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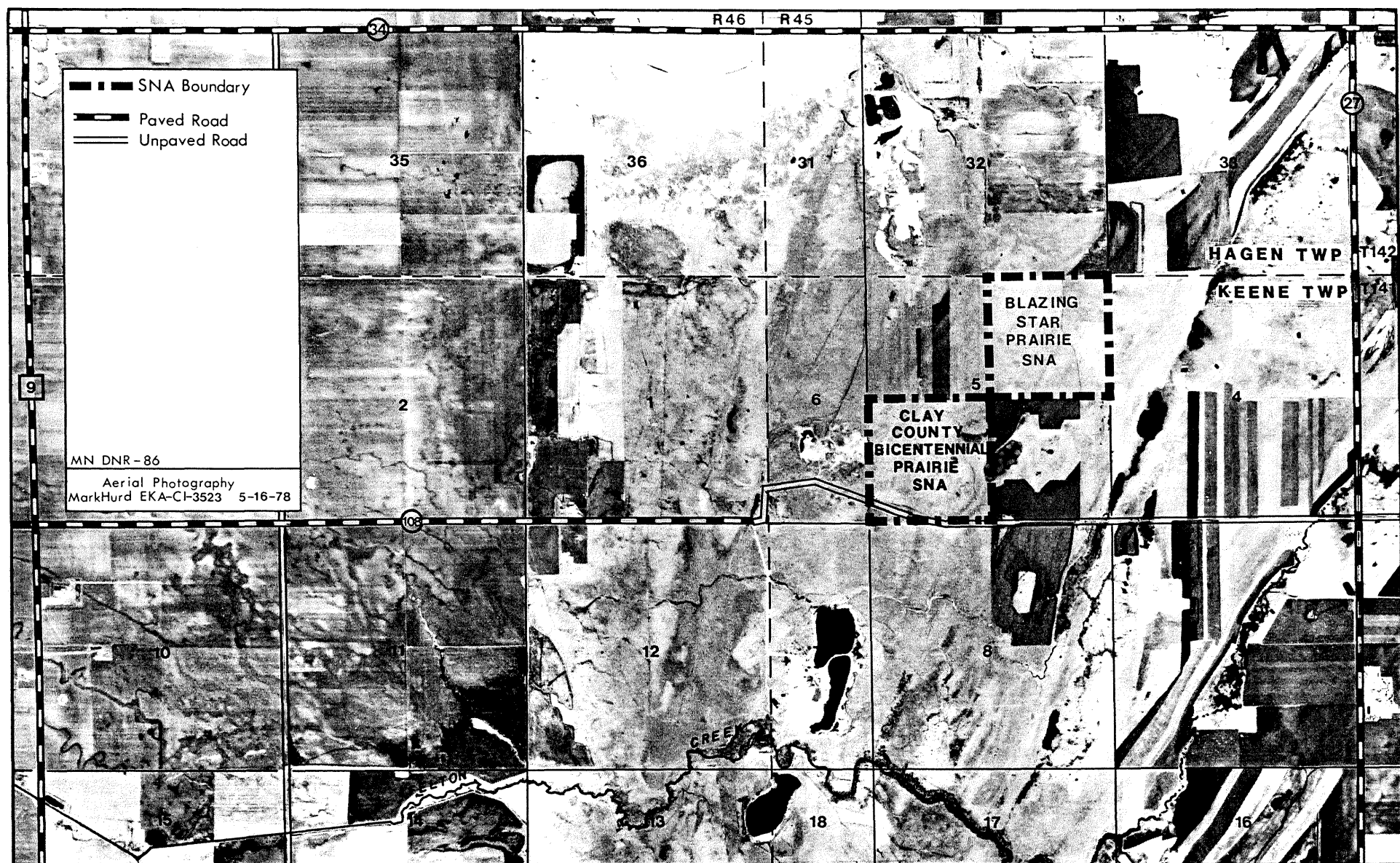
APPENDIX TO THE MANAGEMENT PLAN

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RESOURCE INVENTORY
FOR THE BICENTENNIAL PRAIRIE TRACT
OF THE FELTON PRAIRIE
SCIENTIFIC AND NATURAL AREA

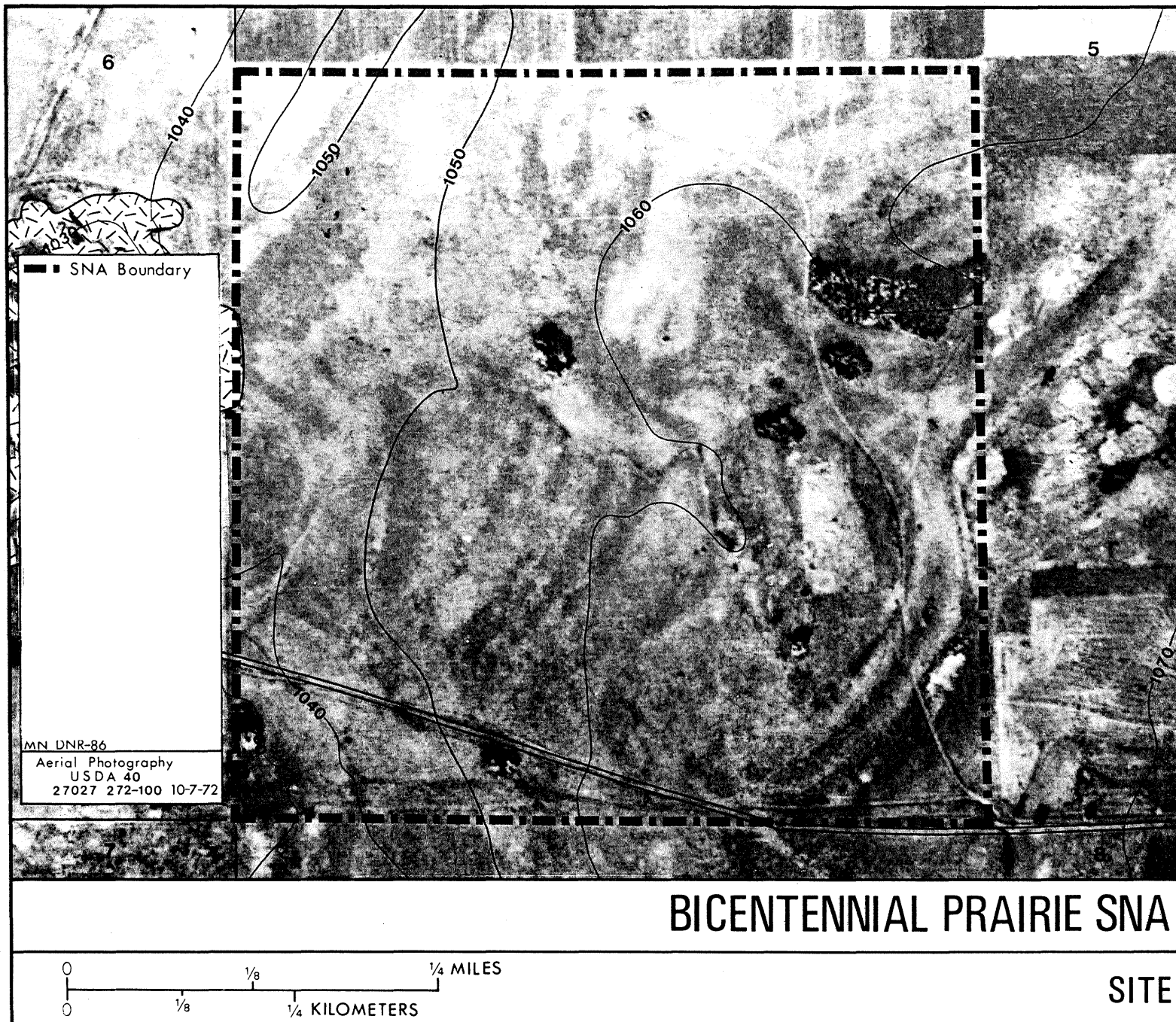
November 1986

Revised from December 1979 Draft



BICENTENNIAL PRAIRIE SNA

VICINITY



PREFACE

The field work for this Resource Inventory was done in 1979 by the Scientific and Natural Areas (SNA) Program. Since that time, additional resource information has been collected in the Bicentennial Prairie by the DNR Natural Heritage Program, The Nature Conservancy, and the SNA Program. Emphasis on data collection has been on state-significant species and communities (designated as endangered, threatened, or special concern "elements"). All of this information is maintained by the DNR Natural Heritage Program in a centralized data base.

The original 1979 Resource Inventory Report is included in this document, with the exception of a few minor changes and an updated Land Use History section which replaces the old section. The updated information regarding state-significant natural features in the Bicentennial Prairie is included in the Management Plan accompanying this document (Overview section). Especially notable is the change of the natural community classifications in the site. The Natural Heritage Program-defined names of communities in Bicentennial Prairie are Mesic Blacksoil Prairie NW, Gravel Prairie, and Wet Blacksoil Prairie. In addition, the prairie white-fringed orchid now is classified as federally threatened and state endangered. Species elements documented in Bicentennial Prairie since 1979 include the assiniboia skipper and Uhler's arctic butterflies.

The most comprehensive source of additional information is the report entitled "Felton Prairie", submitted to The Nature Conservancy and the DNR Natural Heritage Program in November 1985. Copies of the report are filed in Nature Conservancy, Heritage Program, and SNA offices.

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INTRODUCTION

Scope and Organization

This report documents the information collected during a 1979 inventory of Clay County Bicentennial Prairie. The inventory recorded information on climate, geology, soils, hydrology, plant communities, flora, butterflies, birds, mammals, amphibians, reptiles, and land use history of the natural area. Data supplied by this document will be used by the Minnesota Natural Heritage Program and other evaluators to assess the site as a potential Scientific and Natural Area (SNA). The document can also be used by scientists, educators and others interested in the area. Should the site be designated an SNA, management plans can be written using this document as a reference.

This report is divided into five sections including: introduction, abiotic, vegetational, and zoological components, and land use history of the site. Methodologies and results are presented for each section.

The inventory of Clay County Bicentennial Prairie was part of a larger 1979 effort in which eighteen natural areas in east central, northwest, and southeast Minnesota were surveyed. Inventory team members were: John Borowske, SNA Planning Coordinator; Cherry Keller, Karen Lustig, Deb Schowalter, and Jeff Weigel, Researcher/Writers; Kathy Bolin, Community Specialist; and Nancy Berlin, Tony Busche, Barbara Eikum, Peter Farrell, Joanne Herman, Laura Hill, Susan Ottoson, Deanna Schmidt, Marianne Severson, Angela Tornes, and James Ziegler, Researchers. Gerald Jensen, Coordinator Scientific and Natural Area

Program, and Mark Heitlinger, Coordinator of Preserve Management, The Nature Conservancy, Minnesota Chapter served as inventory advisors. Michael Rees, Project Editor, The Nature Conservancy, provided editorial assistance. Other individuals who assisted in the preparation of the inventory are mentioned in the appropriate sections. Their help is gratefully acknowledged.

Description of Study Area

Clay County Bicentennial Prairie is a 160 acre unit in northeastern Clay County, approximately 23 miles northeast of Moorhead, Minnesota. It is a portion of the project boundary of the Felton Prairie, a 6000 acre complex consisting of public and private lands, supporting native prairie vegetation. The area's climate is mid-continental, relatively cool and moist, with warm summers and cold winters. A wave deposited beach ridge of Glacial Lake Agassiz crosses the site. The tract's topography is flat to gently rolling, though the natural area is prominently elevated above the lowland basin to the west. Fairly deep, very poorly to excessively drained soils formed on the tract in sand and gravel parent material under tall prairie grasses. Present vegetation is primarily native prairie with several small aspen clones.

The flora and fauna of Clay County Bicentennial Prairie are mostly typical of native Minnesota grassland. Species observed on the tract in 1979 include: 146 vascular plants, 27 butterflies, 47 birds, 8 mammals, 3 amphibians and 1 reptile. Ten plants not native to Minnesota occurred on the tract.

Clay County Prairie is in a small grain, potato, sunflower, legume seed, and hay production area. It has never been plowed, but was hayed annually prior to preservation. The site was also used as a pasture for cattle and sheep prior to 1940. Possible evidence of Indian use of the natural area has been found.

Preliminary Assessment of Significance

This section lists features identified by the Minnesota Natural Heritage Program (MNHP) as potential elements¹, and identifies other aspects of the preserve believed by the authors to be important components of Minnesota's natural diversity, or which otherwise might qualify the site for SNA designation. Criteria for SNA evaluation are enumerated in "Minnesota Department of Natural Resources Policy Plan for Scientific and Natural Areas", dated July 6, 1979.

Clay County Bicentennial Prairie is notable as a tract of native prairie located within a beach ridge complex of Glacial Lake Agassiz. Six plant and animal species of national and/or state significance were identified on the site during the 1979 inventory. The White Fringed Prairie Orchid (Habenaria leucophaea; Platanthera l. Fernald, 1950), a species with restricted habitat requirements, has been proposed for federally threatened status by the Smithsonian Institute (Ayensu & DeFilipps, 1978). The Dakota Skipper butterfly (Hesperia dacotae), apparently confined to undisturbed prairie (Howe, 1975), has been proposed as a federally threatened species by the U. S. Fish & Wildlife Service. The Minnesota Natural Heritage Program lists the White Fringed Prairie Orchid, the Dakota Skipper, the Greater Prairie Chicken (Tympanuchus cupido), the Marbled Godwit (Limosa fedoa), the Prairie Vole (Microtus ochrogaster), and the White-tailed Jack Rabbit (Lepus townsendi) as potential elements of state significance. In addition to

¹ An element is a natural feature of particular interest because it is exemplary, unique, threatened, or endangered on a national or state-wide basis.

sightings on the tract, Greater Prairie Chickens were observed booming on adjacent cultivated fields.

The Baird's Sparrow (Ammodramus bairdii), the Chestnut-collared Longspur (Calcarius ornatus), and the Sprague's Pipit (Anthus spragueii) are also listed as elements of state significance by the Heritage Program. Although they were not observed on Clay County Bicentennial Prairie during the 1979 inventory, these birds have all been sighted in the vicinity within the last two years. This part of Clay County has been the most consistently recorded Minnesota locality for these species in recent years. However, because their breeding distribution in the state is relatively unknown, they may occur on other tracts of native prairie in western Minnesota.

A feature of geological significance at Clay County Bicentennial Prairie is a Glacial Lake Agassiz beach ridge. Although Lake Agassiz beach ridges are common topographic feature in the Red River Valley, many have been cultivated or destroyed by graveling operations. The natural area's beach ridge and interbeach area are significant as topographically undisturbed landforms supporting native vegetation. Vegetation types on Clay County Bicentennial Prairie are representative of varying moisture conditions. Low, wet areas are dominated by Cord Grass (Spartina pectinata) and Canada Anemone (Anemone canadensis); drier sites are dominated by Little Bluestem (Andropogon scoparius). Two bird species observed on the site in 1979, the American Woodcock (Philohela minor), and the Yellow-bellied Flycatcher (Empidonax flaviventris) are found at the western edge of their ranges at Clay County Bicentennial Prairie.

ABIOTIC FACTORS

The abiotic resources of an area provide a framework necessary to the existence of all life. The role of physical factors, involving processes of climate, geology, soils, and water is important in ecology. Biotic characters such as range, distribution, and diversity of plant and animal life are ultimately determined by potential limiting factors of the physical environment. These factors must be considered in any analysis of the biota of a natural area.

The natural diversity of an area must be assessed in terms of abiotic as well as biotic elements. Unique physical characteristics, such as influential hydrologic conditions or landforms illustrating geologic processes contribute to overall diversity. The preservation value of a particular area may rest wholly on its abiotic features. The following sections describing climate, geology, soils, and hydrology are an effort to describe the abiotic setting of Clay County Bicentennial Prairie.

CLIMATE

Methods

Climatological data were gathered by researching reports from the National Oceanic and Atmospheric Administration (NOAA), Minnesota Agricultural Experiment Station, and Soil Conservation Service (SCS). Most numerical data were obtained from the NOAA station at Ada, approximately 17 miles north of Clay County Bicentennial Prairie.

Regional Climate

The climate of northwestern Minnesota is typical of areas in the central part of the North American continent. Sharp seasonal contrasts in temperature and precipitation result from a lack of moderating factors, such as location near a large body of water. During summer months, southerly winds carry warm, moist air masses northward from the Gulf of Mexico, making summer the season of greatest precipitation. During winter, cold air masses invade from the north, making the winter months cold and dry.

Discussion

The mean temperature for June, July, and August in the Clay County Bicentennial Prairie area is 68° F; the December, January and February mean is 10° F. On the average, there are 15 days above 90° F. in the summer and 55 days below 0° F. in the winter. The average duration of the freeze-free season is 125 days. The length of the total crop season, which includes the growing period for both cool and warm season plant species, averages 190 days (Baker and Strub, 1963b).

About 75%, or slightly over 18 inches, of the area's annual precipitation (water equivalent) falls during the period of April

Table 1. Selected Weather Data For Ada.

TEMPERATURE	°F	°C
Mean annual temperature	40.9	4.9
Highest temperature recorded (6 July 1936)	111	43.9
Lowest temperature recorded (15 February 1936)	-53	-47.2
Mean temperature warmest month		
Month: July	70.3	21.3
Mean daily maximum	82.6	28.1
Mean daily minimum	56.9	13.8
Mean temperature coldest month		
Month: January	5.8	-14.6
Mean daily maximum	15.3	-9.3
Mean daily minimum	-4.7	-20.4
Average date last freeze (Spring) ^a	c. 22 May	
Average date first freeze (Fall) ^b	c. 21 Sept.	
Average days freeze free season ^c	125	
Average days total crop season ^d	190	
PRECIPITATION	in.	cm.
Mean annual precipitation	22.95	58.3
Mean precipitation wettest month		
Month: June	4.17	10.6
Mean precipitation driest month		
Month: February	0.53	1.3
Mean annual snowfall ^e	36.2	91.9
Mean snowfall heaviest month ^f		
Month: January	8.9	22.6

^aBased on Figure 3. Baker, D. G., and J. H. Strub, Jr. 1963a. Climate of Minnesota: Part I. Probability of Occurrence in Spring and Fall of Selected Low Temperatures. Minnesota Agr. Exp. Sta. Tech. Bull. 243.

^bBased on Figure 4. Baker and Strub, 1963a.

^cBased on Figure 16. Baker, D. G., and J. H. Strub, Jr. 1963b. Climate of Minnesota: Part II. The Agricultural and Minimum-Temperature-Free Seasons. Minnesota Agr. Exp. Tech. Bull. 245.

^dBased on Figure 14. Baker, D. G., and J. H. Strub, Jr. 1963b. Climate of Minnesota: Part II. The Agricultural and Minimum-Temperature-Free Season Minnesota Agr. Exp. Sta. Tech. Bull. 245.

^{e,f}Data for NW Agricultural Experiment Station, Crookston, from Climate of Minnesota. National Oceanic and Atmospheric Administration, 1977. Climatology of the U.S. #60. Asheville, N.C.

through September. June is the wettest month, with numerous thunderstorms accounting for an average of 4.2 total inches of rain. There are about 34 thunderstorms per year. Rainfall intensities of 1.9 inches per day every year, 3.5 inches per day every ten years, and 4.6 inches per day every 50 years are expected to occur. The precipitation during the winter months usually falls as snow, with an average seasonal total of 36 inches. About 110 days a year have a ground snow cover of one inch or more. Precipitation of 0.01 inch or more can be expected about 102 days a year. Total annual evaporation equals or exceeds total annual precipitation in the area. Prevailing winds blow from the west and northwest, except during late summer and early fall, when they shift to the southeast.

Damaging storms such as severe blizzards, tornadoes, and ice storms occur infrequently in the area. The occurrence of ice storms averages less than once a year. However, heavy rains, winds, and hail associated with thunderstorm squall lines occur each year. Table 1 is a summary of selected climatic data for the Ada area.

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GEOLOGY

Methods

Geologic information was primarily obtained through a literature search. Field observations using topographic maps and aerial photographs aided in interpretation.

Historical Geology

Glaciation during the past two million years (the Pleistocene Epoch) has dominated development of the landscape of Minnesota. The most recent ice advances of the Wisconsin Stage of glaciation are responsible for the majority of the state's landforms. Northwestern Minnesota was subjected to glaciation by two major ice lobes during the Wisconsin Stage. Both left characteristic deposits of grey, calcareous glacial drift. Before 35,000 B.P. (years before present; Bray, 1977) the Wadena lobe advanced southeastward out of Manitoba into the Red Lakes lowland area. This lobe eventually covered much of western and central Minnesota about as far south as Mankato. Following retreat of the Wadena lobe, the Des Moines lobe advanced southward from Manitoba, scouring out the Red River lowland before reaching a terminus near Des Moines, Iowa about 14,000 B.P. (Wright, 1972).

As the Des Moines lobe retreated northward, it paused briefly near Brown's Valley, Minnesota, where it formed a small recessional moraine. This landform, called the Big Stone moraine, served the purpose of damming southward drainage from the ice front into the Red River lowland and thus forming Glacial Lake Agassiz about 12,400 B.P. (Elson, 1967).

As the ice front retreated further, Lake Agassiz grew, eventually becoming larger than all the modern Great Lakes combined. The level

of Lake Agassiz fluctuated repeatedly throughout its 5,000 year history, due to various factors such as minor glacial readvances and the opening of different drainage outlets. Each of the many distinguishable lake levels is assigned a name, such as the "Herman phase". The lake drained out of the Minnesota part of the Red River valley about 8,300 B.P; it emptied completely about 7,300 B.P. (Elson, 1967; Wright, 1972).¹

Contemporary evidence of Lake Agassiz includes old shorelines marked by beach ridge deposits, delta deposits formed where tributary streams entered the lake, and lacustrine sand, silt and clay deposits. A beach ridge of the Norcross phase of Lake Agassiz crosses Clay County Bicentennial Prairie.

Beach ridges are formed when waves attack a parent material (usually glacial till, such as grey drift) that will yield sand and gravel-size particles. Wave action washes out the smaller silt and clay particles, leaving the sand and gravel portion of the drift piled in a ridge on the shore. The silts and clays are carried basinward and eventually settle out as level lacustrine deposits. Lake Agassiz beach ridges, as described by Elson (1967), are "typically a ridge 2 to 15 feet high, but locally as high as 30 feet . . . width ranges from about 150 to 500 feet but commonly several are grouped together into complexes a half mile or more wide". They were formed at the shore line at different times and many locations and levels in the Lake Agassiz basin. Beach ridges are good indicators of former water levels. Clay County Bicentennial

¹ Large lakes such as the Red Lakes, Lake of the Woods, and Lake Winnipeg are remnants of Glacial Lake Agassiz.

Prairie lies in the midst of a beach ridge complex, with ridges associated with four levels of Lake Agassiz found in a 4 mile wide belt.

When Lake Agassiz was at its highest or Herman level, Clay County Bicentennial Prairie was probably under about 50 feet of water. The grey drift on the tract was gently reworked by relatively shallow Lake Agassiz waters. Some fine sediments were carried away to deeper water. Thus, the till has a slightly coarser texture than the unworked till found outside the Lake Agassiz basin. The lake lowered to the Norcross level about 12,000 B.P. (Elson, 1967), when the shoreline was located at the natural area. The beach ridge was deposited as a low, smoothly rounded ridge of gravel and sand.

The beach ridge complex in Clay County Bicentennial Prairie area represents four named levels of Lake Agassiz. To the east are older Herman beaches, to the west are younger Campbell and McCauleyville beaches, with the Norcross beach crossing the natural area, and the Campbell shoreline probably overlapping slightly onto the northwest corner. The Herman and Campbell beaches are generally better developed, representing relatively long-lived phases of Lake Agassiz. However, in this part of Clay County, the Campbell shoreline is marked by an eroded escarpment with only small deposits of sand and gravel, rather than by large beach ridges. The McCauleyville beaches are very indistinct in this area, having deposited little sand and gravel into ridges.

Topography and Bedrock

The site ranges in elevation from about 1030 feet near the southwest corner to slightly less than 1070 feet near the southeast edge. Topography is flat to gently rolling, with a general east to west decline in elevation. There are no prominent relief features. Although the beach ridge

itself has only a few feet of relief, as a part of the previously mentioned multi-beach complex its elevation affords a good view of the Lake Agassiz Basin/Red River Lowland to the west. The site is approximately 150 feet higher than the land three miles west. A very large glacial erratic granite boulder rests near the north boundary; there are also a number of smaller erratics exposed on the tract.

Clay County Bicentennial Prairie lies on the west facing slope of a broad, north-south trending lowland called the Red River lowland, the topography of which is controlled largely by the underlying bedrock configuration. (Allison, 1932; Wright, 1972). Deposits of grey glacial drift, approximately 250 feet thick at the natural area, overlie Cretaceous shales and sandstones and crystalline bedrock found throughout the lowland. (USGS, 1970). The nearly continuous deposits of marine shales and sandstones in western Minnesota represent some of the easternmost deposits of the Cretaceous sea which covered large areas of North America about 100 million years ago. These deposits, which are generally less than 50 feet thick, overlap unconformably onto much older crystalline rocks of the Canadian Shield (Dott and Batten, 1976; Sims and Morey, 1972).

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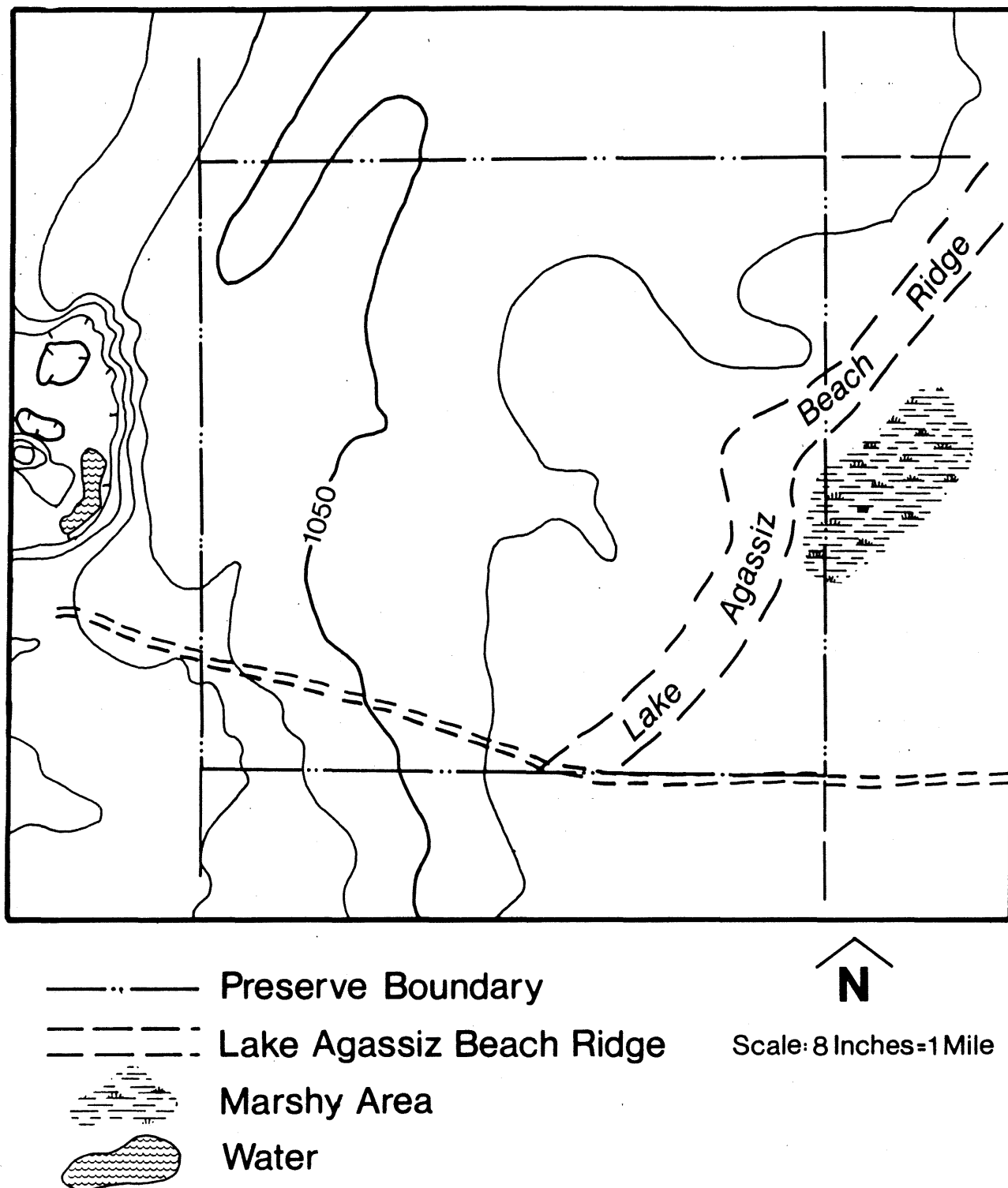


Figure 1. Topography of Bicentennial Prairie. Adapted from U.S. Geological Survey, Ulen SW Quadrangle (1:24000), 1966.

SOILS

Methods

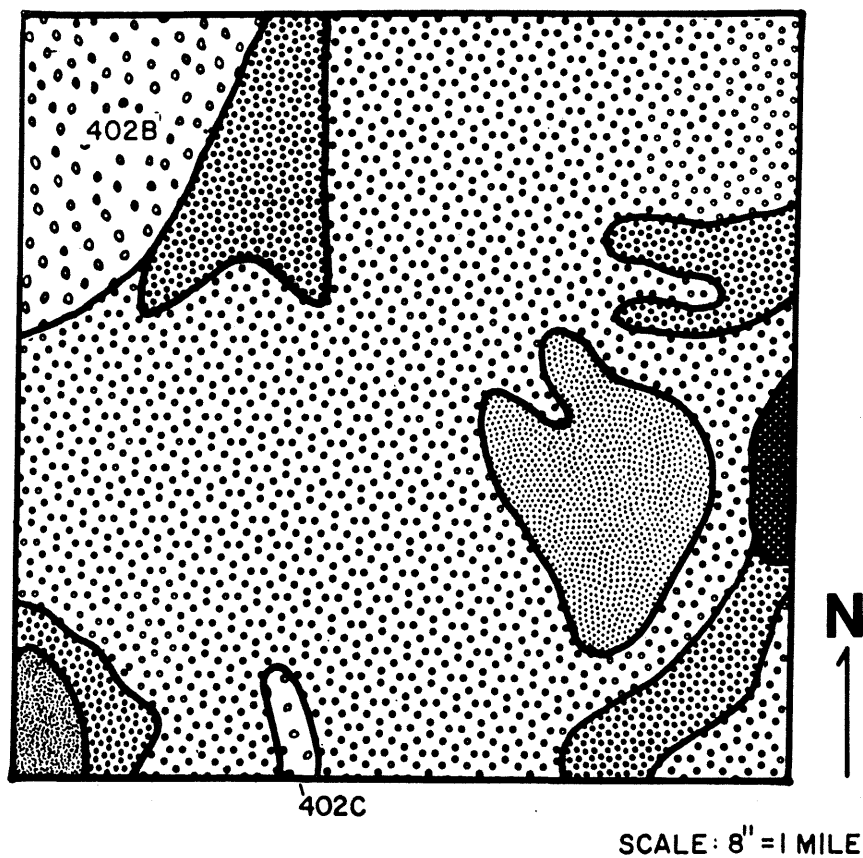
Soil information was obtained from the literature and from a detailed soil survey of Clay County Bicentennial Prairie conducted by the U.S. Soil Conservation Service (SCS).¹ Soils series descriptions are based on single sheet soil interpretations provided by SCS.

Soils of Clay County Bicentennial Prairie

Clay County Bicentennial Prairie lies in an area of coarse to fine textured prairie soils and organic soils of glacial lake plains (Arneman, 1963). The site's soils formed primarily in calcareous beach and interbeach sand and gravel deposits in the midst of a large complex of Glacial Lake Agassiz beach ridges. One soil association and five soil series are present on the tract.

The Beach-Interbeach soil association (SCS, 1979) occupies a narrow belt of roughly parallel north-south trending beach ridges in Clay County. Glacial till, reworked and sorted by wave action associated with Lake Agassiz shorelines (see geology section), is the parent material for soils of this association. Landscape is varied, with numerous low interbeach areas with wet conditions, restricted drainage outlets, and high water tables. All of the soils of Clay County Bicentennial Prairie are mollisols, characterized by nearly black, friable surface horizons rich in organic material.

¹ Malvern N. Jacobson, SCS, Moorhead, Donald Barron, SCS, Thief River Falls, and Ray Diedrich, Soil Specialist, SCS, St. Paul provided valuable help for this section.



<u>DRAINAGE SYMBOL</u>	<u>DRAINAGE CLASS</u>	<u>KEY</u>	<u>SOIL SERIES</u>	<u>MAP SYMBOL</u>
	Excessively Drained		Sioux	402B 402C
	Well Drained		Lohnes	245B
	Moderately Well Drained		Lohnes	1874
			Osakis	413
	Moderately Well-Somewhat Poorly Drained		Divide	1212
	Poorly Drained		Syrene	435
	Very Poorly Drained		Marsh	1055

Figure 2. Soil series and drainage classes of Bicentennial Prairie

Soils of the Divide (aeric calciaquolls) and Syrene (typic calciaquolls) series occupy relatively wet parts of the natural area. They consist of seasonally wet soils with a near surface horizon of calcium carbonate accumulation. The Divide soils are slightly better drained and aerated, with moderately alkaline surface layers. Syrene soils are slightly acidic. A very poorly drained marsh area overlapping onto the east side of the preserve has highly variable unclassified soils.

Sandy soils of the Lohnes and Sioux series (udorthentic haploborolls) and the Osakis series (pachic udic haploborolls) are classified as cool region mollisols with no horizon of clay accumulation. Excessively drained, mildly alkaline Sioux soils occupy beach ridge crests. Lohnes soils are found in interbeach outwash areas and are less well drained. Their surface layers are neutral in reaction. Both series display minimal horizon development. The Osakis soils are slightly acid loamy soils associated with interbeach areas. They are thicker and better developed than Lohnes and Sioux soils.

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Key to Table 2

TEXTURE: Relative proportions of various soil separates (silt, sand, clay) in a soil.

Topsoil: "surface soil" in uncultivated soils, a depth of 3 or 4 to 8 or 10 inches; in agriculture, refers to the layer of soil moved in cultivation.

Subsoil: soil below the top soil, from 8 or 10 to 60 inches.

DRAINAGE CLASS: Soil drainage refers to natural frequency and duration of saturation which exists during soil development. Soil drainage classes are those used in making detailed soil maps (Arneman and Rust, 1975; USDA-SCS and Minnesota Agr. Expt. Sta., 1977).

ED - Excessively Drained - water is removed very rapidly. Soils are without mottles.

SED - Somewhat Excessively Drained - water is removed rapidly and soils are without mottles.

WD - Well Drained - water is removed from soil readily but not rapidly. Soils are nearly free of mottling.

MWD - Moderately Well Drained - water table usually below 5 feet. Soils are wet for small but significant part of the time. Mottling in lower B horizon.

SPD - Somewhat Poorly Drained - water table at depths of 36 to 60 inches. Soil is wet for significant periods, commonly with mottles below 6 to 16 inches.

PD - Poorly Drained - water table seasonally near surface for prolonged intervals. Water table from 18 to 36 inches. Soils wet for long periods, generally with mottles.

VPD - Very Poorly Drained - water table remains at or near surface (above 18 inches) greater part of time. Soils wet nearly all the time, with or without mottling.

COMPONENT IN STATE: Extent of acreage in state.¹

M - Major: 100,000 acres or more.

I - Intermediate: 10,000 to 100,000 acres.

m - Minor: 10,000 acres or less.

LOCATION IN STATE:¹

NW - Northwestern Minnesota

W - Western Minnesota

WC - West Central Minnesota

¹ Determined by Ray Diedrich, Soil Specialist, SCS, St. Paul.

Table 2. Soil Characteristics of Clay County Bicentennial Prairie.

	SOIL SERIES # ACRES PERCENT	DRAINAGE CLASS	DEPTH TO WATER TABLE	PARENT MATERIAL	LANDSCAPE POSITION	TEXTURE		VEGETATION		COMPONENT IN STATE	LOCATION IN STATE
						TOPSOIL	SUBSOIL	ORIGINAL	PRESENT		
udorthentic haploborolls	Sioux	ED	>6.0'	gravelly outwash	glacial lake beach ridges and outwash areas 2-36% slopes	sandy loam	gravelly loam and gravelly sand	tall grass prairie	bluestem prairie, aspen woods	M	NW & W
	Lohnes 140.5 Acres 87.8%	MW- WD	3.0'- 6.0'	sandy deposits	glacial lake and outwash plains 0-6% slopes	loamy coarse sand	loamy coarse sand	tall grass prairie	bluestem prairie, sweet clover	I	NW
aeric calciaguolls	Divide 12.6 Acres 7.9%	MW- SPD	3.0'- 5.0'	sandy and gravelly outwash	level or depressional out- wash plain areas 0-2% slopes	loam	sand and gravel	tall grass prairie	bluestem prairie, aspen woods, sweet clover, spartina meadow	m	NW
pachic udic haploborolls	Osakis 4.5 Acres 2.8%	MWD	3.0'- 5.0'	loamy material over sand and gravel out- wash	outwash plains 0-2% slopes	sandy loam	gravelly coarse sand	tall grass prairie	bluestem prairie, aspen woods, sweet clover	M	WC

ble 2. (Continued) Soil Characteristics of Cla County Bicentennial Prairie.

	SOIL SERIES # ACRES PERCENT	DRAINAGE CLASS	DEPTH TO WATER TABLE	PARENT MATERIAL	LANDSCAPE POSITION	TEXTURE		VEGETATION		COMPONENT IN STATE	LOCATION IN STATE
						TOPSOIL	SUBSOIL	ORIGINAL	PRESENT		
typic calciaquolls	Syrene 1.3 Acres 0.8%	PD	0-3.0'	loamy over gravelly lacustrine deposits	glacial lake plains and beach ridges 0-2% slopes	loam	gravel- ly sandy loam	tall grass prairie, reeds and sedges	spartina meadow	I	NW
land type	Marsh 1.1 Acres 0.7%	VPD	0-5.0' above soil level	variable	depressional areas	un- classifi- ed	un- classi- fied	cattails, reeds, and sedges	sweet clover	M	state- wide

HYDROLOGY

Methods

Hydrologic conditions of the site were investigated using soil and topographic maps, aerial photographs and literature sources. Field observations were also used in determining relief and drainage patterns.

Hydrology of Clay County Bicentennial Prairie

Past geologic events associated with Glacial Lake Agassiz are primarily responsible for the hydrologic conditions present in Clay County Bicentennial Prairie today. The waters of Lake Agassiz re-worked glacial till on the tract into a complex mixture of sands and gravel of varying proportions. The morphology of these sands and gravels and the soils formed in them dictates the flow patterns of both surface and subsurface waters at the site. No permanent bodies of water exist on the tract.

Surface runoff on the tract is affected by the presence of a Lake Agassiz beach ridge. The general east to west decline in elevation of the site is interrupted by the relief of the north-south trending beach ridge, which acts as a topographic barrier to westward drainage flow. Surface runoff collects in a shallow trough parallel to the upslope, east facing side of the beach ridge. Annual runoff is sufficient to cause wetter than average conditions adjacent to the upslope side of the ridge. The marsh on the eastern edge of the tract has formed under these conditions. Natural westward flowing drainageways have formed on the prairie in several locations; they are visible on color infrared aerial photographs of the area (DNR, 1979).

The natural area is located in a ground water discharge zone of the Wild Rice River watershed. Localized areas of recharge are found near beach ridges, where surface water easily penetrates the sandy and gravelly deposits. Ground water flows generally westward out of the morainic uplands to the east. The presence of sand and gravel drift aquifers in the area accounts for the relatively high water table in beach and interbeach areas such as Clay County Bicentennial Prairie (USGS, 1970).

Sources of Information

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- _____, Scientific and Natural Areas Section. 1979. Color infrared aerial photograph of Clay County Bicentennial Prairie.
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- U.S. Department of the Interior, Geological Survey (USGS). 1966. Ulen SW Quadrangle. MN: 7.5 Minute Series (Topographic). 1:24,000. Denver, Colorado.
- _____. 1970. Water Resources of the Wild Rice River Watershed, Northwestern Minnesota. Hydrologic Investigations Atlas HA-339. Washington, D.C.

VEGETATIONAL COMPONENTS

Plants and plant communities are a major part of the ecosystems present on a natural area. Vegetation reflects the combined influences of all physical factors, and provides the primary energy source for all other living organisms. A description of the flora provides information on the natural area's diversity, as well as an understanding of the origin and recent history of the vegetation. An inventory of vegetation-al components was conducted to: 1) document the area's species diversity and communities, 2) obtain baseline data so changes can be discerned, and 3) identify rare, sensitive, or representative species and communities.

VEGETATIVE COMMUNITIES

Methods

Vegetative communities were mapped and described according to their cover type. Vegetation maps were produced by delineating major communities visible on aerial photographs. Recent color infrared and/or black and white photographs were used. Communities were described by walking through the area and recording the dominant (i.e., most abundant) species present based on visual estimation. It should be noted that all variations in vegetation were not distinguished on the map. Rather, major types are separated and variations within each type are discussed in the text.

Releves were conducted on selected communities to supplement field inspection and provide further information on species composition. Visual estimates were made of the abundance (% cover) of each species found in a prescribed plot. Plot locations were chosen to represent homogeneous stands of vegetation within a community type. Releves were conducted mid-July and late August according to the methods described by Heitlinger (1979).

Photo points were established to give a visual description of vegetation, and to allow documentation of any future changes. All photo point slides are on file, Scientific and Natural Area Section, St. Paul and The Nature Conservancy, Minneapolis Field Office.

Overview of Regional Plant Communities

Clay County Bicentennial Prairie is located in the middle of the Red River Valley landscape region, just west of the prairie-forest transition zone (Figure 3). Prior to European settlement, this area

Minnesota's Landscape Regions

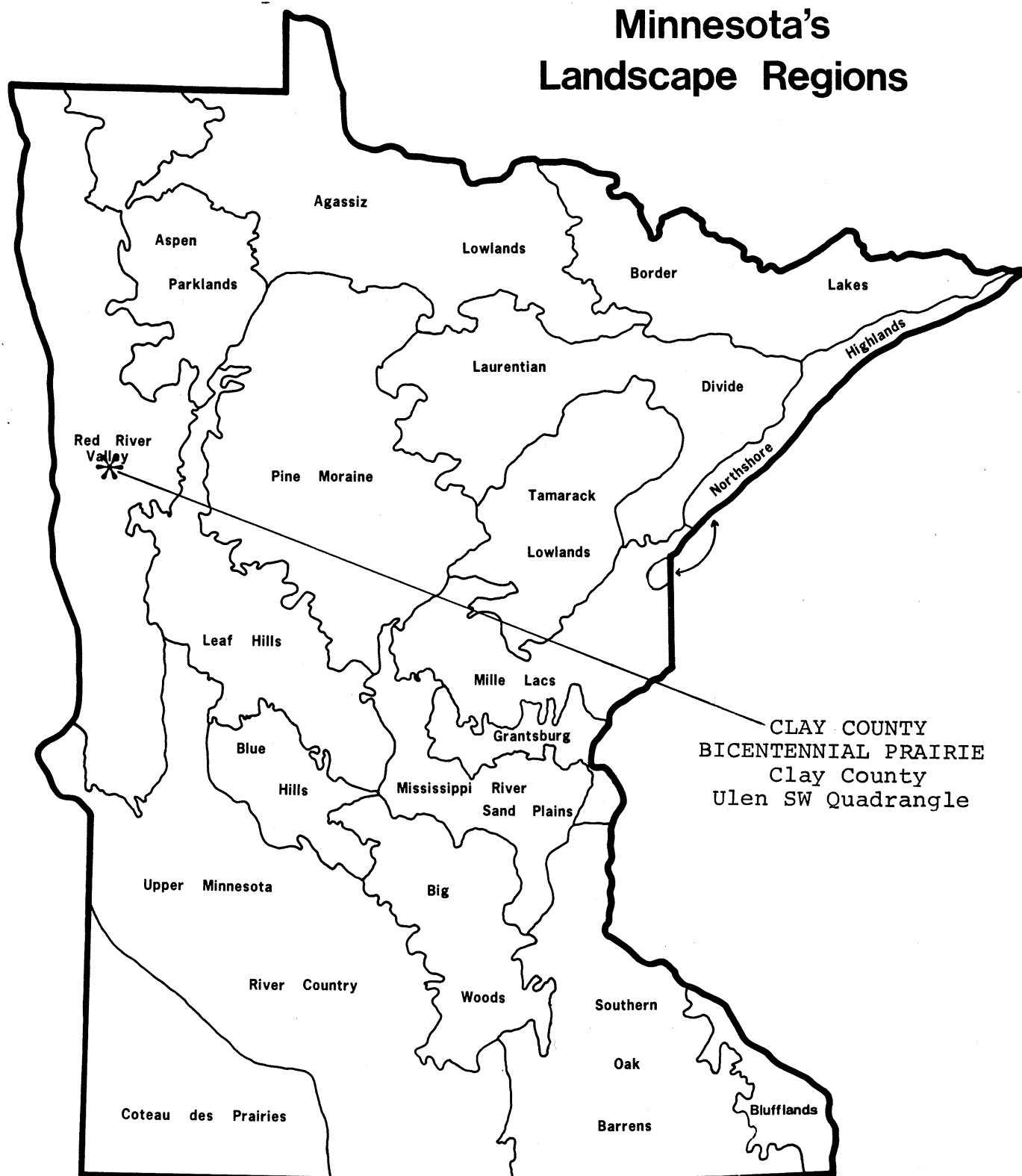


Figure 3. Clay County Bicentennial Prairie in relation to Minnesota's landscape regions. Adapted from T. Kratz and G.L. Jensen, an ecological geographic division of Minnesota (Unpublished, 1977).

was tallgrass prairie with some wet prairie, sloughs, and marshes where soils or topography reduced drainage (Marschner, 1930; Figure 4).

European settlers have converted most of this prairie to farm land, however, examples of the original vegetation can still be found on the area today.

Results

The vegetative communities of Clay County Bicentennial Prairie are illustrated in Figure 5. The area is largely an expanse of bluestem prairie with a few scattered aspen woods and one low wet area.

BLUESTEM PRAIRIE: 137 acres, 85% of preserve.

Little Bluestem (Andropogon scoparius) was estimated to compose over 50% of the cover in releve plots CCBP-1, CCPB-2, and CCBP-3. There are some sites where Porcupine Grass (Stipa spartea) approaches codominance with Little Bluestem. These areas, however, were not separated on the map.

Common forbs in the area were: Daisy Fleabane (Erigeron strigosus), Pussytoes (Annenetaria sp.), Northern Bedstraw (Galium boreale), Violet Wood-Sorrel (Oxalis violaceae) and Dotted Blazing Star (Liatris punctata). Occasional clumps of low shrubs such as Wolfberry (Symphoricarpos occidentalis) and Roses (Rosa sp.) were also scattered in lower areas of the prairie. Source of information: field inspection and releve plots CCBP-1, CCBP-2 and CCBP-3.

SPARTINA MEADOW: 11 acres, 7% of preserve.

This community occurs in a low wet area and is dominated by Cord Grass (Spartina pectinata) and Canada Anemone (Anemone canadensis). Other forbs present in the community were Prairie Blazing Star (Liatris pycnostachya), Mountain Mint (Pycnanthemum virginiana) and Bugleweed

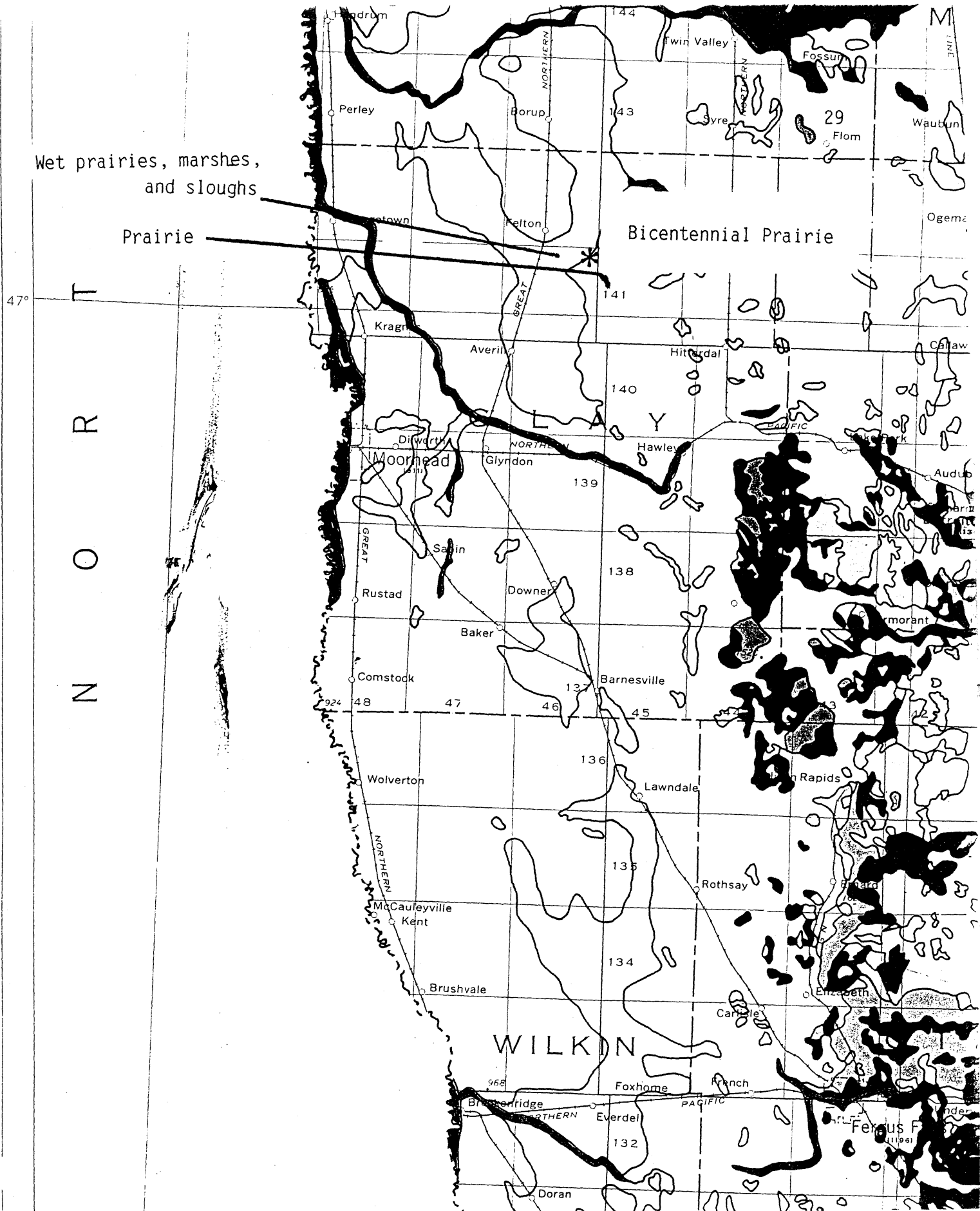


Figure 4. Portion of "The Original Vegetation of Minnesota" map (Marschner, 1930), detailing the original vegetation in the Bicentennial Prairie vicinity

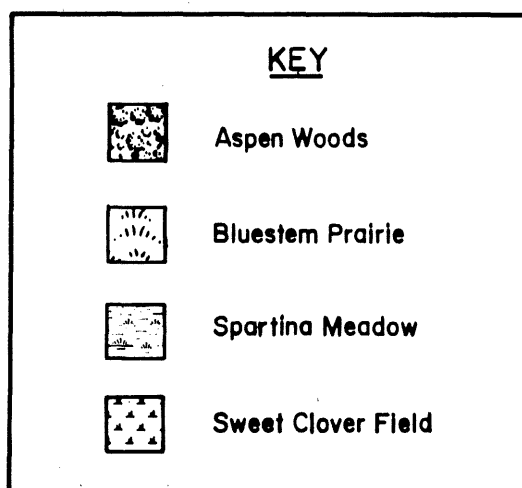
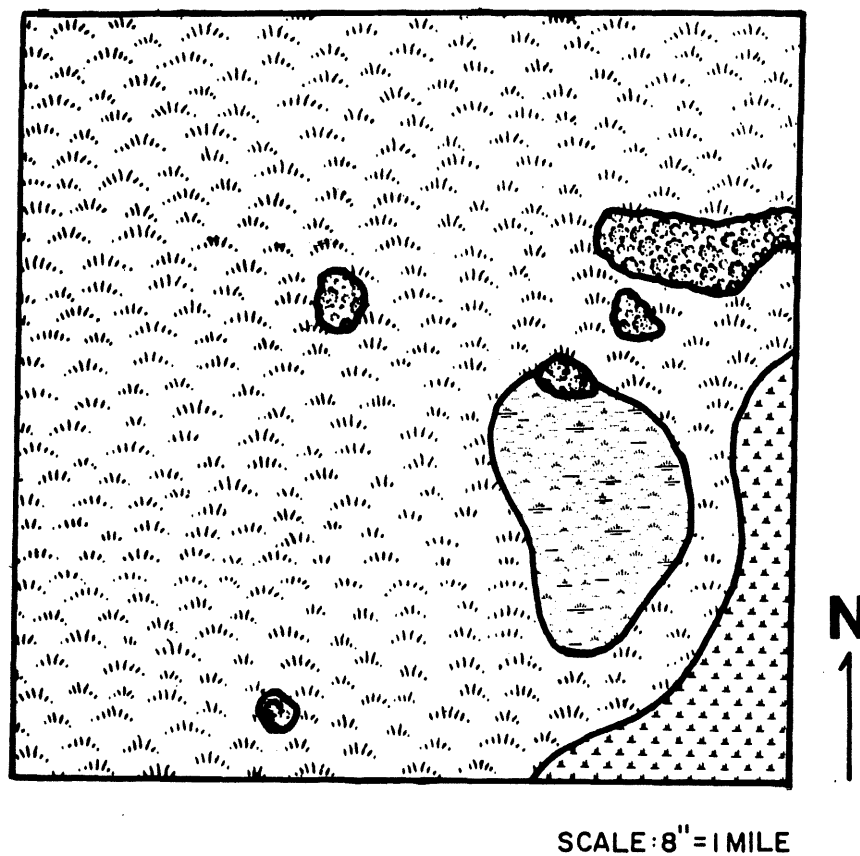


Figure 5. Vegetative associations of Bicentennial Prairie.

(Lycopus americanus). Source of information: field inspection and releve CCBP-4.

SWEET CLOVER FIELD: 8 acres, 5% of preserve.

The area is dominated by Sweet Clover (Melilotus sp.), however, most plants did not bloom in 1979 and appeared to be thinning out.

Source of information: field inspection.

ASPEN WOODS: 4 acres, 3% of preserve.

The Quaking Aspen (Populus tremuloides) woods vary in age from small young stands to large mature woods. The largest woods is actually over mature as most trees in the center of the woods are dead. Source of information: field inspection.

Sources of Information

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FLORA

Methods

Clay County Bicentennial Prairie was visited on a weekly basis, when weather conditions permitted, from 1 May to 31 August, 1979. Flowering or fruiting plants were collected and pressed. Habitat, associated species, and collection date was recorded for all specimens. Locations of specimens were indicated on an aerial photograph of the area, or grid field map.¹ Specimens were deposited at the University of Minnesota Herbarium, Botany Department, St. Paul.

A phenological record of the flowering plants was also kept. The recording began on the first visit to the area and ended on the last visit.

Plants were identified using several references (cited at the end of this section). John W. Moore, retired Associate Scientist, University of Minnesota, identified 22 specimens. Gerald Wheeler, graduate student, Botany Department, University of Minnesota, identified all species of the genus Carex. Dr. Gerald Ownbey, Curator of the Herbarium, University of Minnesota, verified the remaining specimens. Any specimens identified in the field but not collected, are indicated in the list.

Plants were designated alien if described as "introduced" in northeastern United States by both Fernald (1950) and Gleason and Cronquist (1963). Plants were designated possibly alien if described as "introduced" by one of these authorities and native by the other.

¹ On file, Scientific and Natural Areas Section, St. Paul.

Results

Table 3 is an annotated list of the plants identified on the tract.¹ A total of 146 vascular plant species,² representing 35 families, were recorded on the unit in 1979. Nine of these species are alien. The families with the largest number of species were: Asteraceae with 46 species (32% of total), Poaceae with 16 species (11% of total), and Fabaceae with 15 species (10% of total). A predominance of these 3 families is typical of the flora of prairie communities.

Figure 6 illustrates the number of species in flower on each visit to the preserve. A total of 137 species were included. The peak of blooming occurred in August.

1. Nomenclature is according to Gleason and Cronquist (1963).

2. This total does not include additional plant species identified in releve plots.

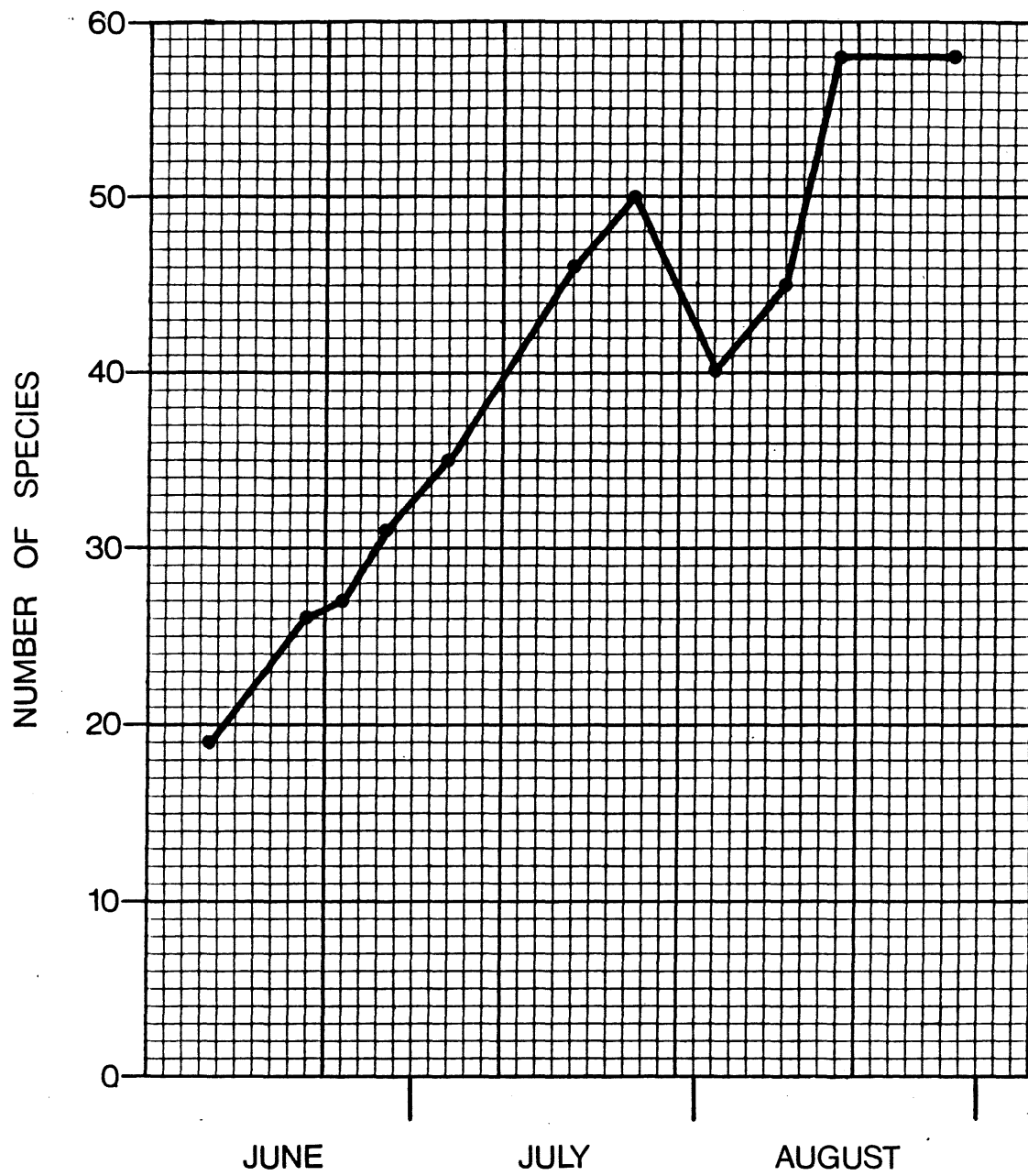


Figure 6. Blooming phenology of Bicerennial Prairie

Table 3 . Annotated List of Plants for Clay County Bicentennial Prairie

Format: Scientific name. Common name. Collection number of voucher specimen. Community in Clay County Bicentennial Prairie. Designated "alien" or "possible alien" if not native to Minnesota. Special significance of collection, if known. A (+) indicates species was noted but not collected. Asterisk (*) if specimen was identified by John Moore. Species of the genus Carex were identified by Gerald Wheeler, all other specimens were verified by Dr. Gerald Ownbey.

MONOCOTYLEDONEAE - Monocots

AMARYLLIDACEAE - Amaryllis Family

Hypoxis hirsuta (L.) Cov. - Yellow Star Grass. #13. Prairie.

COMMELINACEAE - Spiderwort Family

Tradescantia occidentalis (Britt.) Smyth. - Spiderwort. #60. Prairie.

CYPERACEAE - Sedge Family

Carex meadii Dewey. - Mead's Sedge. #12. Prairie - Edge of Woods. *

LILIACEAE - Lily Family

Allium stellatum Ker. - Prairie Onion. #110. Prairie.

Allium textile A. Nels. & Macbr. - Wild Onion. #8. Prairie.

Asparagus officinalis L. - Asparagus. #39. Aspen Woods.

Lilium philadelphicum L. - Wood Lily. #59. Aspen Woods.

Zygadenus elegans Pursh. - White Camas. #55. Prairie.

ORCHIDACEAE - Orchid Family

Habenaria leucophaea (Nutt.) Gray. - White Fringed Prairie Orchid.

#98. Wet Prairie. Threatened Species; Smithsonian Institute List.

Potential Heritage Element.

POACEAE - Grass Family

Agropyron repens (L.) Beauv. - Quack Grass. #153. Aspen Woods. Alien. *

Andropogon gerardi Vitm. - Big Bluestem. #123. Prairie. *

Andropogon scoparius Michx. - Little Bluestem. #120. Prairie. *

Bouteloua curtipendula (Michx.) Torr. - Side-Oats Grama. #128. Prairie. *

Bouteloua gracilis (HBK) Lag. - Blue Grama. Prairie. +

Bouteloua hirsuta Lag. - Hairy Grama. Prairie. +

Bromus japonicus Thunb. - Japanese Brome Grass. #82. Prairie. *

Helictotrichon hookeri (Scribn.) Henr. - Hooker's False Oats. #28.

Prairie. *

Hordeum jubatum L. - Foxtail Barley. #46. Prairie. Alien. *

Panicum leibergii (Vasey) Scribn. - Leiberg's Panic Grass. #70. Prairie. *

Panicum virgatum L. - Switch Grass. #135. Wet Prairie. *

Poa compressa L. - Canada Blue Grass. #83. Prairie. Alien. *

Poa pratensis L. (P. pratensis L. var. angustifolia (L.) Sm. - Lawn Blue Grass. #77. Prairie. Possible Alien. *
Sorghastrum nutans (L.) Nash. - Indian Grass. #147. Prairie. *
Stipa comata Trin. & Rupr. - Needle and Thread Grass. Prairie. +
Stipa spartea Trin. - Porcupine Grass. #50. Prairie. *

DICOTYLEDONEAE - Dicots

APIACEAE - Parsley Family

Cicuta maculata L. - Water Hemlock. #85. Prairie.
Zizia aptera (Gray) Fern. - Golden Alexander. #31. Prairie.

APOCYNACEAE - Dogbane Family

Apocynum androsaemifolium L. - Dogbane. #56. Prairie.
Apocynum sibiricum Jacq. - Indian Hemp. #107. Prairie.

ASCLEPIADACEAE - Milkweed Family

Asclepias incarnata L. - Swamp Milkweed. #99. Wet Prairie.
Asclepias ovalifolia Decne. - Dwarf Milkweed. #54. Prairie.
Asclepias speciosa Torr. - Showy Milkweed. #86. Wet Prairie.
Asclepias syriaca L. - Common Milkweed. #93. Aspen Stand.
Asclepias viridiflora Raf. - Green Milkweed. #94. Prairie.

ASTERACEAE - Composite Family

Achillea millefolium L. - Yarrow. #24. Prairie.
Agoseris glauca (Pursh) D. Dietr. - Prairie Dandelion. #27. Prairie.
Ambrosia psilostachya DC. - Ragweed. #119. Prairie.
Antennaria plantaginifolia (L.) Richards. - Pussy Toes. #3. Prairie.
Artemisia campestris L. (A. caudata Michx. in Fernald, 1950). - Green Sage. #129. Prairie. *
Artemisia ludoviciana Nutt. - White Sage. #121. Prairie.
Aster ericoides L. - Heath Aster. #145. Prairie.
Aster laevis L. - Smooth Aster. #146. Prairie.
Aster ptarmicoides (Nees) T. & G. - Upland White Aster. #105. Prairie.
Aster ptarmicoides (Nees) T. & G. x Solidago riddellii Frank. (Hybrid). #149. Prairie.
Aster sericeus Vent. - Silky Aster. #144. Prairie.
Aster simplex Willd. - Panicked Aster. #151. Wet Prairie. *
Bidens frondosa L. - Beggar-Ticks. #155. Aspen Woods. *
Chrysopsis villosa (Pursh) Nutt. - Hairy Golden Aster. #51. Prairie.
Cirsium arvense (L.) Scop. - Canada Thistle. #81. Aspen Woods. Alien.
Cirsium flodmanii (Rydb.) Arthur. - Flodman's Thistle. #122. Prairie.
Conyza canadensis (L.) Cronq. - Horseweed. #143. Prairie.
Echinacea pallida Nutt. var. angustifolia (DC.) Cronq. (E. angustifolia DC. in Fernald, 1950) - Purple Coneflower. #73. Prairie.
Erigeron glabellus Nutt. - Fuzzy Fleabane. Prairie. +
Erigeron philadelphicus L. - Common Fleabane. #36. Edge of Aspen Woods
Erigeron strigosus Muhl. - Slender Daisy Fleabane. Prairie. +

- Gaillardia aristata Pursh. - Blanket Flower. #33. Prairie.
Helenium autumnale L. - Sneezeweed. #114. Prairie.
Helianthus laetiflorus Pers. - Prairie Sunflower. #103. Prairie.
Helianthus maximiliani Schrader. - Maximilian's Sunflower. #131. Prairie.
Hieracium canadense Michx. - Hawkweed. #113. Wet Prairie.
Krigia biflora (Walt.) Blake. - Dwarf Dandelion. #58. Prairie.
Lactuca pulchella (Pursh) DC. - Wild Blue Lettuce. #78. Prairie.
Liatris aspera Michx. - Rough Blazing Star. #127. Prairie.
Liatris punctata Hook. - Dotted Blazing Star. #111. Prairie.
Liatris pycnostachya Michx. - Tall Blazing Star. #97. Wet Prairie.
Prenanthes racemosa Michx. - Glaucous Rattlesnake Root. #148. Prairie.
Ratibida columnifera (Nutt.) Woot. & Standl. - Gray-Headed Coneflower
 #62. Prairie.
Rudbeckia hirta L. - Black-Eyed Susan. #156. Prairie. Alien.
Senecio integerrimus Nutt. - Ragwort. #4. Prairie.
Senecio pauperculus Michx. - Western Ragwort. #44. Prairie.
Solidago canadensis L. var gilvocanescens Rydb. - Plains Goldenrod.
 #106. Prairie.
Solidago gigantea Ait. - Late Goldenrod. #136. Wet Prairie.
Solidago graminifolia (L.) Salisb. - Lance-Leaved Goldenrod. #132. Prairie.
Solidago missouriensis Nutt. - Missouri Goldenrod. #139. Prairie.
Solidago riddellii Frank. - Riddell's Goldenrod. #150. Prairie.
Solidago rigida L. - Hard-Leaved Goldenrod. #138. Prairie.
Solidago speciosa Nutt. - Showy Goldenrod. #124. Prairie.
Sonchus uliginosus Bieb. (S. arvensis L. var glabrescens Guenth.,
 Grab. & Wimm.) - Sow Thistle. #154. Aspen Woods. Alien. *
Taraxacum officinale Weber. - Common Dandelion. Prairie. +
Tragopogon dubius Scop. - Goat's Beard. #34. Prairie. Alien.

BORAGINACEAE - Borage Family

- Lappula echinata Gilib. - European Burseed. #75. Prairie. *
Lithospermum canescens (Michx.) Lehm. - Hoary Puccoon. #5. Prairie.
Lithospermum incisum Lehm. - Narrow-Leaved Puccoon. #11. Prairie.

BRASSICACEAE - Mustard Family

- Erysimum inconspicuum (Wats.) MacMill. - Small-Flowered Rocket. #43.
 Prairie.
Sisymbrium altissimum L. - Hedge Mustard. #95. Prairie. *

CAMPANULACEAE - Harebell Family

- Campanula rotundifolia L. - Harebell. #40. Prairie.

CAPRIFOLIACEAE - Honeysuckle Family

- Symphoricarpos occidentalis Hook. - Wolfberry. #65. Prairie.

CARYOPHYLLACEAE - Pink Family

- Arenaria lateriflora L. - Sandwort. #21. Aspen Woods.
Cerastium arvense L. - Field Chickweed. #2. Prairie.

CONVOLVULACEAE - Morning Glory Family

- Cuscuta coryli Engelm. - Hazel Dodder. #141. Aspen Woods. *

FABACEAE - Bean Family

- Amorpha canescens Pursh. - Lead Plant. #91. Low Prairie.
Amorpha nana Nutt. - False Indigo. #38. Wet Prairie.
Astragalus adsurgens Pall. - Purple Milk-Vetch. #41. Prairie.
Astragalus agrestis Dougl. - Milk-Vetch. Prairie. +
Astragalus canadensis L. - Canada Milk-Vetch. #72. Prairie.
Astragalus crassicaupus Nutt. - Prairie Plum. #7. Prairie.
Melilotus alba Desr. - White Sweet Clover. #52. Prairie. Alien.
Melilotus officinalis (L.) Desr. - Yellow Sweet Clover. #53. Prairie.
 Alien.
Petalostemum candidum (Willd.) Michx. - White Prairie Clover. #71.
 Prairie.
Petalostemum purpureum (Vent.) Rydb. - Purple Prairie Clover. #89.
 Prairie.
Psoralea argophylla Pursh. - Silver-Leaf Scurf-Pea. #92. Prairie.
Psoralea esculenta Pursh. - Prairie Turnip. #29. Prairie.
Trifolium pratense L. - Red Clover. #130. Aspen Woods. Alien.
Trifolium repens L. - White Clover. #84. Prairie. Alien.
Vicia americana Muhl. - American Vetch. #32. Aspen Woods.

LAMIACEAE - Mint Family

- Lycopus americanus Muhl. - Water Horehound. #134. Wet Prairie.
Lycopus asper Greene. - Water Horehound. #117. Aspen Woods.
Monarda fistulosa L. - Wild Bergamot. #140. Clearing in Aspen Woods.
Pycnanthemum virginianum (L.) Durand & Jackson. - Virginia Mountain Mint.
 #96. Wet Prairie.
Stachys palustris L. - Hedge Nettle. #57. Wet Prairie.

LINACEAE - Flax Family

- Linum sulcatum Riddell. - Yellow Flax. #80. Prairie.

LOBELIACEAE - Lobelia Family

- Lobelia kalmii L. - Brook Lobelia. #152. Prairie.
Lobelia spicata Lam. - Lobelia. #64. Prairie.

NYCTAGINACEAE - Four O'clock Family

- Oxybaphus hirsutus (Pursh) Sweet. - Four O'clock. #108. Prairie.

ONAGRACEAE - Evening Primrose Family

- Gaura coccinea Pursh. - Scarlet Gaura. #42. Prairie.
Oenothera biennis L. - Evening Primrose. #104. Prairie.
Oenothera nuttallii Sweet. - Evening Primrose. #109. Prairie.
Oenothera serrulata Nutt. - Serrate-Leaved Evening Primrose. #48. Prairie.

OXALIDACEAE - Wood-Sorrel Family

- Oxalis violacea L. - Prairie Wood-Sorrel. #10. Prairie.

PHRYMACEAE - Lopseed Family

- Phryma leptostachya L. - Lopseed. #100. Aspen Woods.

POLYGALACEAE - Milkwort Family

Polygala senega L. - Seneca Snakeroot. #49. Prairie.

PRIMULACEAE - Primrose Family

Lysimachia ciliata L. - Fringed Loosestrife. #69. Aspen Woods.

RANUNCULACEAE - Crowfoot Family

Anemone canadensis L. - Canada Anemone. #35. Aspen Woods.

Anemone cylindrica Gray. - Thimbleweed. #87. Prairie.

Anemone patens L. - Pasque Flower. #1. Dry Prairie.

Delphinium virescens Nutt. - Larkspur. #61. Prairie.

Thalictrum dasycarpum Fisch. & Ave-Lall. - Tall Meadow Rue. #66.
Aspen Woods.

ROSACEAE - Rose Family

Geum canadense Jacq. - White Avena. #68. Aspen Woods. *

Geum triflorum Pursh. - Prairie Smoke. #18. Prairie.

Potentilla arguta Pursh. - Tall Cinquefoil. #76. Prairie.

Prunus pumila L. - Sand-Cherry. #17. Edge of Aspen Woods.

Prunus virginiana L. - Choke-Cherry. #16. Aspen Woods.

Rosa suffulta Greene. - Wild Prairie Rose. #125. Prairie.

Spiraea alba DuRoi. - Meadow Sweet. #67. Prairie.

RUBIACEAE - Madder Family

Galium boreale L. - Northern Bedstraw. #23. Prairie.

SALICACEAE - Willow Family

Populus tremuloides Michx. - Quaking Aspen. #47. Aspen Woods.

Salix humilis Marsh. - Prairie Willow. #15. Edge of Woods.

SANTALACEAE - Sandal-Wood Family

Comandra umbellata (L.) Nutt. - Bastard Toad-Flax. #6. Prairie.

SCROPHULARIACEAE - Figwort Family

Castilleja coccinea (L.) Spreng. - Painted Cup. #20. Prairie.

Castilleja sessiliflora Pursh. - Downy Painted Cup. #19. Prairie.

Pedicularis lanceolata Michx. - Lousewort. #133. Wet Prairie.

Penstemon gracilis Nutt. - Beard-Tongue. #37. Prairie.

Veronicastrum virginicum (L.) Farw. - Culver's Root. #101. Aspen Woods.

VERBENACEAE - Vervain Family

Verbena hastata L. - Blue Vervain. #112. Prairie.

VIOLACEAE - Violet Family

Viola pedatifida G. Don. - Prairie Violet. #9. Prairie.

VITACEAE - Grape Family

Vitis riparia Michx. - River-Bank Grape. #126. Aspen Woods.

The following additional list of plant species were identified in releve plots. Voucher specimens were not collected.

ASTERACEAE

Artemisia dracunculusArtemisia frigidaSenecio cf. plattensisSolidago nemoralis

FABACEAE

Medicago saliva

POACEAE

Calamagrostis inexpansaCalamovifa cf. longifoliaMuhlenbergia cf. cuspidataPhleum pratenseSpartina pectinata

ROSACEAE

Fragaria virginiana

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ZOOLOGICAL COMPONENTS

Animals are an important part of virtually all of Minnesota's natural areas. Their diversity is determined by both abiotic and vegetational components of the environment. Reciprocally, the zoological components may have a limited effect on the vegetational and abiotic resources of an area; seed dispersal, soil aeration, and water levels, for example, are often influenced by animals. In addition, certain animal species, by their presence or absence, are considered ecological indicators that might provide information on changes occurring in the area. An inventory of butterflies, birds, mammals, amphibians and reptiles was conducted to: 1) document the area's species diversity, 2) obtain baseline data so changes can be discerned, and 3) identify rare, sensitive, or representative species and communities.

BUTTERFLIES

Methods

The 1979 butterfly¹ inventory was conducted from 4 June to 3 September, during which seven visits were made to the tract. Each major habitat type was sampled with an emphasis on areas containing flowering plants.

A standard butterfly net was used to capture the insects. Those captured were released, except when identification required a prepared specimen or when a voucher specimen was desired.

Identification of prepared specimens was based on the references below. The butterfly collection at North Dakota State University was used to verify identifications. In addition, assistance in field techniques and verification of specimens were provided by Robert Dana (graduate student in Entomology, University of Minnesota) and Ron Huber (Zoology Assistant with the Science Museum of Minnesota).

Voucher specimens were deposited in the University of Minnesota, Department of Entomology, Fisheries, and Wildlife collection. Duplicate specimens were deposited at the Science Museum of Minnesota.

Discussion

Twenty-seven butterfly species were identified on Clay County Bicentennial Prairie during the 1979 inventory. Table 4 lists all the species, recorded in phylogenetic order.²

1 The term butterfly in this document refers both to the true butterflies (Papilionoidea) and the Skippers (Hesperiodea).

2 Major habitat types, butterfly activity, observed flight dates and a rough estimate of each species frequency are on file, Scientific and Natural Areas, St. Paul.

Table 4. Butterflies Observed on Clay County Bicentennial Prairie.

HESPERIIDAE

Atrytonopsis hianna (Scudder) - Dusted Skipper
Atrytone arogos (Boisduval & LeConte) - Arogos Skipper
Atrytone delaware (Edwards) - Delaware Skipper *
Polites themistocles (Latreille) - Tawny-edged Skipper
Polites mystic (Scudder) - Long Dash
Hesperia pawnee Dodge - Pawnee Skipper *
Hesperia dacotae (Skinner) - Dakota Skipper - Natural Heritage Element
Oarisma poweshiek (Parker) - Poweshiek Skipper
Pyrgus communis (Grote) - Checkered Skipper *

PAPILIONIDAE

Papilio polyxenes asterius Stoll - Black Swallowtail

PIERIDAE

Pieris protodice Boisduval & LeConte - Checkered White *
Pieris rapae (Linnaeus) - Cabbage Butterfly *
Colias eurytheme Boisduval - Alfalfa Butterfly
Colias philodice Godart - Common Sulphur

LYCAENIDAE

Plebejus melissa (Edwards) - Melissa Blue
Glaucopsyche lygdamus couperi Grote - Silvery Blue

NYMPHALIDAE

Limenitis archippus (Cramer) - Viceroy
Vanessa atalanta (Linnaeus) - Red Admiral
Vanessa cardui (Linnaeus) - Painted Lady
Phyciodes tharos (Drury) - Pearl Crescent
Chlosyne gorgone carlota (Reakirt) - Gorgone Checkerspot
Boloria selene (Denis & Schiffermuller) - Silver-bordered Fritillary
Speyeria idalia (Drury) - Regal Fritillary *
Speyeria aphrodite (Fabricius) - Aphrodite

DANAIDAE

Danaus plexippus (Linnaeus) Monarch *

SATYRIDAE

Coenonympha tullia inornata Edwards - Inornate Ringlet
Cercyonis pegala (Fabricius) Wood Nymph

* Observed on the tract, but not collected.

Sources of Information

- Ehrlich, Paul R. and Anne H. Ehrlich. 1961. The Butterflies. Wm. C. Brown Co. Publishers, Dubuque, Iowa.
- Howe, W.H. (Co-ord. ed.) 1975. The Butterflies of North America. Doubleday, Garden City, N.Y.
- Klots, Alexander B. 1951. A Field Guide to the Butterflies of North America, East of the Great Plains. Houghton Mifflin Co. Boston.
- McCabe, Tim L. and Richard Lewis Post. 1977. Skippers of North Dakota. Department of Entomology, Agricultural Experiment Station. North Dakota State University.
- Puckering, D. Lovell and Richard L. Post. 1960. Butterflies of North Dakota. Department of Agricultural Entomology, North Dakota Agricultural College.

BIRDS

Methods

Two methods were used during the 1979 bird inventory. A route method was used to gather data on species diversity, and a variation of the IPA (Indices Ponctuels d'Abondance) or Point Count Method (Robbins, 1978) was used to inventory breeding birds.

The route method was used from 14 May to 7 June. One evening visit and two early morning visits were made during this period. This method required the observer to record observations made along an established route and at random stops in each habitat type. The amount of time spent at a given stop varied from 10 to 30 minutes, depending on bird activity and the observer's identification abilities. The observer was permitted to leave the route in order to identify unfamiliar birds.

The Point Count Method (used from 18 June to 11 July) infers a breeding territory based on repetition of a singing male in the same area during the breeding season (May-June). Four circular stations¹ (50 m. radius) were established to include each of the major habitat types. A researcher made five early morning visits to the stations, remaining 10 minutes at each station. The order in which the stations were visited was varied. All birds seen or heard from each station were recorded. All observations were summarized on a single map at the end of the breeding season. A minimum of two noncontemporaneous occurrences of a particular species was used as a guideline for inferred breeding of that species.

¹ Maps showing the location of these stations are on file, Scientific and Natural Areas Section, St. Paul.

Additional species observed outside of the established stations were also recorded. Species identification was based on visual observations, songs, and/or nest characteristics. Locating nests was done on an incidental basis throughout the field season.

Results

The results of the 1979 bird inventory are presented in the form of an annotated list, Table 5. Forty-seven species of birds, representing 19 families, were observed on, above, or adjacent to Clay County Bicentennial Prairie. Distribution records according to Green and Janssen (1975) were consulted to determine species which may not be common in the vicinity of the natural area due to scarcity and range distribution. Birds either outside of the range or near the edge of the range were recorded. Those species included at Clay County Bicentennial Prairie are: American Woodcock, western range extension; and Yellow-bellied Flycatcher, western range extension. Four species were found nesting on the area with 11 others recorded as inferred breeders.¹

¹ Additional information, in the form of field data sheets and secondary sources, is on file, Scientific and Natural Areas Section, St. Paul.

Key to Table 5

FAMILY/SCIENTIFIC NAME: Names are in phylogenetic order, according to Green and Janssen, 1975.

DATE: Date of first observation.

HABITAT: All habitats where a given species was observed are listed.

AsWo - Aspen Woods
CF - Cultivated Field
Pr - Prairie

RESIDENCY: Represents a basic breakdown based on breeding populations in Minnesota (Green and Janssen, 1975).

M - Migrant
P - Permanent Resident
S - Summer Resident
WV - Winter Visitant

BREEDING STATUS:

- - Positive Nesting - nest with eggs, adult sitting on nest constantly, or eggshells near nest; young in nest; downy young or young still unable to fly seen away from nest (Green and Janssen, 1975).
- - Inferred Nesting - adults seen building nest, in distraction display, carrying fecal sac, or carrying food; fledglings seen in area (Green and Janssen, 1975).
- ⊙ - Inferred Breeding - based on the Point Count Method (Robbins, 1978), a minimum of two noncontemporaneous occurrences of a species at a given observation station.

TABLE 5. ANNOTATED LIST OF BIRDS OBSERVED AT CLAY COUNTY BICENTENNIAL PRAIRIE

FAMILY/SCIENTIFIC NAME	COMMON NAME	DATE	HABITAT	RESI- DENCY	BREEDING STATUS	REMARKS
ANATIDAE						
<u>Branta canadensis</u>	Canada Goose	7 June		S		Observed Flying
<u>Anas acuta</u>	Pintail	7 June		S		Observed Flying
ACCIPITRIDAE						
<u>Buteo jamaicensis</u>	Red-Tailed Hawk	15 May		S		Observed Flying
<u>Circus cyaneus</u>	Marsh Hawk	24 May	Pr	S	●	1 nest 5 eggs 6/4/79
TETRAONIDAE						
<u>Tympanuchus cupido</u>	Great Prairie Chicken	28 April	CF Pr	P		Observed booming East of preserv Natural Heritage Element
CHARADRIIDAE						
<u>Charadrius vociferus</u>	Killdeer	5 July	Pr	S		Observed Flying
SCOLOPACIDAE						
<u>Philohela minor</u>	American Woodcock	5 July	AsWo	S		
<u>Capella gallinago</u>	Common Snipe	7 June	Pr	S		Observed Flying
<u>Bartramia longicauda</u>	Upland Sandpiper	24 May	Pr	S		
<u>Limosa fedoa</u>	Marbled Godwit	22 June	Pr	S		Natural Heritage Element
LARIDAE						
<u>Chlidonias niger</u>	Black Tern	7 June	Pr	S	0	Observed Flying
COLUMBIDAE						
<u>Zenaida macroura</u>	Mourning Dove	15 May	AsWo	S	⊕	
STRIGIDAE						
<u>Bubo virginianus</u>	Great Horned Owl	7 June	AsWo	P		
PICIDAE						
<u>Colaptes auratus</u>	Common Flicker	15 May	AsWo	S	⊕	

TABLE 5. (Cont'd) ANNOTATED LIST OF BIRDS OBSERVED AT CLAY COUNTY BICENTENNIAL PRAIRIE

FAMILY/SCIENTIFIC NAME	COMMON NAME	DATE	HABITAT	RESI- DENCY	BREEDING STATUS	REMARKS
TYRANNIDAE						
<u>Tyrannus tyrannus</u>	Eastern Kingbird	24 May	AsWo	S		
<u>Sayornis phoebe</u>	Eastern Phoebe	24 May	AsWo	S		
<u>Empidonax flaviventris</u>	Yellow-Bellied Flycatcher	18 June	AsWo	S		
<u>Empidonax minimum</u>	Least Flycatcher	24 May	AsWo	S		
HIRUNDINIDAE						
<u>Iridoprocne bicolor</u>	Tree Swallow	15 May	AsWo	S	0	Birds flying in and out of dead tree cavity
<u>Riparia riparia</u>	Bank Swallow	7 June	Pr	S		Observed Flying
<u>Stelgidopteryx ruficollis</u>	Rough-Winged Swallow	22 June	Pr	S		Observed Flying
<u>Hirundo rustica</u>	Barn Swallow	7 June	Pr	S		Observed Flying
<u>Petrochelidon pyrrhonota</u>	Cliff Swallow	7 June	Pr	S		Observed Flying
CORVIDAE						
<u>Cyanocitta cristata</u>	Blue Jay	15 May	AsWo	P	⊕	
<u>Corvus brachyrhynchos</u>	Common Crow	7 June	Pr	S		Observed Flying
TROGLODYTIDAE						
<u>Troglodytes aedon</u>	House Wren	24 May	AsWo	S	●	1 nest with young 7/5/79
MIMIDAE						
<u>Dumetella carolinensis</u>	Gray Catbird	24 May	AwWo	S	0	Nest material in mouth
<u>Toxostoma rufum</u>	Brown Thrasher	15 May	AsWo	S		
TURDIDAE						
<u>Turdus migratorius</u>	American Robin	24 May	AsWo	S		
<u>Catharus fuscescens</u>	Veery	22 June	AsWo	S	⊕	
BOMBYCILLIDAE						
<u>Bombycilla cedrorum</u>	Cedar Waxwing	7 June		S		Observed Flying

TABLE 5. (Continued) ANNOTATED LIST OF BIRDS OBSERVED AT CLAY COUNTY BICENTENNIAL PRAIRIE

FAMILY/SCIENTIFIC NAME	COMMON NAME	DATE	HABITAT	RESI- DENCY	BREEDING STATUS	REMARKS
VIREONIDAE						
<u>Vireo gilvus</u>	Warbling Vireo	18 June	AsWo	S		
PARULIDAE						
<u>Dendroica magnolia</u>	Magnolia Warbler	24 June	AsWo	S		
<u>Dendroica striata</u>	Blackpoll Warbler	24 May	AsWo	M		
<u>Geothlypis trichas</u>	Common Yellowthroat	24 May	AsWo	S		
ICTERIDAE						
<u>Dolichonyx oryzivorus</u>	Bobolink	15 May	Pr	S	⊕	
<u>Sturnella neglecta</u>	Western Meadowlark	15 May	Pr AsWo	S	●	1 nest 5 eggs 6/22/79
<u>Xanthocephalus xanthocephalus</u>	Yellow-Headed Blackbird	7 June	Pr	S		
<u>Agelaius phoeniceus</u>	Red-Winged Blackbird	7 June	Pr	S		
<u>Icterus galbula</u>	Northern Oriole	24 May	AsWo	S	⊕	
<u>Molothrus ater</u>	Brown-Headed Cowbird	15 May	Pr AsWo	S		
FRINGILLIDAE						
<u>Spinus tristis</u>	American Goldfinch	22 June	AsWo	S		
<u>Passerculus sandwichensis</u>	Savannah Sparrow	28 April	Pr	S	⊕	
<u>Ammodramus savannarum</u>	Grasshopper Sparrow	24 May	Pr	S	⊕	
<u>Ammospiza leconteii</u>	LeConte's Sparrow	24 May	Pr	S		
<u>Poncetes gramineus</u>	Vesper Sparrow	7 June	Pr AsWo	S		
<u>Spizella pallida</u>	Clay-Colored Sparrow	15 May	AsWo	S	●	1 nest 4 young birds 6/18/79

Sources of Information

Harrison, Hal H. 1975. A Field Guide to Birds' Nests, Peterson Field Guide Series #21. Houghton Mifflin Company, Boston.

Pettingill, Olin Sewall, Jr. 1970. Ornithology in Laboratory and Field. Burgess Publishing Company, Minneapolis.

Robbins, Chandler S., B. Bruun, H.S. Zim. 1966. Birds of North America. Golden Press, New York.

Robbins, Chandler S. 1978. Census Techniques for Forest Birds. Proceedings of the Workshop Management of Southern Forests for Non-game Birds. U. S. Department of Agriculture Forest Service General Technical Report SE-14:142-163.

Additional Sources of Information

Peterson Field Guide. A Field Guide to Bird Songs. Eastern and Central North America. 1971. Houghton Mifflin Company, Boston.

Sounds of Nature Series. Vol. IV Warblers, Vol. VI Finches, Federation of Ontario Naturalists.

MAMMALS

Methods

Mammals were identified by sight, track, sound, and collection. Collection tools used were drift fences, live and snap traps. The 1979 mammal inventory was conducted late in the summer; incidental observations were made throughout the summer.

The mammal inventory was conducted over a three day period during which traps were set and scent stations were made. A trapline was set in each of the major habitat types. Each line consisted of 15 Museum Special snap traps and five Sherman live traps set approximately 8 m. apart. Traps were baited with a peanut butter and oatmeal mixture. Victor Pocket Gopher traps were set in gopher mounds. The drift fences used during the amphibian and reptile inventory were reopened. Scent stations, 1 m. diameter, were established on mounds of soil excavated by pocket gophers.

Traps and scent stations were checked once daily over a three day trapping period. The specimens were collected for measurements and identification; live duplicates were released. A male and female of each species collected were deposited in the Bell Museum of Natural History, University of Minnesota, Department of Ecology and Behavioral Biology, as voucher specimens.

Results

The results of the 1979 mammal inventory are presented in the form of an annotated list, Table 6. Eight species, representing six families were observed or captured on Clay County Bicentennial Prairie.¹

¹ Additional information, in the form of field data sheets and secondary sources, is on file, Scientific and Natural Areas Section, St. Paul.

Table 6. Mammals Identified on Clay County Bicentennial Prairie.

Family Name/ Scientific Name	Common Name	Habitat
SORICIDAE		
<u>Sorex cinereus</u>	Masked Shrew	Prairie
<u>Blarina brevicauda</u>	Short-tailed Shrew	Low Prairie, Aspen
LEPORIDAE		
<u>Lepus townsendii</u> *	White-tailed Jack Rabbit	Prairie
CRICETIDAE		
<u>Clethrionomys gapperi</u>	Gapper's Red-Backed Vole	Aspen
<u>Microtus ochrogaster</u> *	Prairie Vole	Low Prairie, Prairie
ZAPODIDAE		
<u>Zapus hudsonius</u>	Meadow Jumping Mouse	Low Prairie
MUSTELIDAE		
<u>Mustella frenata</u>	Long-tailed Weasel	Aspen
CREVIDAE		
<u>Odocoileus virginianus</u>	White-tailed Deer	Prairie, Wood Edge, Aspen

* Natural Heritage Element

Sources of Information

Banfield, S.W.F. 1974. The Mammals of Canada. University of Toronto Press, Toronto.

Burt, William H., Richard Grossenheider. 1964. A Field Guide to the Mammals. Houghton Mifflin Company, Boston.

Gunderson, Harvey L. and James R. Beer. 1953. The Mammals of Minnesota. University of Minnesota Press, Minneapolis.

AMPHIBIAN AND REPTILES

Methods

Amphibians and reptiles were identified by vocalizations, sight, and collection of specimens.¹ Collection techniques used were drift fences, fyke nets, and hand collection. Incidental observations were made throughout the summer.

Collection of amphibians was accomplished by hand capture and with drift fences. In the spring frogs, toads, and salamanders congregate for breeding, often in the same areas. Frogs and toads were identified using their breeding vocalization, located and hand captured. Salamanders were collected by searching the breeding area. Collecting was done at night with head lamps and waders. Later in the spring and throughout the summer drift fences, ranging from 50 to 100 feet long, were constructed of 18 inch high galvanized flashing sunk 3 to 4 inches into the ground. Two buckets were placed at each end of the fence, serving as drop receptacles for amphibians moving along the fence. The fences were placed in low areas and along the shores of water areas. Any animal moving toward or away from the water was diverted by the obstructing fence into one of the drop buckets.

Reptiles were collected by hand or by the use of drift fences and snake traps. The snake traps were a wire mesh and wooden rectangular box (18"x30"x26") with lead-in funnels on each end. The traps were set along the sides of the drift fences, trapping snakes that had been diverted by the fence. These traps were used in conjunction with mammal trapping.

¹ Field work in the spring and early summer was conducted by Scientific and Natural Areas volunteers, Bruce Brecke and Mike Pappus.

Voucher specimens were deposited in the Bell Museum of Natural History, University of Minnesota, Department of Ecology and Behavioral Biology.

Results

The results of the 1979 amphibian and reptile inventory are presented in the form of an annotated list, Table 7. Three amphibians and one reptile were identified on Clay County Bicentennial Prairie.

Table 7. Amphibians and Reptiles Observed on Clay County Bicentennial Prairie.

AMPHIBIA

HYLIDAE

Pseudacris triseriata maculata - Swamp Tree Frog

RANIDAE

Rana pipiens pipiens - Leopard Frog

Rana sylvatica - Wood Frog (Heard in chorus)

REPTILIA

COLUBRIDAE

Thamnophis radix haydeni - Plains Garter Snake

Sources of Information

Breckenridge, W.J. 1944. Reptiles and Amphibians of Minnesota. The University of Minnesota Press, Minneapolis.

Conant, Roger. 1958. A Field Guide to Reptiles and Amphibians. Houghton Mifflin Company, Boston.

Clay County Bicentennial Prairie Land Use History

Updated and Revised 1986

Introduction

The reconstruction of the Bicentennial Prairie land use history and vegetational history was accomplished utilizing several sources. The earliest accounts of the area history were derived from historical texts and field notes of the surveyors who first surveyed Clay County in 1871. Detailed land use information prior to 1930 was not available.

Information regarding the last fifty years was acquired through aerial photos, plat maps, interviews with landowners near the prairie, field inspections, and earlier reports regarding the area's land use (Scientific and Natural Areas Program 1979 and Braker 1985).

General History

When the first explorers and settlers arrived in Clay County during the 1800's, it was primarily covered by prairie. Historical texts contain a biased description of the county as being, "composed of as fine prairie land as the eye ever saw". Historians also claimed, "the yearly occurrence of the destructive prairie fire was much dreaded by the pioneer families."

Most of the Glacial Lake Agassiz prairie soils in Clay County have been put into cultivation. The Agassiz beach ridge areas, however, were not settled and converted to agricultural lands as quickly. The large distance from rivers and lakes and the sandy character of the soils also accounted for the comparatively late settlement of the lands in several townships, including Felton, Flowing, Keene, and Spring Prairie. These areas consequently hold a large percentage of the remaining native vegetation cover in the county.

Land Use History - American Indians

Prior to the arrival of Europeans in Clay County, American Indians were inhabitants of the Bicentennial Prairie area. In at least two places on the north end of the prairie, stones thought to be remnant teepee rings exist on the SNA (Figure 7). These "teepee rings" consist of small stones, embedded deeply in the soil. Stones were used by Indians to anchor teepee hides and poles. The "teepee rings" on the tract are rather small. Two possible explanations have been suggested: 1) the teepee rings may be extremely old (from a time when teepees were small because horses were not in use and supplies were minimal), or 2) they may have been meditation teepees, made to hold only one person. One archeologist has suggested the stones may simply be subsurface rocks which happen to be arranged in a circular pattern (K. Bakken, pers. comm.).

Land Use History - Hunting

Bicentennial Prairie is within the Clay County Game Refuge, established by county residents' petition on August 5, 1921. Hunting and trapping have been allowed in the refuge off and on since that time, with the amount of hunting allowed each year depending on current wildlife populations in the area.

Land Use History - Agriculture

Since European settlement of Clay County in the late 1800's, agriculture has changed the land from a great expanse of prairie to a mosaic of cultivated croplands, pasture, and native haylands. The Bicentennial Prairie SNA was used for both pasture and native hayland prior to its designation as a Scientific and Natural Area in 1976. Surrounding lands have also been used agriculturally for many years (Figure 8).

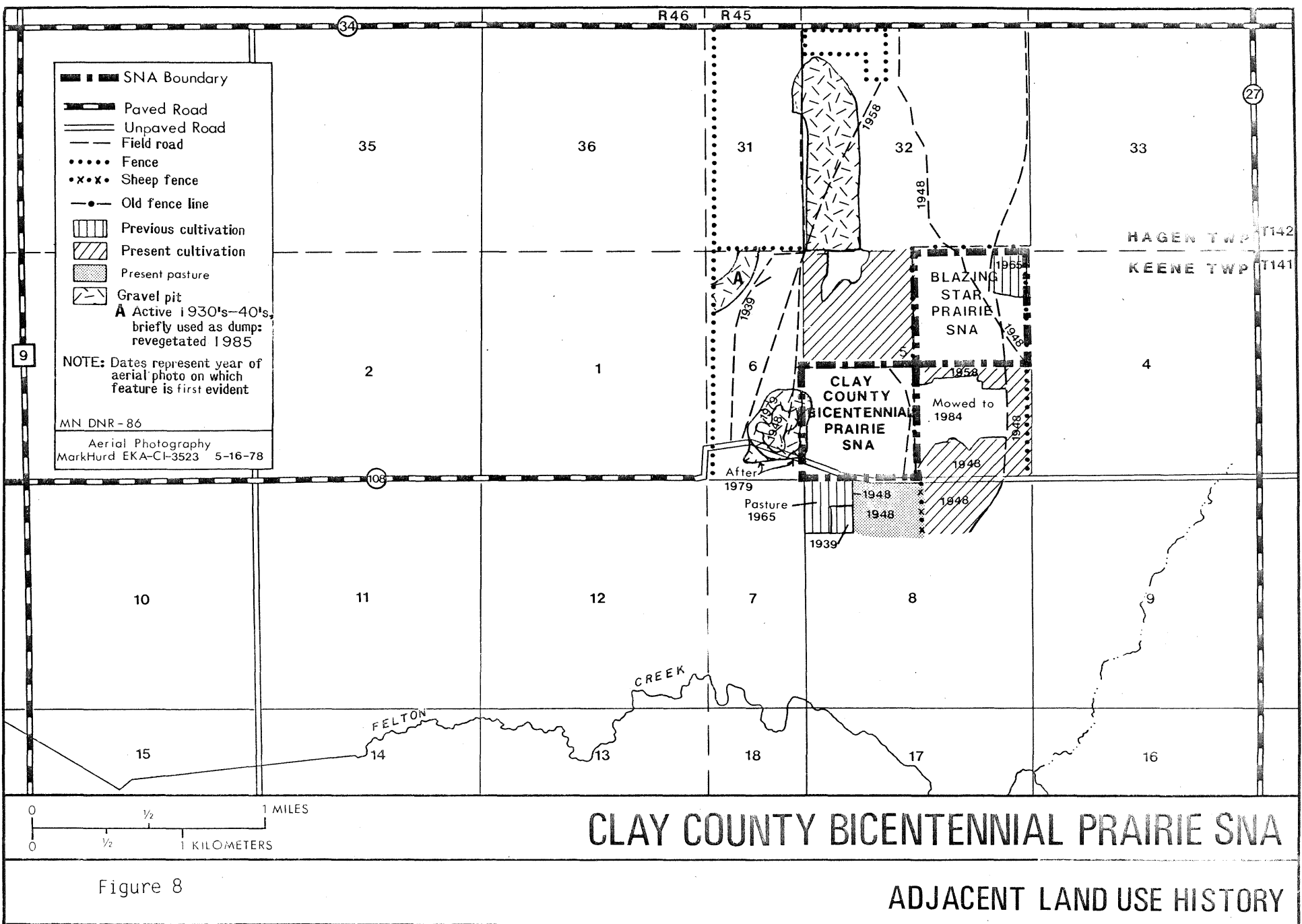


Figure 8

Prior to the early 1940's, the entire Bicentennial Prairie was part of a larger pasture area which included Section (6) in Keene Township [abbreviated as Keene (6)] and Section (31) in Hagen Township. The area was "heavily" grazed by sheep and cattle similar to the current grazing condition of the B Bar B Ranch, according to a member of the family whose animals were pastured there. About 1943, Hagen (31) was fenced and continued to be used as pasture, while Keene (5) and (6) were no longer grazed and the practice of mowing for hay was established in these sections.

With the exception of the aspen covered areas the entire SNA was mowed on alternating years between 1943 and 1971. Prior to 1955 the native hay was cut and stacked loosely on the prairie until fall when it was removed. After 1955, the prairie hay was cut, raked into windrows, and baled at one time. Occasionally the hay would be left stacked on the prairie, depending on the market, but usually it was moved by fall.

The exact hay yield from the Bicentennial Prairie was not documented, but a yield of 1 to 1 1/2 tons per acre was common for native prairie hay in the surrounding area. During a 1979 site visit, an old haystack was found in the north portion of the tract (Figure 1). The stack was covered by Canada thistles.

Land Use History - Roads and Structures

Several abandoned field roads, as well as currently used field roads cross the Bicentennial Prairie (Figure 7). The field roads which run through the area have been in existence for varying lengths of time. The most developed southern road leads directly to the county gravel pit in the S 1/2 of Keene (6) and presumably was utilized by trucks hauling gravel. Presently gravel hauling over the prairie no longer occurs, but

visitors to the site drive on the roads and adjacent farmers continue to use the field roads as cartways to move their equipment. The farmers are entitled to use the roads in this manner by the terms of a 1976 conservation easement between Clay County and the DNR. There is an abandoned road to the south of the old gravel hauling road which is now rutted and covered mostly by brome grass (Figure 7). In wetter areas of the site, the field roads are causing increasing disturbance to prairie vegetation. When roads become too wet to be passable, vehicles often drive off the roads and onto the prairie.

Except for Indian teepees, there have not been any buildings or structures constructed on the prairie. Semi-permanent bee cases have been placed on the prairie at two known locations. In 1954, approximately 48 domestic bee cases were placed at the east edge of the eastern most aspen clone, and they remained in that location until about 1979. Currently, about 30 privately-owned active bee cases are located in the southwest corner of the tract (Figure 7).

Land Use History - Fires

Other than the non-specific statements cited in historical texts regarding "destructive prairie fires" which frequently burned in the county, the fire history for Bicentennial Prairie prior to the 1930's is not available. In the period since the 1930's, fires were generally absent from the prairie landscape near Bicentennial Prairie. The effects of a fire which burned most of Bicentennial Prairie, the remaining prairie of SE 1/4 Keene (5), and the N 1/2 of Keene (6) is evident on the 1948 aerial photo (Figure 7). There are no records of fires occurring in the area between 1940 and 1983.

Prescribed burns were conducted by The Nature Conservancy burn crew at Bicentennial Prairie during both 1984 and 1985 (Figure 7). The first took place on May 3, 1984, when the western 80 acres of the prairie were burned. The conditions present during the burn were described as:

air temperature of 60 degrees; relative humidity of 24 percent;
north to northwest wind at 3-5 mph; the time of the burn
7:00 p.m. - 9:30 p.m.

The second prescribed burn was conducted on October 10, 1985. During this burn 50 acres in the northern portion of the prairie were burned under the following conditions:

air temperature of 50 degrees; northwest wind 10-12 mph
with gusts to 17 mph; relative humidity of 50%; time of
burn 2:27 p.m. - 3:25 p.m.

Almost all litter was removed and the burn coverage was complete with the exception of the core of the western aspen clone. The suckers around most of the west clone were burned and the eastern-most clone in the burned area (Figure 7) burned through.

Adjacent Land Uses

Bicentennial Prairie is surrounded by a variety of land uses which include cattle grazing, cultivation, gravel extraction, native hayland, and management of the Blazing Star State Scientific and Natural Area (Figure 9).

Immediately to the north of Bicentennial Prairie is a 160 acre field which was first broken between 1939 and 1948. The cultivated field is owned by the Hanson Brothers (Figure 10). Northwest of but not adjacent to the SNA lies the Felton State Wildlife Management Area.

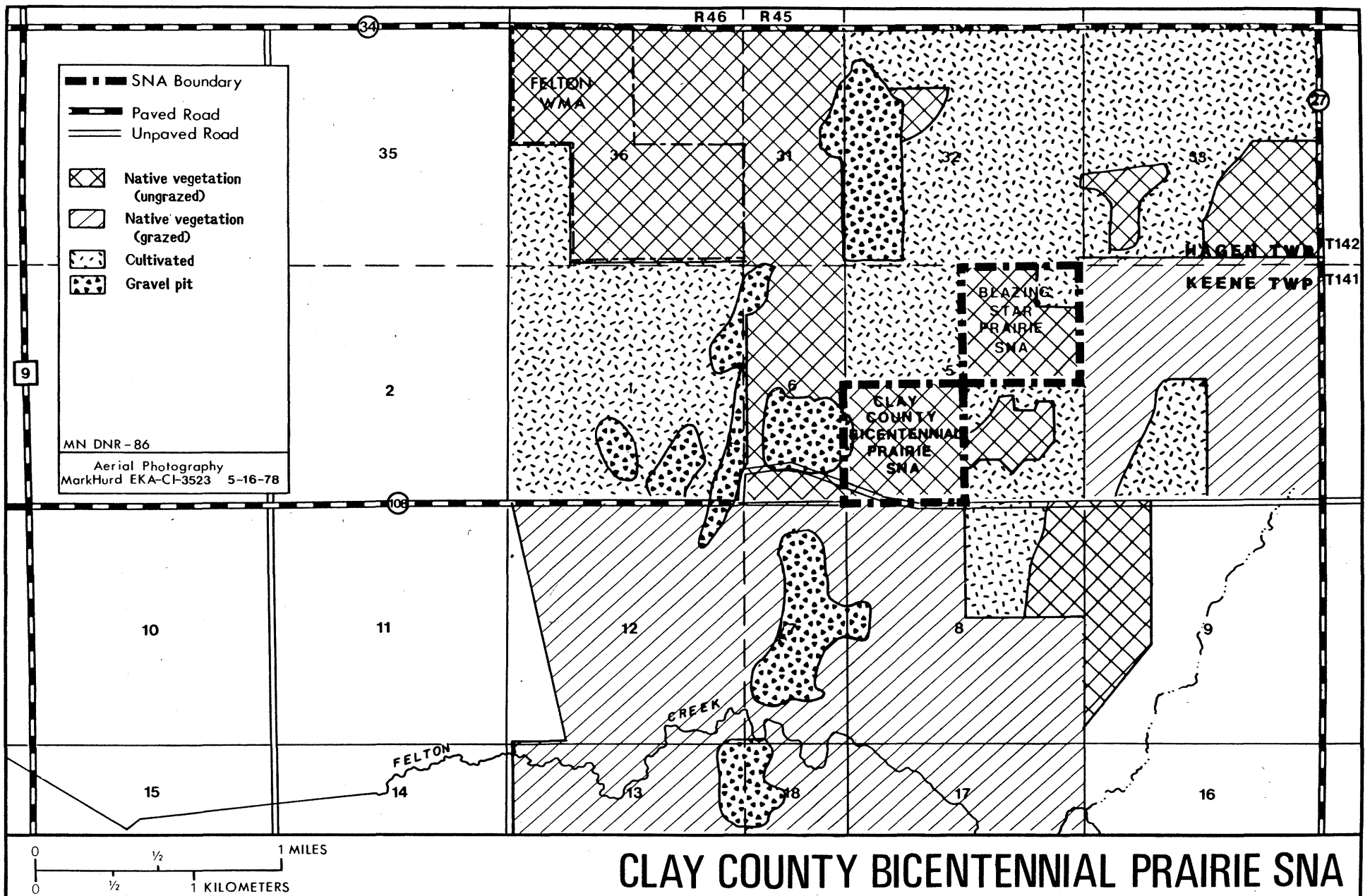


Figure 9

CURRENT LAND USE

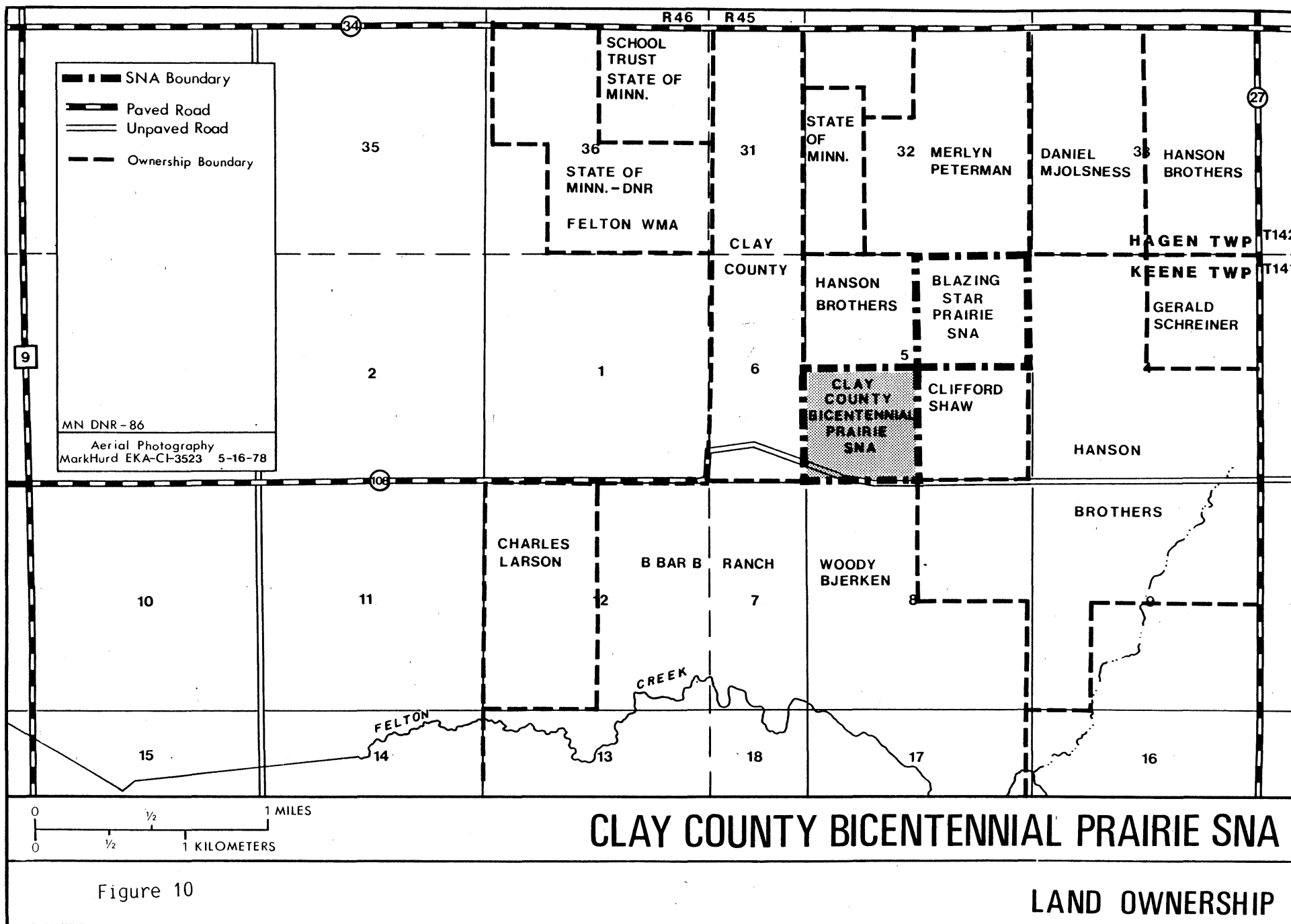


Figure 10

The lands between Felton WMA and Bicentennial Prairie were acquired by Clay County in the mid 1930's, as tax forfeit property. They are currently held in trust by the State for the County, which has been granted gravel mining rights on Keene (6), Hagen (31) and the Bicentennial Prairie. Presently, the county gravel pit is located in the southern half of Keene (6), and supplies the northern half of Clay County with gravel for county roads (Braker, 1985). This gravel pit has crossed the section line into the Bicentennial Prairie tract by about 200 feet. Gravel disturbance has also occurred in the north half of Hagen (31), but presently no mining is occurring there. Numerous gravel test pits are located throughout the southern half of Hagen (31). They are generally 5 to 10 feet deep, 10 feet wide, and 20 feet long.

Both Hagen (31) and Keene (6) were subjected to sheep and cattle grazing in the 1930's and early 1940's. Pasturing on Hagen (31) continued until the late 1950's when it was added to the Keene (6) area and mowed for native hay. Hagen (31) was last mowed in 1971, while portions of Keene (6) were mowed in 1984 and 1985.

The B Bar B Ranch is adjacent to the southern boundary of Bicentennial Prairie (Figure 10). It is approximately five square miles in size and contains more than 2000 acres of unplowed grassland. The ranch has been owned by the Bjerken family since 1946 and has been grazed by sheep and cattle since that time. Prior to the Bjerken ownership, the land was used primarily as a native hay source, although some grazing and cultivation took place as well. (NOTE: Further descriptions of the B Bar B Ranch land use history are found in Braker, 1985).

Adjoining Bicentennial Prairie on the east side is a parcel which contains cultivated areas as well as 55 acres of native prairie (Figure 3). The tract is owned by Clifford Shaw who wishes to keep this area as prairie and has applied for prairie tax credit. The prairie was hayed until about 1978, except in wet years when it was not possible to hay the area. The owner believes the site has not been grazed. (NOTE: The Braker 1985 report on the Felton Prairie has additional information regarding the Shaw property).

Vegetation History

The present vegetation of Bicentennial Prairie SNA is the result of a long period of prairie ecosystem development prior to settlement and also human modifications in post settlement times. In order to realize the magnitude of the human impact, it is important to understand the vegetation as it existed prior to settlement.

One of the primary tools for reconstructing the State's vegetation prior to settlement are the original General Land Office survey records. Those records constitute the field notes of the surveyors who originally surveyed Minnesota in the mid 1800's.

As each township was surveyed, the surveyors walked along the section lines marking the mile and half mile intervals. In the treeless prairie townships this was done by digging pits and creating a mound of soil. In addition to these marks the surveyors also recorded the location of uplands, swamps, prairies, marshes, groves, and windfalls, as well as all streams, rivers, lakes and roads.

Transcription of the survey notes has been carried one step further by Marschner (1930), who used the records to develop comprehensive maps of the state's original vegetation. Using the General Land Office

survey notes and the Marschner map, a general description of the presettlement vegetation can be formed.

According to Marschner's Original Vegetation Map of Minnesota (1930) the majority of Clay County was covered by prairie interspersed with areas of wet prairies, marshes, sloughs, oak openings, and oak barrens. In the vicinity of Bicentennial Prairie, survey records of 1871 indicate the existence of "rolling prairie with 2nd and 3rd rate soils".

Because the land use history during the period between settlement and the 1930's is unknown, we can only speculate as to vegetation changes during that period. Presumably, the rolling prairie areas were treeless at the time of settlement with the exception of scattered bur oaks. But following settlement, prairie fires, which once commonly burned the area, became less frequent and eventually allowed woody species to establish themselves on the prairie landscape. On the Bicentennial Prairie several aspen clones have established, but only one was present prior to the 1930's (as indicated on early aerial photos). Following the termination of mowing in 1971, the existing aspen clones started to expand, and new clones have become established in the southwest corner of the SNA.

Lower than expected forb densities may be attributed to the past grazing activity on the prairie (Dana, 1985). A qualitative change in the floral composition in portions of Bicentennial Prairie between 1979 and 1985 was reported by Valentine (1985). The major vegetation change was a large increase of Canada bluegrass (Poa compressa) and an associated decrease in little bluestem (Andropogon scoparius) and some other native grasses.

Today the Bicentennial Prairie retains much of its presettlement "rolling prairie" characteristic despite the land use activities of the past.

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Braker, Nancy (Compiler), Felton Prairie. Report submitted to The Nature Conservancy and the Department of Natural Resources, Natural Heritage Program.

Aerial Photos

1939	7-10-39	BXR-6-23,21	ASCS
1948	6-30-48	BXR-1E-136,135,134	ASCS
1958	7-18-58	BXR-1V-134,135	ASCS
1965	8-10-65	BXR-3FF-12	ASCS
1972	10-7-72	A-40 27027 272-100	
1978	5-16-78	EKA-C1-3522,3523	Mark Hurd
1979	6-27-79	---	
1979	6-27-79	---	Color IR

Table 8. *Cover and sociability in releve plot #3 in 1979 and 1985, and in an unnumbered releve plot in 1986. Both plots are 100 m x 100 m and are in the west portion of Bicentennial Prairie. Both plots were prescribe burned in spring 1984, and the unnumbered plot was also burned in the fall of 1985.

Common Name	Scientific Name	Cover/Sociability		
		Plot #3	Unnumbered Plot	
		7/4/79 & 8/22/79	7/10/85	8/20/86
<u>GRASSES</u>				
little bluestem	Schizachyrium scoparium	4/3	2/4	3/1
bluegrass	Poa sp.		5/4	1/1
blue grama	Bouteloua gracilis			+/1
side oats grama	Bouteloua curtipendula		r/1	
porcupine grass	Stipa spartea	2/1	4/4	
needle & thread grass	Stipa comata			1/1
plains mulhy grass	Muhlenbergia cuspidata	+/1	1/2	+/1
a wheat grass	Agropyron sp.		3/3	1/1
june grass	Keoheria macrantha		3/3	+/1
wilcox panic grass	Panicum wilcoxiana			1/1
prairie dropseed	Sporobolus heterolepis			2/1
threadleaf sedge	Carex fillifolia			1/1
sedge	Carex sp.			+/1
TOTAL GRASS SPECIES		3	7	11
<u>FORBS</u>				
northern bedstraw	Galium boreale	1/1		2/2
daisy fleabane	Erigeron strigosus	2/1	+/1	
dotted blazing star	Liatris punctata	+/1		1/1
pasque flower	Anemone patens	1/1	1/2	1/2
prairie wood-sorrel	Oxalis violaceae	2/1		
prairie turnip	Psoralea esculenta	+/1	+/1	+/1
harebell	Campanula rotundifolia	+/1	+/1	
downy painted cup	Castilleja sessiliflora	1/1		
prairie plum	Astragalus crassicaupus	1/1		
lead plant	Amorpha canescens			1/1
pussy toes	Antennaria neglecta	2/1	1/4	1/2
gray-haded coneflower	Ratibida columnifera	1/1		
serrate-leaved	Oenothera serrulata	4/1	+/1	
evening primrose				
heath aster	Aster ericoides	1/1		1/1
prairie sunflower	Helianthus laetiflorus		+/1	
milkwort	Polygala verticillata			1/1
purple prairie clover	Petalostemum purpureum			+/1
a flax species	Linum rigidum			+/1
thimble weed	Anemone cylindrica			+/1
prairie onion	Allium stellatum			+/1
a ragwort species	Senecio platensis			+/1
scarlet gaura	Gaura coccinea			+/1
hoary puccoon	Lithospermum canescens			+/1

Table 8. Cont.

Common Name	Scientific Name	Cover/Sociability		
		Plot #3	Unnumbered Plot	
		7/4/79 & 8/22/79	7/10/85	8/20/86
purple coneflower	<i>Echinacea angustifolium</i>			+/1
green milkweed	<i>Asclepias viridiflora</i>			r/1
star toadflax	<i>Comandra umbellata</i>			+/1
ground cherry	<i>Physalis virginiana</i>			+/1
alum root	<i>Heuchera richardsonii</i>			r/1
a penstemon species	<i>Penstemon</i> sp.			r/1
starry chickweed	<i>Cerastium arvense</i>			+/1
white sweet clover	<i>Mellilotus alba</i>			+/1
TOTAL FORB SPECIES		13	7	23
TOTAL OF ALL SPECIES		16	14	44

*Symbols used for cover (indicating how abundant the species is) and sociability (indicating how dispersed the species is) are as follows:

Cover-abundance

- r single occurrence
- + occasional, cover < 5%
- 1 plentiful, cover < 5%
- 2 very numerous, cover 5-25%
- 3 any number of individuals, cover 25-50%
- 4 any number of individuals, cover 50-75%
- 5 any number of individuals, cover 75-100%

Sociability

- 1 growing singly
- 2 grouped, few individuals
- 3 large group, many individuals
- 4 small colonies, extensive patches, broken mat
- 5 extensive mat

