGACEAE, the Water-milfoil Family

Myriophyllum exalbescens Fernald

Submerged aquatic. Sect. 19.

M. verticillatum L.

Ponds of sect. 1.

IRIDACEAE, the Iris Family

Sisyrinchium angustifolium Miller

Moist sites, sect. 36.

S. montanum Greene

Sect. 1, 23.

JUNCACEAE, the Rush Family

Juncus balticus L.

Edge of wetlands, sect. 23, 24, 27, 35, 36. Introduced.

J. interior Wiegand

Sect. 23, 31, 36.

J. torreyi Coville

Edge of marsh, sect. 3, 24, 25.

LAMIACEAE (LABIATAE), the Mint Family

Hedeoma drummondii Bentham

Sect. 19, 23.

Lycopus americanus Muhlenberg

Moist sites of low areas, sect. 19, 26, 30, 31.

L. asper Greene

Moist sites of low areas, sect. 3, 23, 24, 26, 27.

Mentha arvensis L.

Moist sites of low areas, sect. 3, 23, 24, 25, 31.

Salvia reflexa Hornemann

Chiefly of disturbed soils, sect. 1, 31.

Stachys palustris L.

Moist sites of low areas, sect. 1, 3, 19, 23, 24, 25, 27, 31, 34.

Teucrium canadense L.

Moist sites of low areas, sect. 24, 25, 26, 31.

LEMNACEAE, the Duckweed Family

Lemna minor L.

Floating or on saturated soil of wetlands, sect. 3, 23, 24, 34, 36.

L. trisulca L.

Submerged or on saturated soil of wetlands, sect. 3, 23, 36.

LENTIBULARIACEAE, the Bladderwort Family

Utricularia vulgaris L.

Shallow water of ponds, sect. 3, 34, 36.

LILIACEAE, the Lily Family

Allium cernuum Roth

Moist site, sect. 27.

A. stellatum Ker-Gawler

Apparently tolerant of variations in soil and moisture. Sect. 19, 24, 25, 26, 30, 31, 35, 36.

A. textile A. Nelson and Macbride

Sect. 19, 23, 25, 26, 31.

Zigadenus elegans Pursh

Moist sites, sect. 23, 24, 36.

LINACEAE, the Flax Family

Linum rigidum Pursh

Well-drained sites, sect. 19, 24, 31, 35.

L. sulcatum Riddell

Well-drained sites, sect. 1, 3, 19, 34.

LOBELIACEAE, the Lobelia Family

Lobelia spicata Lamarck

Sect. 24, 34, 36.

MALVACEAE, the Mallow Family

Malva rotundifolia L.

Disturbed soils, sect. 1, 31. Introduced.

Sphaeralcea coccinea (Pursh) Rydberg

Compacted soils, sect. 23.

NAJADACEAE, the Naiae Family

Ruppia maritima L.

Submerged, large lake in sect. 27.

NYCTAGINACEAE, the Four-o'clock Family

Mirabilis hirsuta (Pursh) MacMillan

Sect. 23, 24, 25, 26, 27.

ONAGRACEAE, the Evening-primrose Family

Epilobium leptophyllum Rafinesque-Schmaltz

Sect. 27.

Gaura coccinea (Nuttall) Pursh

Sect. 1, 19, 23, 24, 26, 27, 35.

Oenothera biennis L.

Sect. 19, 25, 27, 30, 35.

O. nuttallii Sweet

Sect. 1, 26.

O. serrulata Nuttall

Apparently tolerant of variations in soil and moisture. Sect. 1, 3, 19, 24, 25, 26, 31, 34, 35, 36.

OXALIDACEAE, the Wood-sorrel Family

Oxalis stricta L.

Sect. 19, 24, 25.

PLANTAGINACEAE, the Plantain Family

Plantago major L.

On cow-path, sect. 3. Introduced.

P. patagonica Jacquin

Dry or hillside sites, sect. 19, 23.

POACEAE (GRAMINEAE), the Grass Family

Agropyron cristatum (L.) Gaertner

Well-drained soil in sect. 3, 19, 23, 24. Introduced.

A. repens (L.) Gaertner

Disturbed soils, sect. 19, 23, 31. Introduced.

A. smithii Rydberg

Well-drained sites, sect. 1, 3, 19, 23, 24, 30, 31, 34, 35, 36.

A. subsecundum (Link) Hitchcock

Well-drained sites, sect. 3, 24, 25, 35, 36.

A. trachycaulum (Link) Malte

Sect. 23, 24, 27.

Agrostis hyemalis (Walter) Britton, Stearns and Poggenberg

Sect. 1, 3, 19, 34, 35, 36.

Alopecurus aequalis Sobolewski

Moist sites of low areas, sect, 1, 3, 24.

A. pratensis L.

Edge of wetlands, sect. 19, 23. Introduced.

Andropogon gerardii Vitman

Ubiquitous.

Avena fatua L.

Disturbed soil, sect. 1. Introduced.

Beckmannia syzigachne (Steudel) Fernald

Edge of wetlands, sect. 1, 3, 19, 23, 24.

Bouteloua curtipendula (Michaux) Torrey

Apparently tolerant of variations in soil and moisture. Sect. 1, 3, 19, 23, 24, 25, 27, 35.

B. gracilis (H.B.K.) Lagasca ex Steudel

Sect. 23, 31, 35.

Bromus inermis Leysser

Disturbed soils, sect. 3, 19, 23, 24, 31. Introduced.

B. japonicus Thunberg

Disturbed soils, sect. 23, 24. Introduced.

Buchloë dactyloides (Nuttall) Engelmann

Sect. 3, 36.

Calamagrostis canadensis (Michaux) Palisot de Beauvois

Edges of marshes, sect. 19, 24, 36.

C. inexpansa A. Gray

Moist sites near ponds and sloughs, sect. 3, 27.

C. neglecta (Ehrhart) Gaertner, Meyer and Schreber

Edge of wetlands, sect. 1, 3, 19, 23, 24, 25, 31, 34.

Calamovilfa longifolia (Hooker) Lamson-Scribner

Sect. 3, 19, 23, 24, 27, 30, 35, 36.

Distichlis stricta (Torrey) Rydberg

Sect. 3, 23, 31, 34, 36.

Echinochloa crusgalli (L.) Palisot de Beauvois

Disturbed soils, sect. 23, 31. Introduced.

Elymus canadensis (L.)

Sect. 19, 23, 24, 25, 27, 31.

Eragrostis cilianensis (Allioni) Link ex Vignola-Lutati

Disturbed soils, sect. 19, 31, 34. Introduced.

Festuca ovina L.

Dry site, sect. 23. Introduced.

Glyceria grandis S. Watson

Moist site of low area, sect. 31.

Hierochloë odorata (L.) Palisot de Beauvois

Road-bank gravel, sect. 3.

Hordeum jubatum L.

Ubiquitous in low areas.

Koeleria cristata (L.) Persoon

Well-drained sites of sect. 1, 3, 19, 23, 24, 27, 30, 31, 34, 35, 36.

Muhlenbergia asperifolia (Nees and Meyer) Parodi

Moist sites, sect. 23, 27, 34.

M. cuspidata (Nuttall) Rydberg

Sect. 3, 23, 31.

Panicum capillare L.

Well-drained site, sect. 30.

P. perlongum Nash

Well-drained site, sect. 3.

P. virgatum L.

Edge of wetlands, sect. 3, 23, 24, 25, 26, 27, 30, 31, 34, 35, 36.

Phalaris arundinacea L.

Moist loam, edge of slough, sect. 24.

Phleum pratense L.

Sect. 24. Introduced.

Poa canbyi (Lamson-Scribner) Piper

Moist loam, hillside in sect. 36.

P. compressa L.

Well-drained sites, sect. 1, 19, 23, 24, 36. Introduced.

P. interior Rydberg

Moist loam beside slough, sect. 24.

P. palustris L.

Sect. 3, 30, 34, 35.

P. pratensis L.

Ubiquitous. Introduced.

Puccinellia nuttalliana (Schultes) Hitchcock

Moist site, sect. 23.

Schizachyrium scoparium (Michaux) Nash

Ubiquitous on well-drained sites.

Scolochloa festucacea (Willdenow) Link

Edge of wetlands, sect. 3, 24, 30, 35.

Secale cereale L.

Disturbed soil, sect. 23. Introduced.

Setaria lutescens (Weigel) F. T. Hubbard

Disturbed soils, sect. 19, 23, 27. Introduced.

S. viridis (L.) Palisot de Beauvois

Disturbed soils, sect. 23, 34. Introduced.

Spartina pectinata Link

Edge of wetlands, sect. 3, 23, 24, 25, 27, 30, 35.

Sporobolus neglectus Nash

Disturbed soil, roadside, sect. 31.

Stipa comata Trinius and Ruprecht

Well-drained sites, sect. 1, 19, 23, 24, 36.

S. spartea Trinius

Apparently tolerant of variations in soil and moisture. Sect. 1, 3, 23, 24, 26, 30, 34, 35, 36.

S. viridula Trinius

Ubiquitous on well-drained sites.

POLYGALACEAE, the Milkwort Family

Polygala alba Nuttall

Well-drained sites, sect. 23, 24, 26, 31, 34, 36.

P. verticillata L.

Dry site, sect. 19.

POLYGONACEAE, the Smartweed Family

Polygonum achoreum Blake

Disturbed soil, sect. 31.

P. aviculare L.

Disturbed soil, sect. 23, 24, 31. Introduced.

P. coccineum Muhlenberg

Edges of marshes, sect. 3, 19, 23, 30, 31.

P. convolvulus L.

Disturbed soil, sect. 23, 24, 30. Introduced.

P. erectum L.

Disturbed soils, sect. 23, 24, 31, 34.

P. lapathifolium L.

Level loam in sect. 1, 30.

P. ramosissimum Michaux

Sect. 24, 31.

Rumex crispus L.

Moist sites of low areas, sect. 23, 24, 30. Introduced.

R. occidentalis S. Watson

Moist site, sect. 27.

R. maritimus L.

Sect. 27, 31.

R. mexicanus Meissner

Moist sites of low areas, sect. 3, 24, 36.

R. stenophyllus Ledebour

Moist sites of low areas, sect. 23, 30. Introduced.

PORTULACEAE, the Purslane Family

Portulaca oleracea L.

Sect. 31. Introduced.

POTAMOGETONACEAE, the Pondweed Family

Potamogeton berchtoldii Fieber

Submerged aquatic, sect. 3.

P. diversifolius Rafinesque-Schmaltz

Pond in sect. 26.

P. foliosus Rafinesque-Schmaltz

Ponds in sect. 26.

P. gramineus L.

Ponds in sect. 3.

P. pectinatus L.

Ponds in sect. 3, 34, and lake in sect. 27.

P. pusillus L.

Ponds in sect. 3, 24.

PRIMULACEAE, the Primrose Family

Androsace occidentalis Pursh

Chiefly well-drained sites, sect. 3, 24, 25, 26, 31, 35.

Lysimachia hybrida Michaux

Edges of marshes, sect. 19, 24.

RANUNCULACEAE, the Crowfoot Family

Anemone canadensis L.

Ubiquitous in moist, low areas.

A. cylindrica A. Gray

Chiefly well-drained sites, sect. 1, 3, 19, 23, 24, 26, 31, 34, 36.

A. patens L.

Ubiquitous on well-drained sites.

Ranunculus circinatus Sibthorp

Submerged, sect. 3.

R. cymbalaria Pursh

Moist sites of low areas, sect. 3, 23, 24, 25.

R. pensylvanicus L.

Sect. 26.

R. rhomboideus Goldie

Well-drained sites, sect. 34, 36.

R. sceleratus L.

Wet edge of pond, sect. 19.

R. subrigidus W. B. Drew

Edge of pond, sect. 3.

ROSACEAE, the Rose Family

Potentilla anserina L.

Moist sites of low areas, sect. 23, 24, 26, 27, 34, 36.

P. arguta Pursh

Well-drained or sandy-loam sites in sect. 19, 23, 24.

P. hippiana Lehmann

Moist site, sect. 31.

P. norvegica L.

Moist site, sect. 36.

P. pensylvanica L.

Well-drained sites, sect. 1, 19.

P. rivalis Nuttall

Sect. 19, 24.

Prunus americana Marshall

Rock-pile, sect. 30.

Rosa blanda Aiton

Well-drained site, sect. 31.

R. arkansana Porter

Along fence, sect. 24.

RUBIACEAE, the Madder Family

Galium boreale L.

Sect. 1, 23, 24, 25, 31, 34.

SALICACEAE, the Willow Family

Populus deltoides Marshall

Moist sites, sect. 23, 34.

Salix amygdaloides Andersson

Edges of ponds, sect. 3, 23, 26, 34.

S. interior Rowlee

Moist ditches and edges of ponds, sect. 19, 23, 26, 34.

SANTALACEAE, the Sandal-wood Family

Comandra umbellata (L.) Nuttall

Well-drained sites, sect. 3, 19, 23, 24, 25, 26, 31, 34, 35.

SAXIFRAGACEAE, the Saxifrage Family

Heuchera richardsonii R. Brown

Stony hilltop, sect. 24.

SCROPHULARIACEAE, the Figwort Family

Agalinis tenuifolia (Vahl) Rafinesque-Schmaltz

Moist sandy-loam near slough in sect. 26.

Castilleja sessiliflora Pursh

Chiefly well-drained sites, sect. 23, 24, 25, 31, 35.

Gratiola lutea Rafinesque-Schmaltz

Submerged aquatic, sect. 1.

G. neglecta Torrey

Mud bank, ditch at south edge of sect. 31.

Linaria vulgaris Hill

Sect. 1, 23, 36. Introduced.

Orthocarpus luteus Nuttall

Sect. 19, 23, 24, 25, 27, 30, 36.

Penstemon albidus Nuttall

Sect. 34, 35.

P. gracilis Nuttall

Chiefly well-drained sites, sect. 1, 3, 19, 24.

SOLANACEAE, the Nightshade Family

Physalis virginiana Miller

Well-drained sites, sect. 3, 19, 23, 24, 27, 36.

SPARGANIACEAE, the Bur-reed Family

Sparganium eurycarpum Engelmann

Muck soil or shallow water, sect. 3, 23, 26, 31, 36.

TYPHACEAE, the Cat-tail Family

Typha angustifolia L.

Edge of marsh in sect. 31.

T. latifolia L.

Edges of marshes, sect. 3, 23, 31, 34.

VERBENACEAE, the Vervain Family

Verbena bracteata Lagasca and Rodriguez

Disturbed soils, sect. 19, 23, 26.

V. stricta Ventenat

Sect. 27.

VIOLACEAE, the Violet Family

Viola nuttallii Pursh

Sect. 19, 23, 24, 31.

V. pedatifida D. Don

Sect. 3, 19, 23, 25, 26, 30, 31, 36.

Reported Species

In "Ecology and History of the Hoffman Prairie" (Lokemoen et al., 1975), the authors report seeing closed gentian, prairie smoke, prairie dropseed, and wild lily. Since scientific names of these plants were not mentioned, it would be difficult to determine which species they were referring to. In any case, none of the above mentioned plants were verified by this author.

Rare or Endangered Species

At least six species collected on Ordway Prairie were so rarely seen that their survival here may be considered endangered: Astragalus gilviflorus, Lysimachia hybrida, Silphium laciniatum, Antennaria parvifolia, Heuchera richardsonii, and Oenothera nuttallii. The protection of the habitats in which such threatened species occur is one of the chief objectives of this preserve.

SUMMARY AND CONCLUSIONS

This field study was terminated with the last collections on August 9, 1976. Possibly more species exist than were collected and documented, but the plants collected during this study probably represent all of the ecologically and economically significant species present on Ordway Prairie.

The taxa found are summarized in Table II.

TABLE II

Summary of Taxa

Division, Class, etc.	Genera	Species	
		Native	Introduced
Pteridophyta	1	1	0
Spermatophyta	169	243	65
Gymnospermae	1	1	0
Angiospermae	168	242	65
Monocotyledoneae	48	81	19
Dicotyledoneae	120	161	46
Archichlamydeae	58	81	27
Metachlamydeae	62	80	19

Since the 1976 collections increased the known number of species present by only about 25%, another season's collecting would probably be a waste of time and resources.

LITERATURE CITED

Christensen, Cleo. In press. Geology and water resources of McPherson, Edmunds, and Faulk counties, South Dakota. S. D. Geological Survey Bulletin 26, Part 1, Geology.

Flint, Richard F. 1955. Pleistocene geology of eastern South Dakota. U. S. Geological Survey Professional Paper 262. 173 p.

Harcombe, P. A., and Marks, P. L. 1976. Species preservation. Science 194:383.

Kuechler, August W. 1964. Potential natural vegetation of the conterminous United States. American Geographical Soc. Special Pub. 36:116 p., 1 map.

Lokemoen, John T., Duebbert, Harold F., and Kantrud, Harold A. 1975. Ecology and history of the Hoffman prairie. Manuscript. Northern Prairie Wildlife Research Center. Jamestown, N. D. 10 p.

Over, W. H. 1932. Flora of South Dakota. University of South Dakota, Vermillion, S. D.

Pozarnsky, R. 1966. Steer ranching and deferment improve range. Soil Conservation 31:1.

Roberts, R. Evelyn. 1973. The vascular vegetation of northeastern Day county in South Dakota. M.S. Thesis. South Dakota State University. 79 p.

Spuhler, Walter. 1966. Aberdeen, South Dakota, latitude 45° 27' N, longitude 98° 26' W, elevation 1,296 ft. Climatological Summary. Climatography of the U. S. 20-39, no. 2. 6 p.

Stensland, Ralph. 1960. Rangeland doubles beef production. Mobridge Tribune, Mobridge, S. D. October 13 issue.

U. S. Department of Agriculture, Soil Conservation Service. 1976. Ordway Prairie. [Unpublished soils map]

U. S. Department of Agriculture. 1971. South Dakota technical guide and national cooperative soil survey, Vida series.

U. S. Department of Commerce, National Weather Service. Observations made by cooperative observing of the United States weather service at Roscoe and Eureka stations in South Dakota.

Van Bruggen, Theodore. 1976. The vascular plants of South Dakota. Iowa State University Press, Ames, Iowa. 538 p.

Winter, John M. and Clara, K., and Van Bruggen, Theodore. 1959. A check list of the vascular plants of South Dakota. Dept. of Botany, University of South Dakota, Vermillion, S. D. 176 p.