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FELTON PRAIRIE

Submitted to The Nature Conservancy and The Department of Natural Resources, Natural Heritage Program.

November 1985

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## FELTON PRAIRIE REPORT

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## FELTON PRAIRIE

### I. Introduction

Northwestern Minnesota was originally covered by a vast expanse of rolling prairie. Located in the lakebed of Glacial Lake Agassiz, and upon the beach ridges left as this lake retreated, prairie in this part of the state was a complex mosaic of different prairie types. The dry prairie found on the tops of the beach ridges was typical of the type of grassland found further to the west, while the mesic and wet prairies found in the swales between these ridges are more typical of prairie found at the eastern edge of the prairie-forest border.

As settlers moved into the area, and agriculture became established, the prairie gave way to fields of sunflowers, beets, soybeans, and small grains. Felton, a small farming community 25 miles northeast of Moorhead, was once known as the "hay king of Minnesota". The town is now surrounded by cultivated fields. Only small remnants of the original vegetation may be found. One of the largest remaining tracts of original vegetation left is located 2.5 miles southeast of Felton.

For many years this area has been known as "Felton Prairie", and has been utilized by bird watchers, butterfly collectors, and local educators as an example of a natural prairie. Until 1974 this area contained nearly twelve square miles of unbroken prairie. Since this time much of the area has been cultivated leaving approximately 6 square miles intact.

The area currently known as "Felton Prairie" is a mosaic of grazed, mowed, and protected areas, with some cultivated fields and gravel pits interspersed (figure 1). Much of the area is privately owned, including a 160 acre tract owned by The Nature Conservancy. Several partial

sections and an additional 160 acre tract are owned by Clay County. The 160 acre tract has been designated as Clay County Bicentennial Prairie, and since 1976 has had a semi-protected status. In 1976 the county board of commissioners agreed to protect this tract for a 10 year period. No formal agreement was reached at that time, but the area has been maintained as prairie, and has been managed by the Department of Natural Resources, with the assistance of The Nature Conservancy. Recently the county agreed to enter into a formal agreement and plan to sign a ten year conservation easement, leasing the area to the DNR. The remainder of the area is under private ownership, a number of owners being involved (figure 2).

As previously mentioned, the Felton Prairie has long been known as a choice location for observing prairie dependent species, particularly birds and butterflies. A number of rare and state endangered species are known to occur there. Rare birds observed at Felton Prairie include Sprague's pipit, Baird's sparrow, chestnut-collared longspur (all state endangered), loggerhead shrike (state threatened), greater prairie chicken, upland sandpiper and marbled godwit (all state special concern). Rare butterflies include Assiniboia skipper, Uhler's arctic (both state endangered), Dakota skipper (state threatened), and Poweshiek skipper (state special concern).

Several rare prairie plants have also been located at the Felton Prairie, including the white-fringed prairie orchid (state endangered) and small white lady's slipper orchid (state special concern).

Because of this high incidence of rare species found in the area, the Felton Prairie has been in need of more extensive study and further protection. The current work was undertaken to bring together all past information on the area, to determine the current status of the rare

species and develop a protection and management plan based on these findings. The 1985 study included: an evaluation of plant communities; a search for rare plants; a detailed census of the chesnut-collared longspur population with attention also paid to other rare birds in the area; and an inventory of rare butterflies. Other animals of interest, including mammals, were also noted.

## II. a. Vegetation of Felton Prairie

Although biologists have recognized the special nature of the Felton Prairie for several decades, there is little detailed information about its vegetation until a 1977 survey of the B Bar B Ranch by Dr. Richard Pemble, Moorhead State University, and the Department of Natural Resources 1979 Resource Inventories of the Bicentennial and Blazing Star Prairies.

Marschners map of the original vegetation of Minnesota shows the area simply as "prairie"; he did not attempt to make any finer distinctions within this broad community type, probably because the Federal land surveyors' notes from which he worked do not contain enough information. None of the collectors who worked the Red River Valley area in the past seems to have explored this prairie, as there are no collections by them from here despite the occurrence of several species that caught their attention elsewhere. This may have been because so much of this type of prairie still existed when they worked that they simply chose easily accessible sites, close to towns where trains stopped or close to major roads.

Only with the recent dramatic increase in the rate of destruction of native prairie, and with the availability of good documentation of the current status of animals, plants and plant communities in Minnesota has the special importance of the Felton Prairie become clear enough to prompt more intensive investigation of its plants and plant communities.

Only a couple of rather general comments about the vegetation have been found from before the late 1970's work. J. Roger Bray, in a 1962 note, described it as "a more xeric, midgrass community, a type which is becoming very rare in the Itasca portion of the state". According to him, at this time "the vegetation (was) undisturbed by grazing in

excess, and there (were) few non-native plant species present". He also noted that western species not found to the east occurred here, but he did not specify them. An unsuccessful effort was begun in 1967 to create a Scientific and Natural Area (SNA) in a portion of the Felton Prairie which would have included the Felton Wildlife Management Area and state trust land in Felton 36, the Clay County lands Keene 6 and Hagen 31, and state trust land in W 1/4 Hagen 33. In the nomination for designation this was described as "the finest unplowed prairie yet found in Minnesota" with "an unusually wide range of soil moisture conditions and grassland types, from the dry gravel ridges in the eastern portion to the wet marshland to the west".

A more detailed description of the vegetation of the Clay County Bicentennial Prairie tract is contained in a typescript without author or date (DNR Heritage files), although it was most likely prepared as part of the effort that led to the dedication of this tract in 1976. The prairie in this tract was described as mostly dry mesic or dry, dominated by little bluestem (Schizachyrium scoparium), porcupine grass (Stipa spartea), and needle and thread grass (S. comata), with Kentucky bluegrass (Poa pratensis) common in most places. Other species seen were listed. A small area of wet prairie in the southeast part, bordered by a mesic prairie zone of big bluestem (Andropogon gerardi) and indian grass (Sorghastrum nutans) was briefly described. The student interns inventorying this tract in 1979 for the SNA program reported similar impressions in slightly more quantitative form. They classified 85% of the area as a "bluestem prairie", dominated by little bluestem, with porcupine grass approaching co-dominance. They did not note the presence of exotic bluegrasses. They called the wet prairie,

dominated by prairie cordgrass (Spartina pectinata), a "Spartina meadow". they did not recognize any type corresponding to the mesic prairie of the previous, anonymous, report.

These interns also conducted an inventory of the Nature Conservancy's Blazing Star Prairie in 1979. They classified about 35% of this tract as "Andropogon/Stipa/Bouteloua Prairie", dominated by little bluestem, porcupine grass, and side oats grama (Bouteloua curtipendula). "Sorghastrum/Andropogon Prairie", dominated by indian grass and big bluestem, with mat muhly (Muhlenbergia richardsonis) very common, covered another 44%. "Low prairie", scantily described (Switchgrass, Panicum vergatum, and tall meadow rue, Thalictrum dasycarpum, are the only species mentioned), was given 4%. An old field, abandoned in 1970, and dominated by exotic grass, took up the remaining 17% of the area.

In 1977 Dr. Pemble evaluated the B Bar B Ranch for the Nature Conservancy and submitted a report describing the vegetation and assessing the impact upon it of many years of continuous grazing by domestic livestock (sheep and cattle). He estimated that in 1977 at least 2000 acres of the ranch remained unbroken and undisturbed by gravel mining. Of this, he judged 40% to be dry and dry mesic prairie, with blue grama (Bouteloua gracilis) and fringed sage (Artemisia frigida) the dominants. He provided a long list of other species observed in this prairie type, but with no indication of their abundances. He found mesic sites to be dominated by big and little bluestem and indian grass, and "wet prairie" by indian grass, big bluestem, switchgrass, and prairie cordgrass. The dominants of the wettest sites he reported to be big bluestem, switchgrass, bluejoint grass (Calamagrostis canadensis) and northern reedgrass (C. inexplansa -



his "C. purpurascens" is certainly a slip for this species), with cattails (Typha spp.) in places. He noted that the exotics redtop (Agrostis stolonifera) and Canada thistle (Cirsium arvense) were common in the "wetter sites which have been grazed". For each of these vegetation types he listed other species he found present. He reported the woods along Felton Creek to be structured by topographic position, with American elm (Ulmus americana) and green ash (Fraxinus pennsylvanica) dominating lower slopes near the stream, box elder (Acer negundo), basswood (Tilia americana), and green ash further upslope, and the ecotonal zone along upper slopes occupied mostly by scattered bur oak (Quercus macrocarpa) in a prairie understory.

Pemble judged grazing to have most strongly affected the drier sites, shifting an originally diverse midgrass community as found on similar sites in Bicentennial Prairie to the blue grama dominated one he observed. He also noted a "characteristic reduction" in the diversity of forbs and particularly the greatly increased abundance of fringed sage as compared with Bicentennial Prairie. In contrast he felt that much of the mesic to wet prairie vegetation was "in a condition similar to what we might expect without grazing, or with mowing", either because it is "better able to cope with grazing pressure than the drier types", or because livestock tend to favor drier sites when these are in sufficient supply. In his opinion, these phases of the vegetation were close to their predisturbance "potential" or would recover quickly if appropriately managed. The woods along the creek he judged to be "at its potential for the overstory" although the understory was badly degraded.

The only rare plant records from the Felton Prairie prior to this

project were several calcareous fen species recently collected in the Felton WMA, and a collection of the State Endangered prairie-white fringed orchid (Platentera leucophaea) made during the 1979 inventory of Bicentennial Prairie. Red three awn grass (Aristida longiseta), a State special concern species, was included in the anonymous ca. 1979 description of the vegetation of this tract, but no vouchering collection exists. The only documented record of this grass from northwestern Minnesota is a 1961 collection from a beach ridge near Ulen in Clay County.

The present study extends to the other remaining tracts in the Felton Prairie roughly the same level of analysis previously available for Blazing Star, Bicentennial and the Ranch, as a basis for a comprehensive conception of the whole. Blazing Star and Bicentennial Prairies were superficially reexamined, and the B Bar B Ranch was resurveyed somewhat more thoroughly. Some points of disagreement with the previous reports emerged, but because the level of all this work is impressionistic no definitive resolution is possible. With one possible exception the differences are minor. Inferences from the current condition of surviving tracts to the pre-settlement, pre-disturbance vegetation of the Felton Prairie involve further uncertainty because details of land use history prior to 1946 for the ranch, and 1935 for county lands are not known. Despite these difficulties, reconstruction of at least the most important characteristics can be done with reasonable confidence (see figure 3, plant communities of Felton Prairie). Soil types in the area contribute to the plant community diversity. These are mapped in figure 4, and further discussed within each site description.

The crests of the more prominent beach ridges, and the upper slopes of the scarp-like shoreline in the south half of the ranch had a distinctive flora and seem best classified in the Minnesota Natural Heritage Program's Natural Community classification as gravel prairie. Dispersed mid-height and low bunch grasses and sedges, little bluestem, plains muhly (Muhlenbergia cuspidata), needle and thread grass, Wilcox's panic grass (Panicum wilcoxianum), prairie Junegrass (Koeleria macrantha), prairie dropseed, and threadleaf sedge (Carex filifolia) is frequent, and three western grasses uncommon to rare in Minnesota, Hooker's spike oats (Helictotrichon hookeri), red three awn, and plains reed grass (Calamagrostis montanensis) are occasional to scarce. Fringed sage seems to be restricted to this community in the absence of grazing.

The best remaining examples of this community occur in the county tracts, Hagen 31, Keene 6, and Bicentennial. The crest of the low ridge in the south part of Blazing Star Prairie might also be classified here. Most of this community in the B Bar B has been altered by grazing as described by Pemble, although the steeper bluff-like scarp is relatively undegraded. An extraordinary small sample of this community occurs in the SE corner SW 1/4 Keene 17, where forb abundances are unlike anything seen elsewhere in the Felton Prairie. According to the owner, cattle are allowed on this, which is in a large area otherwise converted to hay, only after the growing season is over.

Most of the remainder of the Felton Prairie would have belonged in the Heritage Program's Blacksoil Prairie NW natural community type, as this is drawn broadly to include dry mesic to wet mesic moisture regimes with their intergrading but distinguishable plant assemblages. The undisturbed dry mesic phase here was dominated by porcupine grass,

little bluestem and perhaps side oats grama. Most of the grasses found in gravel prairie also occurred here as lesser associates, especially prairie dropseed (Sporobolus heterolepis), though blue grama and needle and thread grass were scarce to absent. The mesic phase of this community was dominated by tall-grasses, big bluestem, indian grass and switchgrass, with porcupine grass, side oats grama, little bluestem, and prairie dropseed as important secondary components. Only the tallgrasses and prairie dropseed overlapped into the wet mesic phase, whose other major components included prairie cordgrass, northern reedgrass, and several sedges (Carex spp.) Mat muhly was a diminutive but common member.

The best surviving dry mesic prairie are in the Clay County lands, including Bicentennial, and to a lesser extent, in Blazing Star. These same tracts also contain good quality examples of the mesic phase, especially Blazing Star and Hagen 31. Several very nice examples of wet mesic prairie are found in the NE portion of the Felton Prairie, the Shaw tract in SE 1/4 Keene 5, the Mjolsness tract in SW 1/4 Hagen 33, the Hanson brothers tract in SE 1/4 Hagen 33, and a small part of the Hanson brothers tract in Keene 9. All but the Mjolsness tract are at least occasionally mowed for hay and all are floristically richer than anything seen elsewhere in the Felton Prairie. This may be because they have been subjected to less grazing by livestock, but edaphic factors are another possibility. The quality of the wet mesic prairie below the beach ridge in Hagen 31 is probably good, but was not investigated.

Overall, the condition of this community within the B Bar B Ranch and the adjoining Larson pasture in W 1/2 Flowing 12 seems to be just fair, with only the wet mesic phase in reasonably good shape. Pemble's

opinion that the livestock avoid wetter habitats if given adequate alternatives seems true, but not his inclusion of mesic areas. Just the opposite appeared to be the case during this survey. Almost all mesic habitat looked at seemed to be a closely cropped sod of mostly exotic grasses (especially Kentucky bluegrass). Two possible explanations for this discrepancy are that greater deterioration has occurred in the eight years since he made his observations, or that the ranch was less heavily utilized at that time than during the 1985 season, allowing the taller native species to become more obvious. Dry mesic sites generally looked better, but they have been altered in much the same fashion as gravel prairie, being dominated by blue grama, with a strong bluegrass component and great amounts of fringed sage and yarrow (Achillea millefolium). Probably the only way to get an objective determination of this vegetation is to establish and maintain exclosures for several years.

A small proportion of the interbeach portion of the Felton Prairie belonged to the Wet Blacksoil Prairie NW natural community type. This was more extensive in the northeastern part where interbeach distances increase. Wet prairie was much more extensive west of the beach ridges in the more level lake plain, mostly beyond what had traditionally been regarded as the Felton Prairie. The vegetation of this community is dominated by sedges (mainly Carex spp.) and prairie cordgrass, with bluejoint and northern reedgrass as major associates. Rushes (Juncas spp.) are also fairly important.

Small but nice examples are found in Blazing Star, Bicentennial, and the Shaw tract in SW 1/4 Keene 5, and a good quality, somewhat larger area in the Hanson brothers SE 1/4 Hagen 33 tract. Substantial examples occur below the beach ridge in Hagen 31 and Felton 36, but

these were not investigated. There is some good wet prairie within the ranch, in SE 1/4 Keene 8, and also in the Larson pasture, W 1/2 Flowing 12. The condition of this community in the W 1/2 of Flowing 13, part of the B Bar B Ranch, was not checked.

Another significant natural community type, Calcareous Fen, occurs in the Felton Prairie. An occurrence, known prior to this inventory, is in the SE corner of the Felton WMA. Another one was discovered within the ranch, in the E 1/2 of Flowing 133. This is a large, boggy, wet prairie-fen complex which is in good condition owing to its general avoidance by livestock. Several rare plants typical of this community were found here.

The Felton Creek valley is not assignable to any existing natural community type in the Heritage scheme, and it is not possible on the basis of present information to reconstruct with any confidence what the pre-disturbance character of the vegetation was. The zonation of trees according to topographic position described by Pemble was less evident at the few places checked in this survey. Here, upper slopes support fair numbers of elm, ash, and basswood, as well as bur oak, with aspen (Populus tremuloides), balsam poplar (P. balsamifera) and willow (Salix spp.) invading. Undoubtedly there had been considerable tree canopy development, especially on the upper slopes, since prairie fire disappeared from the system. Long-lived prairie plants (e. g. leadplant, Amorpha canescens) seen growing on now well-shaded slopes attest to this change.

The number of rare plants known from the Felton Prairie has been considerably increase during this inventory, and the discovery of the second calcareous fen expands the amount of habitat known for several

plants that had previously been collected here. Details of rare plants found are mapped in figure 5, and further discussed in the site descriptions.

From the natural community perspective, the most distinctive feature of the Felton Prairie is the high proportion of this gently rolling landscape that is dry and dry mesic prairie. Because of pre-existing topography, all the former beachlines of Glacial Lake Agassiz are closer together than is typical (2 to 3 miles across the whole complex), though they begin to fan out in the northeastern part where the more usual broad expanses of poorly drained terrain between beach ridges can be found. Thus, the Felton Prairie provides a large habitat more similar to mixed grass prairie in the Dakotas than to typical Minnesota tallgrass prairie; the basis no doubt for the presence here of so many western faunal elements. Although the best quality examples remaining have been subjected to at least some intensive grazing by domestic livestock, the damage has not been serious. The major problem is the level of bluegrass infestation. The more serious degradation of the vegetation in the B Bar B Ranch is balanced by the relatively enormous area of prime dry and dry mesic habitat it contains, plus the great diversity of community types. All but possibly the mesic phase of the Mesic Blacksoil Prairie community type are still similar enough to their undisturbed original condition to be identifiable as native prairie communities, and appropriate management could effect considerable recovery rather quickly.

## Felton Prairie - Ornithological Records

The Felton Prairie area has long been recognized as one of the premiere birding spots in Minnesota. In the last 20-30 years it has been the only site in the state where visitors could almost be assured of spotting chestnut-collared longspurs (Calcarius ornatus), Sprague's pipits (Anthus spragueii) and Baird's sparrows (Ammodramus bairdii). All three species are summer residents of the north central prairies of the United States and the prairie provinces of Canada. Early ornithological accounts from the late 1800s and early 1900s suggest they once occurred throughout the grasslands of western Minnesota and, in particular, along the Glacial Lake Agassiz beach ridges of the northwestern quarter of the state. But, as the prairie grasslands gave way to the plow, suitable habitat gradually was converted into expansive fields of corn and soybeans.

As a result of this habitat conversion, breeding populations of longspurs, pipits and Baird's sparrows declined dramatically to the point that by the early 1960s Felton Prairie was the only likely spot to find any one of the three species. Unfortunately, the pace of agricultural development has not lessened in recent years and the Felton Prairie complex continues to diminish in size. In the last few years only the chestnut-collared longspur can still be seen with regularity. The Sprague's pipit and Baird's sparrow, both of which are considerably less conspicuous than the longspur, have not been reported consistently. When they are observed, a maximum of only one or two birds are either seen or heard.

Because of their dramatic decline in Minnesota and their limited range throughout North America, all three species were recently added to Minnesota's



official list of state endangered, threatened and special concern species. All three are classified as State Endangered. More details regarding the occurrence of each species in the Felton area is provided in the species accounts below.

Although the Felton Prairie is best known for the presence of longspurs, pipits and Baird's sparrows, it also provides habitat for many other prairie species of interest. At least one pair of loggerhead shrikes (Lanius ludovicianus), a State Threatened species, has occurred regularly in the Felton vicinity in recent years. Dead frogs and mice, impaled along barbed wire fences enclosing the numerous pastures, are often direct evidence of the shrikes presence. Several state listed Special Concern species also are regularly seen in the area. In the mid to late seventies at least six greater prairie chicken (Tympanuchus cupido) booming grounds had been identified within the Felton complex (Figure 6). Much of the recent land conversion, however, has probably had a negative impact on these birds. Marbled godwits (Limosa fedoa) and upland sandpipers (Bartramia longicauda) are also regular and have been documented nesting on the prairie, the upland sandpiper being the more common of the two species. (see Figure 7 and Appendix D for details regarding 1985 observations of these species.) Kim Eckert, in his recent edition of A Birder's Guide to Minnesota (1983) lists several other grassland species that nest on the Felton Prairie and on adjacent pastures and meadows: Swainson's hawk (Buteo swainsoni), gray partridge (Pardix perdix), alder flycatcher (Empidonax alnorum), willow flycatcher (Empidonax traillii), western kingbird (Tyrannus verticalis), sedge wren (Cistothorus platensis), clay-colored sparrow (Spizella pallida), grasshopper sparrow (Ammodramus saviannarum) and LeConte's sparrow (Ammodramus lecontei). Eckert further points out that visitors to the

area should keep their eyes open for such rare, irregular species as prairie falcons (Falco mexicanus), burrowing owls (Athene cunicularia), lark buntings, (Calamospiza melanocorys), Henslow's sparrows (Ammodramus henslowii) and black-billed magpies (Pica pica) - a pair nested on the prairie in 1973.

Finally, there is one unique problem associated with the majority of ornithological records from Felton Prairie, particularly those reported prior to the mid or late 1970s. Amateurs and professionals alike usually referred to the site simply as the Felton area, the prairie east of Felton, or the prairie 2-3 miles east of Felton. Unfortunately the records were rarely more specific in pinpointing the locality of the observation, thus making it difficult to document the relative significance of the different parcels (e.g., Blazing Star Prairie, Clay County Bicentennial Prairie and the B-B Ranch) to some of the less common prairie birds. In some instances, however, conversations with individuals who visited the area years ago has helped delineate more specific locality data.

All species records in the following accounts for which no reference is given were obtained from the species files of the Minnesota Ornithologists' Union (MOU). These records are also published in the Seasonal Reports of the MOU's publication, the Loon.

#### Sprague's Pipit (Anthus spragueii)

T. S. Roberts, author of the 1932 classic, The Birds of Minnesota, stated that Sprague's pipit was "a common summer resident in the Red River Valley from northern Wilkin County north to Kittson County, and east as far as there are

considerable tracts of prairie intermingled with scattered poplar groves." Documented breeding evidence, however, was scarce and was limited to one record each in Kittson, Marshall, Pennington and Clay counties. The most recent is the report from Clay County which is a 1962 nest record from a locality between the towns of Felton and Ulen - presumably the Felton Prairie complex.

Outside of Minnesota, the pipit ranges west into the Dakotas and eastern Montana and north into the southern half of the Canadian Prairie Provinces (Figure 8). Because of its limited distribution the species is considered a regional endemic.

Although nesting has not been documented at Felton since 1962, individual birds were observed and/or heard singing in the area consistently through the 1960s and early 1970s. When numbers were reported they were seldom higher than a small handful of birds. The largest count was a report of seven singing males heard in July 1974. Since 1980, singing males have been documented in 5 out of 6 years (1980, 1981, 1983, 1984 and 1985). Without exception, birders who visited the tract these years and who documented the species presence all reported seeing and/or hearing the bird (more often the latter) from the same locality - near the fence line and dirt access road separating Clay County Bicentennial Prairie from one of the northern pastures on the B-B Ranch (i.e., along the section line between sections 5 and 8, Keene township). The importance of this area relative to other areas on the prairie is unclear to the casual observer and deserves closer analysis.

In some years, however, such as 1975, 1977, 1979 and 1982, no pipits were reported from Felton. The absence of records may only reflect the fact that no

experienced observers visited the site those years. A small brown-streaked, sparrow-sized bird, Sprague's pipit can be rather inconspicuous in the prairie grasslands. It rarely alights atop any exposed perch, plunging instead down amongst the tall grasses. The species most conspicuous features are its white outer tail feathers, buffy streaked underparts and a long, spur-like hind claw. Behaviourally, its continuous tail wagging and spectacular aerial courtship flight and song are the primary identifying characteristics. Its song, given after flying straight up, high overhead, enchanted early ornithologists such as Audubon, Couls and Sector, who were among the first to describe it. J. A. Allen provided one of the best descriptions in 1873:

"Their notes resemble the syllables jingle, jingle, jingle, jingle, rapidly repeated, beginning loud and high and decreasing rapidly in strength and loudness, and are remarkable for their clear metallic ring, their song reminding one of the jingling sound of a light chain when slowly let fall into a coil."

To those unfamiliar with the species and its behaviour, trying to locate the vocalizer can be a frustrating experience, for rarely is it seen on the ground or flying other than short distances. Even early ornithologists, who at first were unfamiliar with the bird, had difficulty identifying the songster - including Audubon himself. Eckert (1983) also warns that the pipit can easily be confused with a juvenile horned lark or a grasshopper sparrow, one of whose songs it resembles. Perhaps, in part, this is why so little work has been done on the species.

Very little detailed work, for example, has been directed at delineating the pipit's habitat requirements. Stewart (1975) described the species habitat in North Dakota as "mixed grass prairie or uplands, particularly tracts that are ungrazed, lightly grazed or only occasionally mowed." Owens and Myres (1973) investigated the species response to mowing in Alberta and found that the pipit had "a definite preference for long-grass habitat, but appears able to reoccupy recently mown native fescue grassland as it increases in height and density during the season following mowing."

In the Felton Prairie area a significant portion of the remaining acreage is intensively grazed and likely is no longer suitable for Sprague's pipit. The total acreage in undisturbed prairie is quite small and may no longer be sufficient to support a breeding population. Observers to the area should become familiar with the pipit's identifying characteristics and make a point of keeping an eye out for it in May, June and July.

#### Baird's Sparrow (*Ammodramus bairdii*)

The Baird's sparrow is also regionally endemic to the northern Great Plains. Of the three rare songbirds that occur on the Felton Prairie, it has the most restricted distribution, stretching from southern Alberta, Saskatchewan and Manitoba into North Dakota, northern South Dakota and eastern Montana (Figure 9). Like the Sprague's pipit, the Baird's sparrow was formerly a more common summer resident throughout the upland prairie of the Glacial Lake Agassiz lakebed. T.S. Roberts (1932) reported it as occurring from the Canadian border south to northern Traverse county. The species was never documented from grassland habitat in the southwestern quarter of the state

despite extensive field work in the area. Records suggest that the sparrow was probably a regular breeding species in Minnesota up through the early 1900s, at least until about the mid 1930s. Nevertheless, positive evidence of nesting activity was only gathered on two occasions: in 1930, in western Pennington County and in 1937, near the town of Euclid in Polk County. Records became less regular after the 1930s and in the years between 1942 and 1954 Baird's sparrow was not reported anywhere in the state.

In the early 1960s, observations were once again being reported but the large majority originated from a single locality: the Felton Prairie in Clay County. Elsewhere, reports were few and widespread and it was soon apparent that the species had disappeared over wide areas of its former range. At Felton Prairie, however, the sparrow was reported rather consistently from the 1960s into the mid 1970s. On many occasions several birds were heard and/or observed on the same morning. A peak count of 20 birds in the summer of 1961, however, has never been repeated (five birds were actually collected and deposited at the Bell Museum this same year). And, despite the numerous reports, nesting activity has never been documented. Since the mid to late 1970s the species has been reported far less consistently from the Felton tract. Only one or two birds were reported in the late spring or summer of 1976, 1977, and 1978. Although there were no reports in 1979, two birds were again reported in 1980. In the past five summers, however, there have been no documented observations of Baird's sparrow from either Felton Prairie, or elsewhere in the state. One 1985 report of males singing in the NW 1/4 of Section 19, Keene Township awaits further documentation.

As was mentioned earlier, the difficulty with many of these historical records, even the more recent ones, is their lack of specificity regarding locality. Some, however, are known to have originated from the Blazing Star Prairie while others have been reported from Clay County Bicentennial Prairie or on private land east of these two tracts. Only three records provide this more detailed locality data. The five specimens that were collected in 1961 were all taken from an unplowed field on the S. J. Hansen farm. The locality was given as 5.6 miles east and 1.3 miles south of Felton in a large field on the west side of the road (MOU files, unpublished report). In 1961 the vegetation was described as "lush" and standing 12-16 inches in height; now, in 1985, it is a heavily overgrazed pasture. On May 30, 1977, birders Dick Ruhme and Bob Janssen observed one bird and heard two males singing on the Blazing Star tract (Janssen 1977). Three years later, in early July, 1980, Kim Eckert reported two birds near the section line between the SW 1/4 of Section 5 (Bicentennial Prairie) and the NW 1/4 of Section 8, Keene Township (Eckert 1980a).

Difficulty identifying Baird's sparrow in the field, even for experienced birders, compounds the problems of inconsistent reporting. A small brown sparrow, the species has no striking physical characteristics that allow it to be positively identified quickly. The pale brown feathers on its back and wings contrast with a lighter chest and belly beneath. Although a necklace of fine dark streaks across the breast can be prominent and used for identification on some birds, it may be lacking completely. The orange crown stripe which broadens out on the back of the head (and is most obvious when the bird is viewed from the back) is perhaps the best field mark. Identification is made more difficult, however, by the bird's tendency to run through the

grass when approached rather than to fly. Apart from this behavioural trait, and the subtle plumage, the male's territorial song is distinct. It begins with 3 or 4 short introductory notes and ends with a musical trill (i.e., not the buzzy quality of the grasshopper sparrow's trill).

Because of the difficulty identifying the species and its limited occurrence, virtually little work has been directed at delineating the life history and habitat requirements of Baird's sparrow. The species is generally overlooked, the only recent exception being its nomination in 1981 for the Audubon Society's Blue List by observers in Manitoba (Tate 1981). Studies that have been done have focused on describing the species breeding habitat, particularly its response to various agricultural disturbances. In North Dakota, Stewart (1975) has described the species optimum habitat as "idle or lightly grazed tracts of mixed-grass prairie and local pockets of wet meadow or tall-grass prairie in lowland areas." Fish and Wildlife Service biologists, in a recent attempt to prepare a habitat model for the sparrow (USFWS, unpublished report), uncovered little quantitative data to describe breeding habitat requirements but provided the following qualitative description: "prairie grasses with dense mats of litter, an upper strata of midgrasses, and an understory of short grasses as associated with native or second-growth eastern mixed grass prairie." A few studies, particularly that by Owens and Myres (1973) have further demonstrated the negative impact that mowing and grazing have on the species, particularly in the more arid portions of its range. In more mesic areas, light or moderate grazing may be less detrimental. Of particular interest are some recent observations by Kantrud and Faanes (1979) in North Dakota that led the authors to suggest that the species may be



ephemeral in response to moisture conditions. They speculated that the species may be more abundant at moist sites in dry years and at dry sites in moist years.

#### Chestnut-collared Longspur (*Calcarius ornatus*)

Perhaps the most conspicuous and colorful bird on the Felton Prairie each summer is the chestnut-collared longspur. Like the two preceding endangered species, the Baird's sparrow and Sprague's pipit, the longspur is a regional endemic whose breeding range is restricted to the northern Great Plains. It is found south only to northwestern Nebraska, north central Colorado, and north to the southern tier of the three Canadian Prairie Provinces: Alberta, Saskatchewan and Manitoba (Figure 10). Although prior to the turn of the century the species was found throughout western Minnesota its range is now largely confined to the Felton Prairie area with a few scattered records in the west central region of the state. In his book, Birds of Minnesota, Roberts (1932) provides a detailed account of the changes that occurred over time to the longspur's distribution:

"formerly an abundant summer resident throughout the prairie region of Minnesota from Heron Lake, Jackson County on the south to the Canadian boundary on the north and as far east as southeastern Ottertail County and Heron Lake, Jackson County. It has entirely disappeared in recent years from this range, except a few small isolated colonies on the first sand ridge along the Red River Valley in western Pennington and eastern Polk counties ... and in central

Norman County. It became scarce in Pipestone County about 1900 and has not been seen in that part of the state since a short time after that date."

Throughout the 1940s and 1950s there continued to be scattered reports in May, June and July from the northwest quarter of the state, principally Ottertail, Wilkin and Clay counties. During this period there was only one report from the southwest quarter of the state: a 1955 record from Murray County. Additional summer records from this region have been entirely lacking since that date.

In the 1960s longspur records were dominated almost entirely by frequent observations from the Felton Prairie area. The birds were first reported here in the late spring of 1960. On May 28, 1960, birders Ray Glassel, Dick Oehlenschlaeger and Ron Huber were driving along some back roads east of Felton. They "stopped at a fenced-in pasture area just north of a gravel-pit" and found six chestnut-collared longspurs engaged in a courtship display (Huber, 1960). They returned with several other observers on June 18 and reported at least 25 singing males, although they were unsuccessful in their attempt to find any nests. Nevertheless, four weeks later, on July 17, several young longspurs were observed, one of which was being fed by an adult.

After 1960 Felton Prairie became the most consistent site for observing longspurs. Nesting was documented in 1962 and visits were made to the site by numerous observers almost every year thereafter. Loon editor Bob Janssen, commenting on records available to him up until about 1970, noted that the colony was nearly at a peak in 1966 when "hundreds of birds" were reported to

occupy an area of less than one half square mile (MOU files, unpublished Report). The population apparently fell dramatically in the next few years; during a visit to the site in 1969 only two pairs of birds were observed. Although few of the records indicate precisely where the birds were seen, Bob Janssen recently made a rough sketch of the general area where he heard and observed longspurs during his visits to the site. As he recalled, in the 1960s the principal concentration was in the pasture immediately north and northeast of the gravel pit now in operation on the B-B ranch (i.e., NW 1/4 Section 8, Keene Township). They were also found in the grasslands north and northwest of this pasture (the Clay County Bicentennial Prairie and the prairie in Section 6, Keene Township). Several years later, in the early 1970s, the longspurs were more frequently observed further south along the gravel road bisecting the B-B ranch and south of the large gravel pit. Few visitors to the prairie, however, explored those pastures away from the immediate vicinity of the road (Janssen, personal communication).

By the late 1970s birders were still finding the longspurs most consistently in the pastures south of the B-B gravel pit. Occasional reports of a few individuals north of this area were still documented but appear to have been restricted primarily to a heavily grazed pasture immediately east of the Blazing Star tract (personal observations by Eckert 1980, and unpublished observations by Pfannmuller and Wells in 1981 and Wiegell in 1983) and to a grazed pasture immediately south of the Bicentennial Prairie (Eckert 1980b). In 1980, under the direction of the Minnesota Natural Heritage Program, Kim Eckert conducted what was perhaps the first systematic census of chestnut-collared longspurs on the Felton Prairie (Eckert 1980a, 1980b). A survey of the entire area revealed a total of 65 breeding pairs; Figure 11 maps

the distribution of the birds throughout the prairie complex. One year later, in 1981, Pfanmuller and Wells conducted a survey along the dirt road through or bordering sections 18, 19 and 30 in Keene Township. A total of 52 breeding pairs were tallied that year (Natural Heritage files, unpublished report). In 1984 Ann Wycoff, from the University of North Dakota, conducted a similar survey along the same access road and documented a total of 35 breeding pairs (Wycoff 1985). This was followed, in 1985, by the most comprehensive survey to date which resulted in a tally of 132 male territories (as shown in Figure 12). More detail regarding the 1985 study is provided in Appendix D.

Elsewhere in Minnesota, during the 1970s and 1980s, a few scattered summer records for chestnut-collared longspurs were also documented. Ten birds were reported near Averill, Clay County in 1971 and, in 1972, 10-15 pairs were observed at the same locality. Further to the south, near the town of Burr in Yellow Medicine County, one male was heard singing in 1975. Five years later, during an extensive prairie bird survey conducted by Kim Eckert in 1980, observations suggested the birds may be breeding on the Miller Prairie West tract in Traverse County (1 male and 1 female carrying food were observed). One male was also observed on Clinton Prairie in Big Stone County. Birds were again observed at Miller Prairie West in 1984 by Ann Wycoff (personal communication).

As was mentioned earlier, chestnut-collared longspurs are perhaps the most conspicuous breeding songbird on Felton Prairie. The bright and distinctive coloration of the males coupled with their prominent flight song aid identification of this species for even the novice birder. In breeding plumage, the male's black crown and black chest and belly are in stark

contrast to its buffy-white face and chestnut-colored nape. The central black tail feathers fan out to form an inverted triangle bordered by white outer tail feathers. The brown-streaked female is far less distinctive in appearance. In flight the tail pattern is again diagnostic, otherwise there is only a hint of chestnut coloration in the collar and a variable amount of black in the underparts. The male's loud, musical song might easily be mistaken for that of a western meadowlark. It also gives a flight song while it gradually flies upward rapidly beating its wings, then circles and descends.

Although a true prairie species, the chestnut-collared longspur is considerably more tolerant of disturbance than either the Baird's sparrow or Sprague's pipit. Dependent on sparse vegetative cover the longspur was originally dependent on short grass prairie habitat and no doubt took advantage of areas heavily grazed and trampled by bison (Owens and Myres 1973). As the bison disappeared, and the prairie gave way to the plow, the species was forced to adapt to disturbed habitats that provided the same essential habitat requirements as the native prairie ecosystem once did. Today, in North Dakota, Stewart (1975) describes the longspur's optimum breeding habitat as "grazed or hayed mixed grass prairie." Mowed hayfields and heavily grazed pastures also can be attractive. Throughout its range, it now appears that frequent mowing or grazing is necessary to maintain the sparse cover this species is dependent on. It will not, however, utilize cultivated fields. Nevertheless, the longspur is opportunistic and appears flexible in its ability to adapt to newly created environs. In Alberta, Owens and Myres (1973) found longspurs nesting in newly mown hayfields that, because of their dense cover, were unsuitable the year before. Presumably this flexibility would have allowed the species to readily adapt to frequently changing conditions that may have been created by

bison, fire and other natural disturbances in the original grassland environments. Clearly, today, the chestnut-collared longspurs find the Felton prairie so suitable, in part, because of the cattle grazing on the B-B ranch and, to a lesser extent, on the Hansen farm. The birds are absent from both the Clay County Bicentennial Prairie and the Blazing Star Scientific and Natural Area, areas where the grass cover is considerably taller, more dense and, to some extent, more mesic.

Finally, two additional aspects of the longspur's distribution and breeding habitat should be mentioned briefly. First, the species tends to be found in somewhat loose colonies or concentrated groups of breeding territories. This would certainly appear to be the case at Felton. Second, although the longspur is a dry, short-grass prairie species it is dependent on a nearby source of water. Again, at Felton, many of the smaller creeks and ravines seem to provide an important habitat requirement. This and other aspects of the Felton prairie longspur population are described in more detail in Ann Wycoff's report in Appendix D.

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## II. c. Butterflies of Felton Prairie

The Felton Prairie has long been known by collectors as an area where rare species of prairie butterflies could still be found. Three of these are classified as endangered or threatened in Minnesota, while another is on the state's special concern list. Contemporary collectors familiar with the area have documented collection sites fairly accurately, rendering their information about specific sites and butterfly populations useful. Unfortunately, most museum collections are labeled simply "Felton", or "Felton Prairie", allowing deductions concerning collection locations of these specimens to be impossible.

Three species of interest at the Felton Prairie include Uhler's arctic (*Geneis uhleri*), Dakota skipper (*Hesperia dacotae*), and Assiniboia skipper (*Hesperia assiniboia*). The Poweshiek skipper (*Carisma poweshiek*) a state special concern species, has also been recorded from the area. Results of the 1985 inventory are summarized here.

### Uhler's Arctic

The Uhler's arctic is generally considered a western species. Robert Pyle in *The Audubon Society Field Guide to North American Butterflies* (1981) describes it's range as exclusive of Minnesota. The Uhler's arctic is found on undisturbed grasslands throughout its known range of the Northwest Territories, Alberta, Saskatchewan, and Manitoba, Montana, Dakotas, Wyoming, Nebraska, Colorado, and New Mexico. Although there are single collections records from two other sites in Minnesota, the Felton Prairie is the only Minnesota locality where there is any evidence of a persistent, breeding population.

The species has been collected from the Felton prairie often by



several individuals familiar with the area. Museum records indicate the nebulous "Felton Prairie" site, but recent collectors [REDACTED]

[REDACTED] where this butterfly has been seen and collected. One individual (Auger, pers. comm.) recollected sighting several dozen during an afternoon of collecting. The Natural Heritage files of the Department of Natural Resources indicate collections yearly from 1965 through 1971, and then again in 1982, all from [REDACTED]. The 1979 Resource Inventory prepared by the Scientific and Natural Areas Section of the Department of Natural Resources [REDACTED] does not include this species. However, the butterfly's flight period was over when the inventory began on June 25, 1979.

Caterpillars of the Uhler's arctic feed on grasses or sedges (specific host plant unknown) and overwinter when nearly mature. Pupation takes place in the spring in the grass litter. Adult flight occurs in late May to early June. Adults may be seen hovering over the prairie, or may be startled from their perches in the grass. When flushed their flight is strong, and they generally fly a distance of 50 to 100 feet before dropping down into the grass again.

During the 1985 season the weather was overcast and rainy for much of the flight period of this species. As a result, only six individuals were sighted on two different days. Five of these were found [REDACTED], the sixth was found [REDACTED]. In addition, another collector found one butterfly on a third day, [REDACTED]. These spotty collections are indicated in figure 13.

The two sites on which the butterflies were found are both fairly

Figure 13 removed from this document to protect populations of Uhler's Arctic.

undisturbed. Neither have been burned within the past 40 years; one has been mowed on a bi-yearly basis. [REDACTED] historically supported a population of this butterfly, as part of the [REDACTED] referred to by collectors. [REDACTED] has no records of collection, but is privately owned and not accessible to general collectors. No Uhler's arctics were found on the [REDACTED], which has had a population in the past. The [REDACTED] of this prairie, which is where collections have been made, was burned in the spring of 1984. This burn may have eliminated the butterflies from this area, although this is difficult to determine due to the poor weather during the survey.

Because of the low number of individuals located, it is difficult to evaluate the condition of the Uhler's arctic population in the area. Past collections indicate a stable population, but this butterfly should continue to be monitored, and prescribed burns conducted with care. Mowing may be a preferred alternative until a thorough population assessment can be completed, and the effect of burning evaluated.

#### **Dakota Skipper**

The Dakota skipper historically ranged from "Manitoba south into Minnesota, Iowa, and Illinois west to the Dakotas" (Howe, 1975. It is now extirpated in Illinois and is known from only one site in Iowa (Huber and Dana, 1984). Museum records exist for most of the western portion of the state, although strong populations have been documented from only two sites, in Clay and Lincoln Counties. Felton Prairie has historically maintained a population of the Dakota skipper, and collectors records indicate Section 6 of Keene township, and the Clay

County Bicentennial Prairie as strongholds for this butterfly. The 1979 Resource Inventory for the Bicentennial Prairie indicates the presence of this species; the same inventory team also collected the Dakota skipper on Blazing Star Prairie. Natural Heritage files indicate collections beginning in 1964 through 1979 for the Bicentennial Prairie.

The Dakota skipper is a northern great plains species associated with dry calcareous or alkaline prairies (McCabe, 1981). Most sites where it is now found are poorly suited for agricultural purposes, and usually serve as pasture or hayland. Whether or not the skipper has always been solely associated with these calcareous prairies cannot be determined. The Dakota skipper does not tolerate a great degree of habitat disturbance, as occurs with overgrazing. Grazing tends to alter the natural prairie vegetation through soil compaction and selective feeding, making it unsuitable for the skipper due to loss of host plants, and perhaps changes in microclimate and soil pH (McCabe 1981, Dana, unpub.).

The Dakota skipper flight period occurs in late June and early July, with adult individuals living for 2-4 weeks. Eggs are laid indiscriminately on broad-leaved plants and grasses. The newly hatched larva climbs down to the ground and builds a shelter within two blades of grass (McCabe 1981). While exact host plants are unknown, bunch grasses seem to be preferred (MacNeill 1964). Caterpillars live in grass shelters for the rest of their larval development, feeding mostly at night. Underground silk shelters are formed in the fall for overwintering .

Adult male Dakota skippers may be found perched on vantage points, a tall plant or open area, where they watch for and pursue all animals

which fly by, including other butterfly species, moths, and even birds (Dana, pers. comm.). An encounter with another male Dakota skipper leads to a brief skirmish, characterized by a whirling, ascending flight. Both skippers involved typically return to their original perch, which eventually leads to repeated encounters. Encounters with females leads to courtship, where it is the female skipper which accepts or rejects the male (McCabe, 1981).

Other skippers flying at the same time as the Dakota skipper include the tawny-edged skipper (Polites themistocles), the long dash (Polites mystic), and the Poweshiek skipper. To the untrained eye, these first two look remarkably like the Dakota skipper, and capture is often necessary for proper identification.

Dakota skippers were most abundant in ungrazed dry prairies, which had been mowed or burned in the recent past (figure 14). The highest abundance of Dakota skippers was found at Clay County Bicentennial Prairie and Keene 6. Both of these prairies support large populations of purple cone flower, which appears to be the preferred nectar source. In general, both of these prairies had many more flowers in bloom during the flight period of the Dakota skipper than any other sites. In addition to these two areas, Blazing Star SNA, and Hagen 31 also contained large numbers of the skipper. Since Hagen 31 has not been mowed or burned in a number of years, flower density was much lower than on the neighboring Keene 6, with a subsequent reduction in the number of skippers. While Blazing Star SNA produced many blooming flowers during the flight period, occurrences of this skipper were still lower than in the neighboring Bicentennial Prairie. Since Blazing Star is a mesic to wet mesic prairie, with only a small beach ridge containing dry prairie vegetation, the limiting factor may be larval habitat rather than adult

foraging sites. Blazing Star does provide an important nectar resource as evidenced by the numerous adults seen feeding there during this survey. However, Blazing Star SNA should not be considered as typical Dakota skipper habitat. skippers may be flying in from Bicentennial Prairie or other near-by dry prairie sites.

The Dakota skipper was also found on the B Bar B Ranch, more often in sites which happened to be ungrazed during this growing season. In particular, a number of skippers were found in the SW corner of Keene 18 along the edge of the scarp. This corner of the pasture was not grazed until after the Dakota skipper flight period and contained more flowers than the adjacent grazed pastures.

Several Dakota skippers were also found in a small piece of ungrazed prairie in the SW 1/4 of Keene 17. Elsewhere occasional skippers were found in two other locations, Keene 8 and Flowing 12 (NE 1/4).

It is unclear whether these occurrences on the B Bar B Ranch indicate established populations. Due to the mobile nature of this insect, adults may be found at relatively great distances from where they emerged from their cocoons. These isolated individuals may have flown into the Ranch while foraging for nectar. Since known populations exist within two miles of these sightings this possibility cannot be ruled out. On the other hand, these individuals may indicate established, although small populations. In either case, the Dakota skipper population as a whole could benefit from reduced grazing and increased flower and native grass production on these sites. Although specific adaptations to fire are unknown in this species, rapid recolonization through high reproduction and considerable adult dispersion has been suggested (Dana, unpub). This might explain the presence of the skipper on the Ranch, and might suggest a rapid

population increase if more suitable habitat were made available.

### **Assiniboia Skipper**

The published range of this skipper is from "Alberta to Manitoba and south into North Dakota" (Howe, 1975). Eastern South Dakota and northwestern Minnesota should be included on the basis of museum specimens. While there are isolated records from Polk and Kittson Counties, and from Buffalo River State Park in Clay County, Felton Prairie is the only location where it has been consistently reported (Huber and Dana, 1984). Contemporary collectors indicate Keene 6 and Bicentennial Prairie as collecting sites for this skipper.

In North Dakota this skipper is common in virgin prairie as well as heavily grazed pastures. In fact, it has been reported to use cattle droppings as shelters, constructing silk-lined burrows under the droppings, from where it presumably pulls in grasses on which to feed. In Minnesota this species is not associated with cattle, and requires ungrazed prairie (McCabe and Post, 1977). It is restricted to native grassland, and appears to prefer short and mixed-grass prairies (Huber and Dana, 1984). Larval host plants have not been established, but are assumed to be short grass species such as needle and thread grass or June Grass. Adults fly from early August to late September, and are reported to feed heavily on Blazing Star (McCabe and Post, 1977).

The most common skipper flying at the same time as the Assiniboia skipper is the Pawnee skipper. While the Pawnee skipper is larger than the Assiniboia skipper, separations between small Pawnee females and large Assiniboia females may be difficult. In general, the coloration of the two species is different enough to establish identification, but

capture is often necessary.

A total of five Assiniboia skippers were found during this survey. Two were found on Keene 6, the other three were located in Keene 17, Keene 19, and Bicentennial Prairie (figure 15).

While poor weather conditions may have contributed to the low numbers observed, it is more likely that populations of this skipper are small. Many Pawnee skippers were observed flying during the period when the Assiniboia skipper was expected, indicating weather conditions were acceptable for skipper flight. Because of the low numbers observed, judgments concerning the status of this species in the Felton Prairie area cannot be made. Other collectors have indicated that the population here has always been small, (Auger, McCabe, pers. comm.). As western Minnesota constitutes the eastern edge of the skipper's range, these results are not surprising.

This species should continue to be monitored, although these rare occurrences may simply indicate that the Felton Prairie is at the very eastern edge of the range of this skipper. If so, it may never be common on these sites. As with the Uhler's arctic, care should be taken when conducting prescribed burns, until more is known about the species.

#### Other Species

During the butterfly surveys, records of all butterfly species seen were kept. The most interesting of these include the Poweshiek skipper (state special concern), and the regal fritillary (*Speyeria idalia*) (see appendix E for complete lists). Both of these species were commonly found on the ungrazed prairie tracts. The Poweshiek skipper was flying at the same time as the Dakota skipper, and appeared to have similar requirements as far as grazed versus ungrazed prairies are concerned.



It was more common in the mesic to wet mesic areas than the Dakota skipper was.

The regal fritillary, which is not officially listed, requires open grassland and is considered to be in decline in some areas of its range. The larval food of this species is violets.

### **Threats and Management**

Threats to all species mentioned include gravel mining or plowing of the area for use as crop land. While cultivation of these areas are unlikely due to their poor soils, gravel mining does pose a real threat.

An additional note must be made concerning the effects of prescribed burning on butterflies and skippers. On small prairie remnants a prescribed burn has the potential to eradicate entire populations. A burn at any time of year may be detrimental, as most butterflies and skippers are vulnerable throughout the year. Some individuals, however, may be deep enough underground or in the bases of grasses to survive cool, fast moving fires. In many populations recolonization may occur from fire units not burned, if units are based upon known butterfly habitat and requirements (Schweitzer, 1985). In cases such as in the Felton Prairie area, prescribed burning should be planned with caution. These populations have been successfully managed for many years by mowing, and at least one researcher has expressed extreme concern about burning these types of areas (McCabe, pers. comm). "In some sites, autumn or early spring mowing probably should replace fires in management schemes." (Schweitzer, 1985).

Details of the 1985 butterfly census describing methods and exact locations of butterfly observations may be found in Appendix E.

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## II. d. Mammals of Felton Prairie

The only information available concerning mammals of Felton Prairie comes from the 1979 SNA inventory of Bicentennial Prairie.

The 1979 inventory team found eight species of mammals on the Bicentennial Prairie including the Prairie Vole (Microtus ochrogaster) and the White-tailed Jack Rabbit (Lepus townsendii), both state special concern species. In addition the team identified the following: Masked Shrew (Sorex cinereus), Short-tailed Shrew (Blarina brevicauda), Gapper's Red-Backed Vole (Clethrionomys gapperi), Meadow Jumping Mouse (Zapus hudsonius), Long-Tailed Weasel (Mustella frenata), and White-tailed Deer (Odocoileus virginianus).

During the 1985 study, notes were made on the occurrence of uncommon mammals sighted while conducting butterfly surveys. The most common mammals sighted were White-tailed deer and Ground Squirrels; records on these animals were not kept.

Coyotes (Canis latrans) and White-tailed Jack Rabbits were seen throughout the study area, although not in large numbers. A Badger (Taxidea taxus) was seen on two different occasions, and a mink (Mustela vison) was observed fishing in Felton Creek. These observations are noted in figure 16.

## II. Site Descriptions

### **B Bar B Ranch**

Approximately five square miles in size, the B-B Ranch contains more than 2000 acres of virgin grassland. This is the largest tract of uncultivated land left in the Felton Prairie complex. The ranch is owned by Mr. Woody Bjerken of Moorhead, and is managed with the help of his son Brad, who lives on the ranch. Both Woody and Brad are interested in maintaining the area as a ranch in the future.

### **Land Use History**

The B-B Ranch was purchased by the Bjerken family in 1946. Prior to this time the area was used primarily for hayland, although some grazing took place as well. It was originally purchased for a sheep ranch, and 2000 to 3000 sheep were grazed there through 1970, although at times there were as many as 5000. All the current pastures, except for Flowing 13, were used as sheep pasture. Flowing 13 was considered too wet and brushy for sheep and approximately one hundred cattle grazed here instead. The sheep were rotated through the pastures to avoid overgrazing, and were moved every two to three weeks. In 1970 most of the sheep were sold; 25 animals were kept for another two years.

The eastern side of the ranch, including sections 7, 8, 17, and 18, has since been used for grazing of the Bjerken's cattle. Three hundred fifty head of cattle have been grazed year-round in these pastures. Keene 19 is opened in the fall for grazing. In the winter the cattle tend to congregate in the woods along Felton Creek, and near a pole barn shelter in the NW corner of section 18.

The pastures on the western side of the ranch, Flowing 13 and the western 1/2 of Flowing 12, are usually leased as grazing land. Flowing 13 originally was grazed by Bjerken cattle, but recently has been leased

and has approximately two hundred fifty head of cattle on it. This pasture was recently enlarged to include about 1/3 of Keene 18. The eastern 1/2 of Flowing 12 is leased to a herd of one hundred cattle. Cows are introduced to both of these pastures in May and removed in the fall.

### **Topography and Soils**

Most of the ranch is undulating beach ridge and broad more or less level interbeach formation, gradually descending from east to west. The tract stretches from the nearshore bed of Glacial Lake Agassiz and across the whole sequence of beachlines except for the highest; the latter crosses the ranch in the east end of Keene 20 but it is cultivated. A sharp break or scarp enters the ranch at the northwest corner of Keene 19. This retains its blufflike character up through much of Keene 18 and continues on north as a prominent but rounded beach ridge. Another prominent beach ridge runs through the W 1/2 of Keene 20 and the E 1/2 of Keene 17, the highest point of the prairie on the ranch. The moderately meandering, essentially east-west valley of Felton Creek is incised quite deeply into this upland landscape, forming a narrow steep sided gorge as much as 40-50 feet deep in places. This and another parallel but smaller creek about 3/4 mile north provide the major topographic complexity.

The beach ridge complex soils range from excessively drained sandy loam in the highest positions to poorly drained clay loams in the lowest. Sioux sandy loam is found along ridge crests, with Sioux loamy coarse sand along the steep scarp in Keene 18. Extensive interbeach areas are occupied by well-drained Lohnes coarse sandy loam, and there

are lesser areas of Maddock fine sand, also well-drained. Lohnes sand loam, Flaming fine sand, and Ulen fine sandy loam (moderately well-drained to somewhat poorly drained) occupy slightly lower positions. Syrene sandy loam is the major poorly drained soil in the low interbeach sites, with smaller areas of Arveson clay loam in the lowest places. Minor soils include Vallers, Osakis, and Divide loams, which are heavier, less sandy soils with a higher clay content. A large area in the E 1/2 of Flowing 13 is mapped as Urness mucky silt loam. This is a boggy area with many flowing springs, and the surface in much of it appears actually to be a marly peat.

Below the beach ridge complex soils are somewhat poorly to very poorly drained. The major soils are Arveson clay loam and its depressional variant, poorly to very poorly drained. Fossum loamy sand, also poorly drained but more permeable, occupies smaller areas. Ulen fine sandy loam and Flaming fine sand are the most significant of the slightly better drained soils here.

#### **Vegetation**

Pemble's 1977 description of the vegetation of the ranch as a complex of prairie types following the linear north-south pattern of beach ridges and shallowly concave inter beach expanses is excellent. Generally dry and dry mesic conditions occur along the broad crests and upper slopes of the ridges, with mesic to wet conditions in the inter beach expanses and west of the beach complex in the W1/2 of flowing 13. Pemble estimates 40% of the relatively undisturbed grassland area of the ranch to be dry and dry mesic ( 800+ acres by his estimate). Unfortunately nearly all of the pasture land on the ranch was closely grazed at the time current field inspections were made, so that descriptions of the composition of the vegetation are based on somewhat

superficial impressions and are likely to be in error in a number of details.

Although the vegetation in these pastures is in better condition than what is typical in similar pasture land along the beach ridge complex it does appear to differ considerably from that found in several nearby sites in the Felton Prairie which have had less intense and/or less continuous grazing pressure

The strong dominance of drier sites by the low, sod-forming, grazing tolerant blue grama grass, and the apparent absence or low abundance of the midheight bunchgrasses little bluestem, plains muhly grass, and prairie dropseed, which are codominants on equivalent ungrazed sites, is an obvious product of the grazing history. Forb diversity has apparently been reduced in the same sites, with tolerant and/or unpalatable species such as fringed sage and yarrow far more abundant than in ungrazed examples. Nonetheless, native species richness is probably not much if any reduced. Canada bluegrass (Poa compressa) which is common in many of the ungrazed examples, appears to be the only major exotic species in these dry areas. One dry site, the steep face of the scarp in Keene 18, is less degraded; several species not seen elsewhere, including prairie onion (Allium textile) and white beard tongue (Penstemon albidus), are common here, though this may reflect a difference in substrate rather than lower grazing pressure.

The vegetation of most of the mesic areas looked at appeared to be considerably degraded, with exotic grasses, mainly Canada bluegrass, but also redbud, dominant or codominant. Some of these sites appeared to be little more than close-grazed sods of these grasses. Exotic forbs are also fairly common, including clovers (Trifolium spp.) and black medic

(Medicago lupulina). Again, grazing tolerant or unpalatable native forbs are much more common than in ungrazed sites, including the sage and yarrow of drier sites and Canada goldenrod (Solidago canadensis). Forb diversity is considerably reduced, and so probably is species richness in many of these mesic sites.

These observations are somewhat different from those reported by Pemble, whose description of the composition of mesic prairie on the ranch implies fairly good quality. Some examples, as in the SE 1/4 NW 1/4 Keene 8, the western edge of the ranch in Flowing 12, the lower slope of the scarp in Flowing 13, and the north part of a small area in the SW 1/4 Keene 17 which had just been opened to grazing for the first time were closer to Pemble's description, especially the last. The first three were not as closely grazed this season as most mesic sites and thus may be less intensively grazed in general. The contrast across the former fence line at the north end of the last mentioned site provides a striking demonstration of the typical degree of degradation of mesic prairie. Although the native component of the more degraded grazed mesic sites is probably greater than was evident it is unlikely that much of this type of site is better than fair mesic prairie, contrary to the conclusions of Pemble.

Wet mesic and wet sites looked at generally showed moderate to very light levels of current utilization, some of the wettest areas appearing to be completely avoided. This probably reflects the normal level of grazing pressure on sites of this type as they were in good condition, with low levels of exotics and good native diversity. An exception was the perimeter of the large boggy seepage area in Flowing 13, which has been nearly totally ruined. Some of this is mesic, but most is wet mesic. By contrast, the extensive boggy area itself was only lightly



utilized by cattle and seemed very little disturbed. This area is a tussocky wet prairie dominated by sedges (Carex spp.), prairie cordgrass, big bluestem, and reed grasses (Calamagrostis spp.). Within it there are numerous quaking areas with considerable discharges of water. These areas support characteristic calcareous fen vegetation, including a number of rare plants. Sticky false asphodel (Tofieldia glutinosa), Sterile sedge (Carex sterilis), hairlike beak rush (Rhynchospora capillacea), and small arrowgrass (Tryglochin palustris) are a few that are common here. The full extent of this fen complex has not been determined, but based on the soil maps it could be as large as 60 acres. Whether the wet mesic and wet prairie in the western part of Flowing 13 below the beach ridge complex is similarly good was not determined.

As noted by Pemble, most of the valley of Felton creek which bisects the ranch across the beach ridge complex is wooded, as are several large tributary coulees. There is undoubtedly a much more developed overstory now than was originally present; leadplant and other plants of open prairie were observed on the one steep valley wall looked at, now strongly shaded by small basswood, American elm, etc. The combination of increased shading and concentration of animal activity have probably greatly degraded the understory, although the steep slopes may have permitted more to survive than would on more level terrain. The alluvial area in the bottom of the valley looked surprisingly good, with nice stands of prairie cordgrass.

In general most of the area of the B-B ranch is highly disturbed. Leaving out the gravel pits and associated areas, and the cultivated and old field areas, the vegetation is somewhat to considerably different

from its presettlement composition. However, except for the mesic phase, the vegetation is predominately native with probably all species originally found still present. With some relaxation of the intensity of grazing plus some other management strategies, such as timing of grazing and mowing, much of the pasture would probably recover to fair to fairly good prairie. As noted, the mesic areas have been most negatively affected and it is unlikely that much of this will ever be better than just fair.

Several noteworthy plants were found on the ranch in addition to the fen species already mentioned, hairlike beak rush (state threatened), sterile sedge (state threatened), sticky false asphodel (state special concern), and small arrowgrass (state special concern). Nuttall's little rose (Chamaerhodos nuttallii, state special concern) was found on two neighboring west-facing knolls along the scarp in Keene 18. Two small colonies of a broomrape, Orobanche ludoviciana (state special concern), were found, one in the NW corner of Keene 19, the other in Flowing 12, both dry, sandy sites with lots of fringed sage, the most common host of this parasitic plant. A couple of individuals of the related parasite Orobanche fasciculata (state special concern) were found in the same Keene 19 location. Details of individual sites are found below.

#### **B-B Site Details**

##### **Keene 19 Figure 17.**

This section was cultivated in 1948, and planted in flax for one year. Brome grass and alfalfa were seeded in the following year. There are patches of leafy spurge scattered throughout this pasture. A small area in the northeast corner was not cultivated, and most elements

observed occurred here. An old gravel pit is located in the NW corner, in which garbage (such as large appliances) and dead cattle have been dumped.

Element Occurrences: Chestnut-collared Longspur (State Endangered); Assiniboia Skipper (State Endangered); Two species of Broomrape: Orobanche ludoviciana (State Special Concern); Orobanche fasciculata (State Special Concern).

**Flowing 13** Figure 18.

Dikes were built on either side of Felton Creek in 1982 by the county to help reduce flooding. These dikes begin at the center of the section, and follow the creek westward. A fen is located on top of the beach ridge. A buried gas pipeline runs diagonally across this section from the NW to the SE. A telephone line runs N-S through the section. A small corral with numerous small enclosures and a cattle ramp is located in the NE corner of the section.

Element Occurrences: Rare plants associated with the fen: Hairlike Beakrush (State Threatened); Small Arrow Grass (State Special Concern); Sticky False Asphodel (State Special Concern).

**Keene 18** Figure 18.

There is an old gravel pit located in the NW corner of the section, which is now filled with water. The area surrounding this lake was once covered with the spoils from the gravel operation, and now is covered with weedy vegetation. There are several patches of leafy spurge and some extensive thistle patches near the old gravel pit. In the NE corner, just south of Felton Creek, is a junk pile, with old fencing, posts, and various old machinery. Three round silos are south of this junk pile. A pole barn for cattle shelter is located just north of Felton Creek.

Element Occurrences: Chestnut-collared Longspur, Loggerhead Shrike (State Threatened); Dakota Skipper (State Threatened); Nuttall's Little Rose (State Special Concern).

**Keene 17, less S 1/2 of the SE 1/4** Figure 18.

The southern 1/4 of this section is used for hay, and only pastured in the fall. Most of this hayland has been cultivated and seeded with exotic grasses. A small segment on top of the beach ridge was not cultivated and provides a basis of comparison with the other pastures because it still maintains most of the native vegetation, despite the fall grazing. Similarly useful, another small section in the SW corner of this tract was just recently opened for grazing. There are several patches of leafy spurge and thistle is extensive. A pile of irrigation pipe is located on top of one of the beach ridges in the SE 1/4 of the section.

Element Occurrences: Chestnut-collared Longspur, Upland Sandpiper (State Special Concern); Dakota Skipper, Assiniboia Skipper, Powesheik Skipper (State Special Concern).

**Keene 8, less NE 1/4** Figure 19.

There is a pile of barbed wire and other metal garbage along the NE boundary of this pastured section.

Element Occurrences: Chestnut-collared Longspur; Upland Sandpiper, Greater Prairie Chicken (State Special Concern); Dakota Skipper.

**Keene 7** Figure 19.

A gravel operation is located in this section and currently covers almost 3/4 of the area. There are many old vehicles and pieces of abandoned machinery scattered about, in addition to the machinery currently in use. Several buildings are associated with this operation.

A house and mobile home occupied by the ranch owner's son and hired hand are located in the SW corner. Leafy spurge and thistles are present in this section.

Element Occurrences: Chestnut-collared Longspur.

Flowing 12, E 1/2 Figure 19.

In the northern end of this section are several areas which have been highly disturbed by cattle. Mr. Bjerken (the ranch owner) believes this resulted from the cattle having been fed silage in that corner of the pasture. Scattered among these disturbed areas are pieces of metal and wood. There also are patches of leafy spurge and thistles in the section.

Element Occurrences: Chestnut-collared Longspur, Upland Sandpiper, Marbled Godwit (State Special Concern), Dakota Skipper, Orobanche ludoviciana.

#### Potential Management Problems

There are many potential management problems associated with the ranch if it were to be acquired as a preserve. A full-time manager would be required in order to attend to the management needs of a piece of property this size. Because the ranch is well-known as a birding location there is a steady stream of traffic along the main road during the warmer months. In addition to birders, many hunters and local community members use the road through the ranch. While traveling the road is not hazardous, and does not appear to be harmful to the plant and animal community, the presence of a manager would discourage any problems that may be associated with this much visitation. One of these problems includes the presence of the lakes left behind by the gravel operation. These lakes are utilized by the current owners as fishing

and swimming areas, and are well known by the community. Gravel pit lakes are dangerous swimming holes due to their depth and uncertain bottoms, which constantly shift as the sand and gravel settle. It may prove difficult to discourage swimming in these lakes.

Currently the ranch owner rigorously controls ground squirrels (both Richardson's and thirteen striped). This may contribute to the high chestnut-collared longspur population as ground squirrels contribute to egg and nestling mortality.

Leafy spurge and thistle are present in most of the pastures and would require constant attention. The Bjerkens currently spray for spurge each spring and none of these infestations are large.

#### Recommendations

The B-B Ranch is a significant area due to the large number of rare animals and plants found there. In addition, its proximity to other tracts of prairie such as Blazing Star SNA and Bicentennial Prairie add to its potential. Current use and management of the ranch is adequately protecting the most numerous rare species, the chestnut-collared longspur. Under the current regime, the ranch appears unsuitable habitat for the Uhler's Arctic butterfly and not very hospitable for the Dakota skipper. On the basis of the response of the Dakota skipper to cessation of grazing at a site in SW Minnesota (R. Dana, pers. comm.) it can be predicted with some confidence that its numbers would greatly increase on the ranch if grazing were relaxed or eliminated. In fact it is likely that this would become the largest population in Minnesota. Too little is known about the biology of Uhler's Arctic in Minnesota to make similar predictions for it, but what evidence we have supports the view that it should recolonize the ranch. All that can be said about

the Assiniboia skipper is that it seems plausible to predict that an increase in floral nectar resources resulting from decreased grazing intensity would be favorable.

If the only consideration is to maintain present abundance of chestnut-collared longspurs on the ranch, then the present condition is suitable and these "improvements" would be in fact detrimental. Probably some level of grazing can be found which would maintain acceptably high numbers of this bird while also allowing for some recovery of the vegetation and possibly re-establishment of the two butterfly species. This should also enhance the chances of Baird's sparrow and Spragues's pipit persisting in the Felton prairie.

If the current owners should decide to sell the property, acquisition at that time would be suggested. At the present the owners intend to continue using the property as they have for the past 40 years, and this use is consistent with the needs of the longspurs.

Section 13, Flowing township, could benefit from a change in land use. While it is unknown if chestnut-collared longspurs are currently using this section, a fen complex is present here, which is currently suffering from cattle trampling the periphery. It has been suggested to the owner that he discontinue grazing this section, and enroll it in the prairie tax credit program. While the owner is not likely to drain this section, a conservation easement may be in order to protect the water system of this fen.

Mr. Bjerken, the ranch owner, is very cooperative, and aware of the importance of his property. He is very likely to agree to further work on his property, and appears to enjoy the presence of bird watchers and researchers on his land. A system of monitoring the longspur

population, as well as other species of interest, should be instigated. This program would have two objectives: 1) provide additional information on the plants and animals in question, and 2) establish a line of communication with the Bjerkens to keep track of changes in land use, and plans for the ranch. This project need not be time-consuming, and would require only a few days in the field to count longspurs, visit sites with potential for interesting plants, conduct plant community releves and visit with the Bjerkens to inquire about management changes from the previous year.

#### Other Tracts

##### Clay County Tracts- SW 1/4 Keene 5, Keene 6, Hagen 31 Figure 20.

These three tracts comprise the other large block of upland prairie left in the Felton Prairie complex. The 480 acres, 320 acres of which remains undisturbed 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 all three tracts. 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. This gravel pit has crossed the section line into the SW 1/4 of Keene 5 by about 30-40 feet. There also is an abandoned gravel pit in the NW corner of this section which has been used as a dump, although no dumping has taken place recently. The northern half of Hagen 31 has also been disturbed by gravel mining, but is not currently being mined. Numerous test pits may be found in the southern half of this section; pits 5 to 10 feet deep, 10 feet wide, and 20 feet long.

The SW 1/4 of Keene 5 was designated in 1976 as the Clay County



Bicentennial Prairie. At that time an informal agreement between the county board of commissioners, the Department of Natural Resources, and the Nature Conservancy was reached, and the county granted a conservation easement for ten years. In this agreement the county board stated that they would not allow gravel mining on the property without a public hearing or 60 days notice. Currently, efforts are under way to extend this agreement, and to formalize it. It is expected that the county will extend the easement for an additional ten years, and will enter into a formal lease with the DNR Scientific and Natural Areas Program.

#### **Land Use History**

Prior to the early 1940's all three of these tracts were part of a large pasture which was grazed by sheep and cattle. A member of the family involved (Clifford Shaw) reports that the area was heavily grazed, and looked similar to the current condition of the B-B Ranch. Around 1943 Hagen 31 was fenced and continued to be used as pasture, while the other two tracts were mowed for hay. Mowing took place every other year in September. Hagen 31 was grazed until the late 1950's when it was added to the area mowed for hay. Hagen 31 and Bicentennial Prairie were last mowed in 1971. Portions of Keene 6 were mowed in 1984 and 1985. The western half of Bicentennial Prairie was burned in the spring of 1984, and the northern half in the fall of 1985.

#### **Topography and Soils**

The lowest beach in the complex crosses the NW corner of Keene 6, continuing north to the NE corner of Hagen 31. West of this the terrain drops off into the gently sloping lake plain. Most of the beach ridge west of Keene 6 has been dug away for gravel leaving a scarp along the south half of the boundary of this section. A high beach ridge

(Campbell?) curves to the west across the SW 1/4 of Bicentennial Prairie, extending as an unusual E-W lobe across the lower part of Keene 6 and continuing on to the NE across the NW corner of Bicentennial Prairie. Unfortunately, most of this beach ridge lobe across Keene 6 has been destroyed by gravel mining. A broad, nearly level expanse between the western low ridge and the prominent Campbell ridge occupies almost all of Keene 6 north of the gravel pit (the eastern boundary of Keene 6 includes some of the side slopes of the high beach ridge north of the gravel pit) extending up through the SE third of Hagen 31. In Hagen 31 this interbeach area has more rolling relief than the gentle undulating character in Keene 6. The Bicentennial tract east of the somewhat sinuous beach ridge in the west part has a gently rolling character, with extensive nearly level areas. An intriguing pattern of regularly spaced crescent shaped swells and swales across much of Bicentennial east of the Campbell ridge is visible on recent color infra-red air photographs. There is a low beach ridge (Norcross?) across the SE corner. Elevation decreases gradually from east to west. The broad interbeach expanse in Keene 6 and Hagen 31 is about 40 feet lower than Bicentennial Prairie.

Lohnes coarse sandy loam is the predominant mapping unit in the interbeach area of this group of tracts, with smaller areas of Lohnes sandy loam close to beach ridges. Sioux sandy loam occupies the crests and upper slopes of the beach ridges. The Sioux soil is excessively drained, and the two Lohnes soils are moderately well drained. In the SE part of Bicentennial there is a narrow band of Osakis loam, a moderately well drained soil, and a larger area of somewhat poorly drained Divide loam. Most of the area west of the beach ridge in Hagen

31 is mapped as Markey muck, a very poorly drained organic soil, but there is some Arveson clay loam and Fossum loamy sand, both poorly drained non-organic soils, at the north end.

### Vegetation

The beach ridge complex here exhibits the same general pattern described for the B-B Ranch, with dry sandy prairie along the ridge crests, and dry mesic to mesic in the interbeach areas. There is some wet mesic and wet prairie in the eastern part of Bicentennial Prairie. West of the beach ridges in Hagen 31 the vegetation grades through mesic to wet prairie. The lower level part further out was not investigated; it is probably mainly sedge meadow and marsh. Considerable shrub and small tree cover has developed. The condition of the upland prairie in all these tracts is generally good despite past grazing, although forb densities appear lower than those observed in a couple of small sites which may have escaped grazing pressure (one of these is the SE corner of SE 1/4 SW 1/4 Keene 17 on the ranch, a small beach sideslope area in a large, mostly tame grass, hay field). The ridge crests support a community of dispersed small bunch grasses; major ones are little bluestem, needle and thread grass, plains muhly grass, prairie dropseed, and June grass, with blue grama and threadleaf sedge as important subdominants. Two western grasses that are rare in Minnesota, Hooker's spike oats and red three-awn, occur here. Purple cone flower, blanket flower (Gaillardia aristida), prairie golden aster (Chrysopsis villosa), field chickweed (Cerastium arvense), dotted blazing star (Liatris punctata), downy painted cup (Castilleja sessilifolia), white beard tongue, and yellow prairie coneflower (Ratibida columnifera) are characteristic forbs more common along ridges than elsewhere. Fringed sage is restricted to these ridges although it is not especially common.

The dry mesic interbeach vegetation is a porcupine grass - little bluestem - prairie dropseed - blue grama grassland. Wilcox's panic grass, June grass and Carex cf heliophila are important secondary species. Big bluestem is locally common, especially where conditions approach mesic. Leadplant, pasque flower (Anemone patens), and heart leaved alexander (Zizia aptera) are common here as well as on the drier crests. Rough blazing star (L. aspera) is more common here than dotted blazing star. Other common forbs include gray goldenrod (Solidago nemoralis), stiff goldenrod (S. rigida), prairie sunflower (Helianthus laetiflorus) and purple prairie clover (Petalostemum purpureum). Mesic and wet mesic sites are dominated by big bluestem and indian grass (Sorghastrum nutans), with other tall grasses important. Prairie cordgrass is common in wet mesic phases. White prairie clover (Petalostemum candidum), Maximilian's sunflower (Helianthus maximiliani), smooth white lettuce (Prenanthes racemosa) and wood lily (Lillium philadelphicum) are a few characteristic species. Gayfeather (L. ligulistylis) replaces rough blazing star, and tall blazing star (L. pycnostachya) occurs in the wet mesic areas. Dwarf wild indigo (Amorpha nana) is a common associate of leadplant, extending further into the wet phase than the latter. There are several expanding clones of aspen on Bicentennial Prairie.

Bluegrass species are the major exotics, with Canada bluegrass on drier sites and Kentucky bluegrass on moister ones. These grasses seemed to be a major component of the prairie in Hagen 31 and Bicentennial, but less common in Keene 6. This may have been only a difference in apparencey owing to the annual mowing of this tract. The other two tracts have not been mowed for a number of years and there is

a heavy build-up of thatch. Both species of bluegrass were common and vigorously flowering in the west half of Bicentennial Prairie which was burned in 1984. Neither species were indicated as common in the 1979 Resource Inventory. This change was documented in July, 1985, by resampling releve plots which had been set up in 1979. Canada bluegrass, which was a minor component of the grass community in 1979, is now a dominant grass in this tract. The burn, which was hot and dry appears to have killed many native grasses, particularly little bluestem (see memorandum to Blazing Star file, appendix C).

The state endangered white-fringed prairie orchid (Platanthera leucophaea) was not seen during this project, but it has been collected recently from Bicentennial Prairie (R. Pemble, pers. comm), and during the 1979 resource inventory.

Element Occurrences: Uhler's Arctic (State endangered), Dakota Skipper, Assiniboia Skipper, Powesheik Skipper (state special concern), Greater Prairie Chicken, Red Three-awn (state special concern), Hooker's Spike Oat (rare, but no formal status), White-fringed Prairie Orchid (state endangered).

Management Problems: The numerous cartways though all of these tracts provide easy access. Some of these cartways pose particular problems where they cross wet areas, and are enlarged each season when the track becomes impassable. The gravel pits, particularly the county pit and it's associated shallow lakes in Keene 6 pose safety hazards.

Recommendations: These county tracts provide the best quality example of the drier phases of the Felton Prairie remaining and should be protected. The apparent degradation from past grazing is minor; the major problem is the blue grass infestation, probably the result of this grazing, which seems to lead to further degradation in the absence of

any mowing or burning. Appropriate management, including controlled burning with perhaps also some mowing and grazing could quickly produce an excellent representative of the native prairie that originally typified the upland parts of the Felton Prairie, certainly better than equivalent sites in the B-B Ranch. This would increase even further the Dakota skipper abundance in this block of land. This year's experience with Uhler's arctic, coupled with past experience of collectors who found it common in Bicentennial Prairie when that tract was still being mowed, weakly indicates that heavy thatch buildups are unfavorable for it, but it is uncertain whether periodic burning would be as favorable as mowing. It is clear, however, that improvement of the prairie in Hagen 31 and Bicentennial, however accomplished, would increase the chances of its persistence in the Felton Prairie (and in Minnesota). Too little is known about Assiniboia skipper to make any meaningful predictions regarding its response to such improvement.

Unless fairly intensive grazing was initiated, these areas would probably not be attractive to the chestnut-collared longspur. Response of Baird's sparrow and Sprague's pipit, as well as other birds, cannot be predicted.

#### **Blazing Star Scientific and Natural Area, Keene 5, NE 1/4 Figure 20.**

This 160 acre tract is owned by The Nature Conservancy, and leased to The Department of Natural Resources as a Scientific and Natural Area.

A forty acre piece in the NE corner of this tract has been cultivated. The rest of the tract has been mowed for hay. Purchased in 1976, the tract has received periodic prescribed burning and mowing.

This tract lies in a very gently westward sloping interbeach area.

The most prominent topographic feature is a low beach ridge running diagonally across the tract, most evident in the south half. The largest soil mapping unit in the tract is Lohnes coarse sandy loam. The beach ridge is Sioux sandy loam in the south part, and Maddock fine sand in the north. Large irregular areas in the west half are mapped as Divide loam, and there is a lobe of Flaming fine sand on the east side.

The vegetation of this tract is similar to the east half of Bicentennial Prairie. Dry mesic and mesic prairie occupy about equal amounts of this tract. There is a long shallow swale behind the beach ridge which supports some wet prairie vegetation. The type of vegetation found along the crests of the beach ridges in the county tracts is not well developed along the beach ridges here, although most of the species are present. The old field is dominated by smooth brome (Bromus mermis) with limited recolonization by a few native plants. No state or federally listed plants are found here.

Dakota skipper was fairly common on this tract and the beach ridge provides some of the drier habitat that is believed to be favored for larval development. Probably adult insects move rather freely from Bicentennial, where there is more of this habitat, to this tract seeking nectar, making inferences concerning the productivity of this site with respect to this species speculative. This tract provides good habitat for the Powesheik skipper.

In summary, this is a good quality mesic and dry mesic prairie, tending to more mesic character than the county tracts. This may be the result of stimulation of tall grass vigor by several prescribed burns, with limited mowing for a number of years. However the fairly extensive occurrences of less well drained soils with higher available water capacity suggests the difference is more basic than the result of land

use differences.

Element Occurrences: Dakota Skipper, Powesheik Skipper, Greater Prairie Chicken.

Management Problems: The cartway running N-S through the tract allows easy access. This road is low in places, and wet spring conditions promote expansion it. In addition, use of cartways along the north and west boundaries seems to be increasing, and thus disturbing more of the tract.

Recommendations: Continued management as in the recent past. Improvement of the cartway would reduce off-road traffic.

**Keene 5, SE 1/4 Figure 20.**

This tract adjoining Bicentennial Prairie on the east and Blazing Star Prairie on the north, contains an oval-shaped area of native vegetation about 55 acres in extent. The tract is owned by Clifford Shaw of Felton who wishes to keep this area as prairie, and has applied for prairie tax credit. He plans to leave this parcel to his daughter, Betty, who has also expressed a desire to maintain it as prairie.

The prairie in this parcel has been hayed for a number of years, although it is not possible in wet years. Several piles of rotting hay bales are present on the site. The owner believes that it has never been grazed.

This tract is in a shallow closed depressional area between a low beach ridge on the west and a higher one on the east. There is an overall gentle slope from east to west, the lowest part being just behind the bounding ridge on the west.

The uncultivated area is almost perfectly coincident with a mapping



unit of poorly drained Arveson clay loam, plus an area of ponded Haplaquoll or Histosol at the west edge. Small strips of the surrounding better drained Lohnes coarse sandy loam and Lohnes sandy loam are included in the uncultivated area along its east and north edges. Nearly all of the higher soils on the tract are cultivated or in alfalfa.

Wet-mesic prairie is the main type of vegetation here. Wet prairie occurs in scattered small low areas, and more extensively at the west end surrounding the cattail marsh. The wet-mesic type grades into mesic on the better drained perimeter zones. This is all tallgrass prairie with big bluestem, prairie dropseed, switchgrass and prairie cord grass the major species. The last, with northern reed grass and sedges dominates the wet parts. Tufted Hair grass is common in the wet-mesic. Indian grass is a codominant in the mesic, and little bluestem, porcupine grass and side oats grama are found in the drier parts of this phase. Mat muhly is common in both mesic and wet mesic. Forb densities as well as diversity appeared especially high. Three species unusually abundant for sites in the Felton Prairie were dwarf wild indigo, culver's-root (Veronicastrum virginicum) and wood lily. Other common forbs include white camass (Zygadenas elegans), tall blazing star, Virginia mountain mint (Pycnanthemum virginianum), purple prairie clover, heart leaved and golden alexanders (Zizia aptera and Z. aurea), heath aster (Aster ericoides), tall meadow-rue, Maximillians's sunflower, and tall sunflower. Leadplant, hoary puccoon (Lithospermum canescens), white prairie clover, smooth aster (Aster laevis), serrate-leaved evening primrose (Oenothera serrulata) and purple cone flower are restricted to the best-drained parts. The owner reports that "white lady slippers" grow here. While the vegetative part of a lady slipper

was found, it was too late in the season for the flowers necessary for positive identification.

Element Occurrences: Small White Lady Slipper.

Recommendations: This is a very nice prairie remnant whose location adjacent to Bicentennial Prairie to the west, and Blazing Star SNA to the north make its protection more desirable than were it isolated. While the owner is unlikely to sell the property, a conservation easement might be considered. Owner cooperation will be needed to burn the adjoining portion of Bicentennial Prairie, but this should not be difficult to attain. The owner has expressed an interest in burning his parcel and may agree to burn it at the same time.

**Flowing 12, W1/2 Figure 19.**

This 320 acre tract is owned by Charles Larson of Ada, Minnesota. Mr. Larson is retired, and does not work the property himself. He plans to pass the property on to his children and expressed concern that the area remain unbroken.

Approximately 85 acres on the west side of the tract are cultivated. Prior to 1985 the rest of the tract was grazed. Approximately 150 cattle were introduced in May and removed each fall. A buried gas pipeline runs on a steep diagonal through the length of the tract. Mr. Larson does not recall any grasses having been seeded into the area, although exotic grasses are common here.

This tract lies in the nearshore lake plain just below the beach ridge complex, and is adjacent to the B-B. There is an overall gentle slope to the west, with only slight undulations apparent to the eye. Sandy alluvial deposits along a small stream draining to the west in the

N 1/2 provide some local relief. The major soils here are poorly drained Arveson clay loam, its very poorly drained depressional variant, and somewhat poorly drained Ulen fine sandy loam. A small area of poorly drained Rockwell clay loam and its depressional variant is found in the NE corner. Some Flowing fine sand occurs in the SW corner, and the NW corner is occupied by a small area of somewhat poorly drained Wyndmere fine sandy loam, bordered by a zone of moderately well-drained Lohnes sandy loam.

The vegetation is mainly wet-mesic, but downslope drainage is poorly developed, creating local wet areas, some rather extensive. The small creek appears to end in a large wet area on the west side. These areas support a generally good quality wet prairie, dominated by tall Carex spp., prairie cord grass, northern reed grass, with big bluestem and tufted hair grass (Deschampsia cespitosa) common. Forb abundance and diversity is good, with tall sunflower (Helianthus giganteus), tall meadow-rue (Thalictrum dasycarpum), spotted joe-pye-weed (Eupatorium maculatum), tall blazing star, flat-topped white aster (Aster umbellatus) and sneezeweed (Helenium autumnale) among the more conspicuous characteristic species. There may be some sedge meadow in the wettest parts. Scattered willow and red osier dogwood (Cornus stolonifera) shrubs occur in parts. The wet mesic prairie shows considerably more impact from past grazing, with the most mesic areas being badly degraded. Non native species, Canada bluegrass and redbud mainly, were abundant to dominant. Native tallgrasses in these habitats had generally not recovered from the stress of heavy grazing in the past growing season. They were usually found to be fairly common upon close examination, but their low stature and spotty reproductive effort made confident assessment by superficial observation impossible. Overall,

the native forb component of the wet mesic and mesic phases of the vegetation is fair; probably all species originally present on the tract are still here, but densities of many are quite reduced. In the most degraded areas Canada goldenrod is excessively abundant. Rest from grazing plus a burn or two would probably reveal fair quality native prairie vegetation in most of the wet-mesic habitat, but the mesic areas are unlikely to be any better than poor. They represent only a small proportion of the prairie community of this tract however.

Only one plant of special significance was found during the field survey. A small colony (possibly a clone) of the rare Hall's sedge (Carex hallii, state threatened) was encountered in a small, weakly saline spot. More of this habitat is possible on the tract, especially further towards the flatter west side which was not investigated.

This tract does not contain habitat for any of the rare butterflies, though some utilization of flowers here by insects from nearby uplands on the ranch is possible. Extensive wet areas provide habitat for several birds of interest; marbled godwits were observed at this site.

Element Occurrences: Hall's Sedge (state threatened); Marbled Godwit.

Management problems:None.

Recommendations: This tract is mainly wet mesic prairie with substantial areas of wet prairie and possibly sedge meadow. The wet prairie is in good shape, but the wet mesic, especially the areas most mesic in character, is only fair to poor, with heavy infestations of non-native grasses. The potential quality of this tract overall should be fair to good, and it may be better than it appeared after only one growing season without heavy grazing. It's location adjoining the B-B

makes its preservation much more compelling than if it were an isolated tract.

**Flowing 24, NE 1/4 and E 1/2 of SE 1/4 Figure 17.**

This 240 acre tract is owned by Kost Brothers Inc. of Moorhead. The company is currently interested in selling the tract because a buried gas pipeline runs through it, making it unusable for gravel purposes.

The tract has been grazed for a number of years. A few years ago the eastern half (on top of the beach ridge) was disked. This area has now grown back with weedy species, including leafy spurge.

A major beach ridge, running SW to NE, lies in the eastern half of the tract. A steep scarp also is present in the northern half of the tract; to the west the tract gently levels off into a wet marshy area.

Element Occurrences: Chestnut Collared Longspur.

Management Problems: Leafy spurge is a major management problem on this tract.

Recommendations: Except for the presence of the Chestnut collared longspurs, this tract is of little value except as a buffer for other property. It is thought that the Longspurs may have moved here from adjacent land on the B-B Ranch (see Appendix D). If the adjacent tract were managed for the birds, they might again shift back.

**Keene 8, E 1/2 NE 1/4 and Keene 9, W 1/4 Figures 19 and 21.**

These tracts belong to the Hanson brothers, Lester, Gunder, and Theodore, of Ulen, Minnesota. All three brothers currently work full-time farming their extensive property. Approximately 140 acres of these tracts remains undisturbed, and some of this area is registered as

prairie tax credit property.

The drier areas (although these are still fairly wet) of the tract in Keene 9 have been grazed, and in particular there is a small fenced section which has had more grazing than the rest of the area. Currently these drier areas are mowed for hay, when yearly moisture conditions make it possible to do so.

This tract is in the northern part of a large poorly drained area between cultivated beach ridges. A parallel narrow low ridge runs through the site near its west side, the higher parts of which have been cultivated.

Most of the uncultivated area is mapped as Syrene sandy clay loam, a poorly drained calcareous soil. There is a strip of ponded Haplaquoll or Histosol on the west edge. The north part of the low ridge is Flowing fine sand and the south part Lohnes sandy loam, both moderately well drained. Some small areas of Ulen fine sandy loam, somewhat poorly to moderately well drained, and Arveson clay loam, poorly drained, occur on the east side.

The slough on the west margin supports a cattail (Typha spp.) marsh for much of its length. There is a line of young cottonwoods or aspens with other trees west of the cattails. A narrow zone of disturbed wet mesic prairie borders the cultivated strip on the low ridge. Most of the low area in the tract is sedge meadow (Carex spp.) with scattered low willow shrubs, but there is some wet prairie as well (prairie cordgrass, northern reed grass. The small fenced enclosure was apparently originally wet prairie, but is now strongly dominated by sedges, rushes (Juncus spp.), and tufted hair grass, with few forbs. East of this enclosure is a small but very nice example of wet mesic to just barely mesic prairie. Big bluestem is the most important grass in

a diverse tall grass assemblage. Forb diversity and abundance is especially good. This area has some fenlike characteristics, containing many mossy, slightly marly pockets, and looks like a very poorly developed calcareous fen. Although several species that often grow in fens were present, none of the fen obligates or clump sedges were found. Several clumps of a small lady slipper, probably white, (Cypripedium candidum) were noted, but absence of flowers made positive identification impossible. Exotic grasses and forbs were not evident. This part of the tract is comparable to the Clifford Shaw tract in Keene 5 (discussed below), with perhaps even less disturbance. There is somewhat more disturbance evident toward the north end. The part of the tract in the SW 1/4 of Keene 9 was not investigated.

In summary, most of this tract is wet sedge meadow with much of the higher parts destroyed. There is a small amount of very nice wet mesic to barely mesic prairie. There is no habitat for any of the rare butterflies here. Several birds of interest were seen including sandhill cranes and prairie chickens.

Element Occurrences:Keene 9: Small White Lady's Slipper (State special concern); Sandhill Crane (Grus canadensis, State special concern); Greater Prairie Chicken.

Management Problems: None.

Recommendation: The main significance of the tract is the proximity to the B-B Ranch. It provides a good picture of what the original vegetation of the wetter portions of the ranch looked like, thus a standard for assessing the degradation of the latter. Its protection would be desirable to protect the integrity of the rest of the same poorly drained community on the Ranch, in SE 1/4 Keene 8.

**Keene 4, W 1/2 Figure 21.**

This tract is also owned by the Hanson brothers. 250 acres is pastured. A beach ridge runs from the SW to the NE with a deep trough to the east. This pasture has been grazed for many years; because of the intensity of the grazing, the vegetation was not evaluated. The only apparent vegetation is sage, goldenrod, and sedge in the wet areas.

Element Occurrences: A prairie chicken booming ground has been identified on this site, and Chestnut Collared Longspurs have been seen there in the past. Neither of these birds were seen in the current study.

Management Problems: None.

Recommendations: This site may have potential as a wetland for waterfowl production. Despite it's poor condition, it should be considered as a buffer for Blazing Star Prairie, which it adjoins.

**Hagen 33, SE 1/4 Figure 21.**

This tract also belongs to the Hanson brothers. Approximately 30 acres of the drier part is cultivated. The remaining 130 acre wet to wet mesic prairie is mowed annually for hay and is enrolled in the prairie tax credit program. The vegetation does not suggest any significant use of this land for pasture in the past. There is a faint indication in some air photographs of what may be a small abandoned field in the west part, but this was not field checked.



A prominent beach ridge crosses the NW corner of this quarter section; the rest lies in a broad interbeach zone. To the eye this part appears level, but there is a very gentle slope to the NW with the lowest part right behind the beach ridge. The drop in elevation from the SE corner to the low point is less than 20 feet over a distance of nearly 1/2 mile. There are small local depressions scattered through the center of the tract; many of these depressions have large boulders in them.

The beach ridge across the north corner is mainly Sioux sandy loam. The soil map shows a mosaic of poorly drained and somewhat poorly drained soils in the rest of the tract. There are Arveson clay loam, including its depressional phase, Syrene sandy clay loam, Fossum loamy sand and Ulen fine sandy loam. There is a narrow band of moderately well drained Swenoda sandy loam along the east side.

This tract is predominantly wet-mesic tallgrass prairie. Major species include big bluestem, prairie dropseed, switchgrass, indiagrass, prairie cord grass, and sedges. There are numerous small areas of wet prairie in local depressions, and there is probably a more continuous zone of this type along the west side marginal to the narrow slough in the lowest part. This side of the tract was not investigated; some cattails could be seen from a distance. There is some tendency toward mesic prairie along the east side; this was probably better developed towards the SE corner, which was not checked. Undoubtedly the cultivated area has destroyed the best part of the mesic prairie on this site. Forb densities and diversity both are good to excellent. It appeared almost free of exotic grass; only scattered Kentucky bluegrass was noted. There was some sow thistle (Sonchus sp.) close to the ditch on the east boundary. A few clumps of lady slippers (probably small

white) were found on the east side, but plants had finished flowering so positive identification was not possible. A small gentian, possibly Gentiana affinis, was seen in the wet-mesic habitat, but in this case it was too early in the season for confident field identification.

This site is contiguous on the south with two pastured quarter sections (N1/2 Keene 4) which were the last stronghold for Baird's sparrow in the Felton Prairie.

Element Occurrences: Small White Lady Slipper.

Management Problems: None.

Recommendations: This is the largest example of good quality prairie of this type in the Felton Prairie. The cultivation of the upland parts is regrettable, but the size of the remaining high quality prairie and diversity of lowland soils present make protection desirable. It's potential as habitat for Baird's sparrow, based on its proximity to known sites for this bird, lends further weight for protection.

#### **Hagen 33, SW 1/4 Figure 21.**

This tract is owned by Daniel Mjolness of Red Wing, Minnesota, and contains approximately 50 acres of prairie. This tract has been grazed in the past, but there is no evidence of recent use. Vegetative conditions do not indicated prolonged or intensive grazing.

This prairie remnant is confined to the low areas between old beachlines. A prominent beachline lies just east of it, and a poorly defined ridge runs along its west edge crossing part of it at the north end.

Almost the whole remnant area is mapped as Syrene sandy clay loam, a poorly drained calcareous soil. A small area of Sioux coarse sandy

loam marks the low beach ridge across the remnant.

This is a species-rich wet-mesic prairie with good diversity. Tall grass (big bluestem and prairie cord grass) and sedges are the major components. Other common grass include northern reed grass (wetter sites), indian grass (better drained), prairie dropseed, mat muhly, and hair grass. Tall forbs are common and conspicuous, especially Maximillians sunflower, and tall sunflower. There is a slight tendency in the direction of a slightly boggy, fen-like prairie frequently found on the downslope side of beach ridges. Mesic prairie undoubtedly occurs where the beach ridge crosses the site. A lady's slipper, probably small-white lady's slipper occurs here, but positive identification was not possible.

Element Occurrences: Small-white lady's slipper.

Management Problems: None.

Recommendations: A good quality mostly wet-mesic prairie remnant. Its size and irregular shape are unfortunate detractions. Acquisition would only be recommended if the adjoining Hanson property were to be purchased.

**Hagen 32, W 1/2 SE 1/4, NW1/4 Figure 20.**

The owner of this tract, Merlyn Peterman of Hawley, is currently trying to sell the property. Approximately 15 acres of native vegetation remains. The remnant was originally part of a large pasture, and was grazed by cattle and sheep. It has not been mowed or grazed for many years.

This remnant is located on top of a major beach ridge and is cut in half by the ravine of a small stream which runs from east to west.

All of the soil in the remnant is Sioux sandy loam, and the

vegetation is typical of that found on the tops of beach ridges, such as in Keene 6. This the only location in which Plains reed grass was found.

Element Occurrences: Plains Reed Grass (rare, but no formal status); Uhler's Arctic Butterfly.

Management Problems: None.

Recommendations: Due to the small size of this parcel, and the distance from other sites, acquisition is not feasible. The owner may be interested in a conservation easement.

Any tracts not mentioned in this section were not included in the study due to their distance from the main study area, small size, or intense grazing history.

#### IV. Gravel Resource of Felton Prairie

The majority of the area known as Felton Prairie lies along the gravel rich beach deposits of Glacial Lake Agassiz. As evidenced by the numerous gravel pits located along these beach ridges, the gravel in this area is easily mined and of exceptionally high quality. As this gravel interest obviously conflicts with the preservation of prairie species, details of the gravel resource in the area are of interest.

Information in the Clay County Soil Atlas indicates these surface gravel deposits lie mostly along the top of the beach ridges. All the gravel pits in the area are located in areas mapped as Sioux sandy loam, which contains more gravel than areas mapped as Lohnes coarse sandy loam, the other major soil type found on these ridges.

#### Hagen 31, Keene 6 and Bicentennial Prairie

These sections are all owned by Clay County, with the county gravel pit currently in the southern half of Keene 6. Most of the available area in Keene 6 mapped as Sioux sandy loam is already part of the existing pit, and much of the gravel near the surface has been removed. The gravel operation is currently following a lobe of this soil which extends through the NW corner of Bicentennial Prairie, which lies immediately to the east of this section. Another lobe of this soil extends from Keene 6 down through the SW corner of Bicentennial Prairie. Approximately 1/4 of Bicentennial Prairie is mapped as Sioux sandy loam. Hagen 31 has a narrow strip of this soil, running along the top of the beach ridge.

If the gravel of interest is only located in these deposits, then most of the area where gravel may be found in Keene 6 has already been opened to mining. It should be noted here that the county gravel operation is not currently using the existing gravel pit to its full

potential. The county gravel pit is shallow, and does not extend below the water table. Other gravel pits in the area are much deeper than this, extending 40 feet or more below the water table. This deep mining requires large equipment, and considerably more expense than the current surface mining now practiced. The county takes bids for its gravel mining on a yearly basis, and the company responsible for the mining may change every year. Due to this turnover in contractors and the desire for cheap gravel, expensive, deep-mining equipment is not employed.

The mining operation at the county gravel pit is not supervised by the county other than to indicate the general direction the contractors should mine in. Because of this there has been some encroachment onto the Bicentennial Prairie.

During a conversation with the Clay County engineer, it was indicated that the county intended to gravel in a north-west direction from their current location in the southern half of Keene 6. This seems contrary to what appears to be standard practice of avoiding the type of soil found in the north half of Keene 6. The county engineer did not seem to be as well informed on the subject of gravel and gravel mining as he could be, and may be unaware of the nature of the soils in the northern half of Keene 6. The southern half of Keene 6 was tested by the Minnesota Department of Transportation to evaluate the gravel resource. The northern half of this section has not been tested.

Clay County owns several additional gravel pits in the southern half of the county. The Department of Transportation performed testing of portions of two of these sites in the early 1950's, but gravel from the tested areas was exhausted by 1971. These pits are still active, but no further testing has been done. Regardless of the extent of the

resource in the southern part of the county, the cost of transportation of gravel from these southern locations has been cited as restrictively high. The gravel pit in Keene 6 is the only county owned pit in the northern part of the county.

A number of suggestions have been made in an attempt to resolve the issue of the gravel resource in these prairie areas. A short-term solution would be to encourage the county to utilize higher technology mining equipment in order to use the area which is already disturbed to its fullest potential. Gravel remaining in the current pit may serve the county's needs for many years. If this proved too cost restrictive on a yearly basis, a contractor could be brought in on a "one-shot basis", to perform extensive mining in order to create a stockpile to be used in future years. This would leave only the hauling of the gravel to be contracted for on a yearly basis.

A longer-term solution is to provide the county with gravel land at another site, in exchange for the land currently being mined. While this would be a more expensive arrangement, it may be the only permanent solution.

There is currently a large gravel operation on the B-B Ranch, operated by the Ames Gravel Company of Moorhead. This gravel operation has been on the ranch for approximately 25 years and the company has a long-term lease with the Ranch owner. The Ames Gravel Company has recently installed equipment which will allow them to mine to a depth of 100 feet below the water table. The installation of this equipment indicates they believe that there is a large amount of gravel left in the current water-filled pit which is already 40 feet deep in most places. The ranch owner has indicated that he intends to limit their activity to the section they are currently mining in, not wanting to

lose any more of his pasture land.



The section on Preserve Design and the appendices have been removed from this document.