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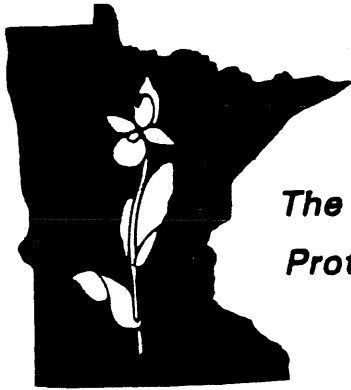
MANAGEMENT PLAN
AND
RESOURCE INVENTORY

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***The Scientific and Natural Areas Program . . .
Protecting and Managing
the Best of Minnesota's
Natural World***

TWIN VALLEY PRAIRIE
SCIENTIFIC AND NATURAL AREA

MANAGEMENT PLAN
AND
RESOURCE INVENTORY

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Division of Fish and Wildlife
Minnesota Department of Natural Resources

TWIN VALLEY PRAIRIE

MANAGEMENT PLAN

MINNESOTA CHAPTER OF

THE NATURE CONSERVANCY

January, 1980

Draft Copy

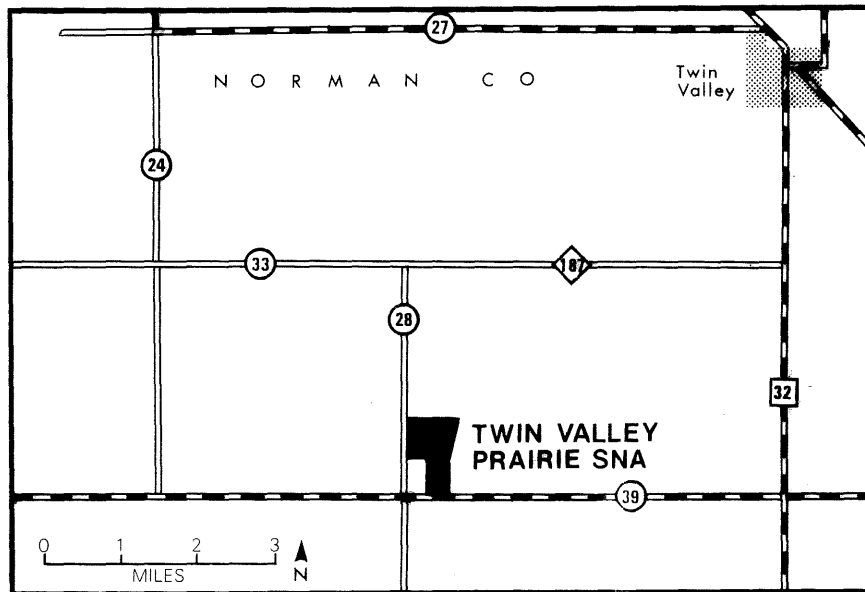


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INTRODUCTION

Twin Valley Prairie was acquired by the Nature Conservancy (TNC) because knowledgeable individuals reported that the Prairie Chickens and the tract's other prairie elements are important elements of Minnesota's natural heritage. The 1979 inventory, a cooperative project of the Minnesota Department of Natural Resources (DNR) and the Nature Conservancy, described and thoroughly documented the tract's features. This information was used by TNC to develop a site management plan. No state resources were utilized in the preparation of the management plan.

The purpose of this management plan is to describe the specific actions which will be taken in managing Twin Valley Prairie. Section I describes the general considerations which affect the management of the tract. First, TNC management guidelines are outlined. Then the Minnesota Scientific & Natural Area (SNA) Program, its policies, rules and regulations, are described. State laws affecting management are also briefly outlined. Section II describes the site-specific detailed actions to be implemented on Twin Valley Prairie. Finally, guidelines for modifying and reviewing the plan are noted in Section III.

I. MANAGEMENT CONSIDERATIONS

Introduction

Presently Twin Valley Prairie is being managed by TNC staff and volunteers. TNC's strategy for Twin Valley Prairie is to explore mechanisms by which public agencies and institutions can be included in management implementation. Our goal here is not to relinquish active TNC stewardship, but rather to develop a cooperative alliance consisting of TNC, local citizens, and one or more public agencies or institutions. This combination, we believe, provides maximum assurance that proper stewardship will be provided in perpetuity for Twin Valley Prairie.

The Scientific & Natural Area (SNA) Program of the Minnesota Department of Natural Resources (DNR) was created by legislative statute in 1969. Its goal is to:

Preserve and perpetuate the ecological diversity of Minnesota's natural heritage, including landforms, fossil remains, plant and animal communities, rare and endangered species, or other biotic features and geological formations for the scientific study and public edification as components of a healthy environment.

(DNR Policy on Scientific & Natural Areas, July, 1979)

(The SNA Program is described in detail beginning on page 8.)

Since the SNA Program objectives and philosophy so closely parallel those of TNC it is appropriate to involve the SNA Program as one member

of the cooperative alliance in the stewardship of Twin Valley Prairie. Therefore, a ten year renewable lease was signed by TNC and the DNR. This lease enabled state and federal funds to be used to evaluate the tract. It calls for the Minnesota Natural Heritage Program to review the tract for possible designation as an SNA. If Twin Valley Prairie is not designated an SNA within two years of the signing of the lease either party may terminate the agreement. If Twin Valley Prairie is designated an SNA it will be managed in accordance with SNA policies, rules and regulations. The lease also specifies procedures for the review and approval of a management plan and delineates other aspects of administering and managing the tract.

Presently the Minnesota Natural Heritage Program is in the preliminary stages of reviewing Twin Valley Prairie as a possible SNA. A decision will not be made on the site's disposition until at least June, 1980. Since it is not presently known whether Twin Valley Prairie will be designated an SNA, and since implementation concerns are dependent on this decision, this plan does not examine the means of implementing specific management actions—questions concerning who is to implement what actions, their duties, responsibilities, and authority, the priority of actions, funding sources, etc., cannot be answered at this time. Until the disposition of the tract has been resolved management actions will be undertaken by TNC staff and volunteers, and funded out of the Minnesota Chapter's preserve management account. All annual reports, survey data, research proposals, registration sheets, informational requests, etc., should be directed to:

Mr. Mark Heitlinger
Minnesota Coordinator of Preserve Management
The Nature Conservancy
328 East Hennepin Avenue
Minneapolis, MN 55414 (tel.: 612/379-2134)

If Twin Valley Prairie is designated an SNA then implementation responsibilities will be specified in a letter of agreement between TNC and the DNR. If the preserve is not designated an SNA then other disposition and management options must be explored by TNC.

The Nature Conservancy's Management Guidelines

TNC's management guidelines govern what management actions will be implemented on Twin Valley Prairie. The two primary TNC stewardship objectives are as follows:

The primary objective is to maintain areas so that they sustain species, communities, and natural features that make significant contributions to the preservation of natural diversity. The secondary objective is to determine and promote land uses compatible with the preservation of natural diversity on the preserve, in order to foster local support for individual preserves and recognition by the general public of the values of natural diversity preservation.

(Stewardship Guide for Preserve Committees, 1978)

The primary objective, the ecological objective, is closely tied to

determining which of the preserve's resources are most significant for preservation. The Minnesota Natural Heritage Program will play a major role in identifying which elements of the preserve are most significant. This assessment in turn determines how the preserve will be managed. For example, if an endangered species is the most significant element on the tract and that species requires a successional plant community, then management should be directed at perpetuating this successional stage in order to preserve the endangered species. If, on the other hand, the most significant element on the tract is a climax community then a different management program is necessary.

Management may be directed at species, communities, natural features, etc. In January, 1978 the Minnesota Chapter of TNC developed a Manual for Stewardship of Nature Conservancy Lands in Minnesota. The following guidelines are taken from this document.

If the occurrence of one or more species are determined to be significant on a preserve TNC will:

1. MAINTAIN POPULATION LEVELS SO THAT THE SPECIES CHANCES OF LONG TERM SURVIVAL ON THE TRACT REMAIN STABLE OR ARE IMPROVED.

Management to increase the population of any species should be integrated with perpetuating other native species and maintaining the tract as a diverse and naturally functioning system. There may be important

ecological factors regulating the population size of significant species and it may not be desirable in all cases to attempt to increase populations.

2. MANAGEMENT OF SPECIES POPULATIONS WILL BE ACCOMPLISHED PRINCIPALLY THROUGH MANAGEMENT OF THE SPECIES' NATURAL HABITAT AND THROUGH PROTECTION OF THE SPECIES FROM VANDALISM, POACHING AND SIMILAR THREATS.

Thus managers generally will not use artificial means, such as direct control of natural predation, manipulation of food supply through food plots, or improvement of nesting habitat through plantings or artificial shelters to manage populations. Exceptions to this guideline should only be made in certain circumstances when special actions are necessary for the survival of a species or to redress an imbalance due to a factor such as predator extinction.

Management of plant communities should also be guided by an assessment of the preserve's communities. Where management is directed toward plant communities TNC will:

3. MAINTAIN OR RESTORE SELECTED PLANT COMMUNITIES AS NEAR AS POSSIBLE TO THE CONDITIONS THEY WOULD BE IN TODAY HAD NATURAL ECOLOGICAL PROCESSES NOT BEEN DISRUPTED. THIS GUIDELINE WILL BE ACHIEVED, TO THE EXTENT FEASIBLE, BY:
 - A) PERPETUATING AND AS NECESSARY RE-ESTABLISHING NATURAL ECOLOGICAL PROCESSES; AND
 - B) MINIMIZING IMPACTS OF CHEMICAL, MECHANICAL AND SIMILAR ARTIFICIAL PROCESSES ASSOCIATED WITH HUMAN INFLUENCES.

Some preserves will be protected because they contain significant geological, hydrological or other natural features. The same Heritage Program methodology used to evaluate species and plant communities should be used to assess the importance of these features. TNC will:

4. MAINTAIN NATURAL FEATURES IN PRISTINE CONDITION AND PROTECT THEM FROM UNNATURAL CORROSION AND DETERIORATION. THIS WILL BE ACCOMPLISHED PRIMARILY THROUGH REGULATING THE LEVELS AND TYPES OF HUMAN USE AND IMPACTS THAT ACCELERATE CORROSION AND DETERIORATION.

In special instances steps may be taken to prevent or diminish even natural processes of deterioration in order to perpetuate significant natural features and other natural elements.

TNC's secondary objective, the social stewardship objective, is to foster local support for preserves and recognition by the general public of the value of natural diversity preservation. The future preservation of natural areas depends upon a constituency of users and supporters. TNC should foster the development of such a constituency by encouraging the appropriate use of preserves by educators, students, researchers, and other members of the general public. The management plan should identify appropriate types and levels of use, and specify programs to facilitate such use.

To achieve the above stewardship objective TNC will:

5. INVOLVE LOCAL RESIDENTS, USERS, AND OTHER INTERESTED MEMBERS OF THE PUBLIC IN DISCUSSIONS ABOUT STEWARDSHIP PLANNING AND IMPLEMENTATION.
6. PROVIDE INFORMATION ABOUT THE PURPOSE AND NATURAL QUALITIES OF THE PRESERVE TO THE LOCAL COMMUNITIES AND PRESERVE USERS.
7. KEEP THE PRESERVE AS FREE FROM HAZARDS TO USERS AS POSSIBLE.
8. CONDUCT STEWARDSHIP ACTIVITIES IN A WAY THAT MINIMIZES UNNECESSARY ANNOYANCES AND HAZARDS TO RESIDENTS NEAR THE PRESERVE.
9. UTILIZE PRESERVE DESIGN, SUCH AS THE PLACEMENT OF TRAILS, PARKING AREAS AND SIGNS, TO BOTH OPTIMIZE ACCESSIBILITY OF THE PRESERVE AND MINIMIZE UNDESIRABLE HUMAN IMPACTS TO THE EXTENT THAT SUCH DESIGN MEASURES DO NOT CONFLICT WITH OTHER PRESERVE OBJECTIVES.
10. PROMOTE APPROPRIATE RESEARCH AND EDUCATIONAL USE OF THE PRESERVE.

The two major stewardship objectives—ecological and social—may at times conflict with each other. People crush vegetation, erode and compact soil, alter the behavior of wildlife and transport onto preserves the seeds of unwanted plants that stick to shoes and clothing. It is the Nature Conservancy's position that:

11. ECOLOGICAL CONSIDERATIONS SHOULD BE WEIGHED MORE HEAVILY THAN HUMAN CONSIDERATIONS WHEN THERE IS A THREAT THAT SIGNIFICANT NATURAL ELEMENTS ON A PRESERVE WILL BE ALTERED OR SIGNIFICANTLY DAMAGED.

The Minnesota Scientific & Natural Area (SNA) Program

Since the SNA Program may also be involved in the stewardship of Twin Valley Prairie a description of the SNA Program management policies, rules and regulations, and pertinent legislation is included here. If Twin Valley Prairie is designated an SNA it will be managed in accordance with these statutes, policies, rules and regulations.

The SNA Program is located in the Minnesota Department of Natural Resource's (DNR) Division of Parks. The Scientific & Natural Areas Act (M.S.A. 84.033) of 1969 created the program. It authorized the Commissioner of the DNR to acquire, designate and maintain SNAs, and to adopt pertinent rules and regulations governing the use of the areas.

The DNR issued rules and regulations governing the SNAs in 1973 (Minnesota Reg. NR 300-303). The rules and regulations, still in effect, cover permitted and restricted uses of SNAs, provide for environmental protection, prohibit certain uses and acts, and establish legal penalties for violations. The rules and regulations also state that the Commissioner of the DNR can restrict: 1) travel within the unit; 2) the hours of visitation; and 3) the number of visitors within the area at any given time.

In 1975 the Scientific and Natural Areas Act was amended by the Outdoor Recreation Act (ORA; M.S.A. 86A.05). This statute further defined and more adequately funded the program. It included SNAs within the

Minnesota Outdoor Recreation System, defined the purpose of SNAs, delineated resource and site qualifications, provided for administration of the units, and classified SNAs into one of three "use designations": Research, Education and Public Use. The law states that only scientific, educational or public uses which do not impair or threaten the preservation objectives are to be allowed. Physical development is limited to facilities absolutely necessary for protection, research and education projects, and when appropriate for interpretive services. Finally, the statute requires plans be drawn up for each SNA. No development funds can be spent by the DNR until these plans have been approved.

To be designated as an SNA a site must: 1) contain elements of "exceptional scientific and educational value," and 2) "be large enough to preserve their inherent natural values and permit effective research or educational functions." The SNA staff notifies the DNR Commissioner's Advisory Committee (CAC) on SNAs and the Minnesota Natural Heritage Program of all new nominations. The SNA staff then is responsible for conducting a field survey of the site to determine the site's qualities, vulnerability, extent of man-made disturbances and management practices which may be needed. The results of this field survey are forwarded to the Heritage Program which then evaluates the significance of the site's elements. Using the field survey data and the Heritage Program evaluation the CAC assesses the site and sends a recommendation to the SNA Program. Based on the CAC recommendation, the priorities for protection as established by the Heritage Program, and on other considerations, such

as the opportunity to acquire the area, the SNA Program sets a priority for designating the area as an SNA. Recommended proposals are next sent to the Director of the Division of Parks for approval. Finally, the proposal is passed on to the Commissioner of the DNR. If the Commissioner approves the site then the land rights are acquired either by fee simple purchase, lease, donation or conservation easement. Once the Commissioner determines sufficient land rights have been acquired to administer the area as an SNA it is formally designated. The formal designation includes the classification of the site as either a Research, Educational or Public Use unit.

If and when Twin Valley Prairie is designated an SNA the Outdoor Recreation Act requires that a master plan for the area be completed and approved. The SNA Program is responsible for completing the SNA plan. After the SNA draft plan is completed the CAC and DNR review and approve it. An announcement is then made to the public and other state agencies regarding the existence of the plan. Interested persons and agencies are invited to review and comment on the plan within thirty days of the announcement. Comments received by the DNR are reviewed and appropriate changes are made in the plan. Finally, the revised plan is submitted to the State Planning Agency for review. After the DNR reviews this agency's recommendations, and makes the necessary changes, the plan is officially approved.

In July, 1979 the DNR issued a policy statement on SNAs. These policies will affect the management of Twin Valley Prairie if and when it is designated. The policies are divided into Designation, Resource Management, and Human Use Management. To ensure the preservation of the SNA's elements of natural diversity it is the DNR's policy to:

1. IDENTIFY AND CATALOG THE NATURAL FEATURES OF THE AREA.
2. ENSURE THAT RESOURCE MANAGEMENT IS DIRECTED TOWARD PRESERVATION AND MAINTENANCE OF ALL SIGNIFICANT ELEMENTS OF THE AREA.
3. MANAGE THE AREA IN SO FAR AS POSSIBLE, TO PERPETUATE OR ESTABLISH NATURAL PROCESSES AND LIMIT THE EFFECTS OF HUMAN ACTIVITIES.
4. PROMOTE WISE STEWARDSHIP WITH USERS, LOCAL RESIDENTS AND SPECIAL INTEREST GROUPS.

To fulfill these general policies the DNR will:

5. MONITOR AND EVALUATE SNA MANAGEMENT PERIODICALLY TO DETERMINE IF MANAGEMENT OBJECTIVES ARE BEING ACHIEVED.
6. USE MANAGEMENT METHOD(S) CONSIDERED MOST NATURAL AND APPROPRIATE TO THE TOTAL ENVIRONMENT OF THE AREA AND:
 - A) NOT USE COST ALONE TO DICTATE SELECTION OF THE APPROPRIATE MANAGEMENT METHODS;
 - B) DESIGN MANAGEMENT PLANS TO ADDRESS THE ECOLOGICAL INTEGRITY OF THE AREA TO PREVENT MISMANAGEMENT;
 - C) REMOVE EXISTING DEVELOPMENTS OR UNNATURAL OBJECTS UNLESS THEY ARE UNOBTRUSIVE AND NOT DETRIMENTAL TO THE PURPOSES FOR WHICH THE AREA WAS DESIGNATED OR OF HISTORIC VALUE.

7. PROHIBIT THE FOLLOWING:
 - A) CUTTING OF GRASS, BRUSH, OR OTHER VEGETATION, THINNING TREES, REMOVAL OF DEAD WOOD AND WINDFALLS, OPENING OF SCENIC VISTAS OR PLANTING EXCEPT AS PROVIDED FOR IN THE MANAGEMENT PLAN;
 - B) INTRUSIONS OF DEVELOPMENT ON, THROUGH OR OVER SNAs UNLESS ESSENTIAL TO THE MANAGEMENT OF THE UNIT;
 - C) MINERAL EXTRACTION, PEAT HARVESTING AND WATER INUNDATION OR APPROPRIATION;
 - D) COLLECTION OF PLANT, ANIMAL, HISTORIC OR GEOLOGICAL SPECIMENS (EXCEPT BY PERMIT) OR ANY CONSUMPTIVE USE OF NATURAL RESOURCES;
 - E) INTRODUCTION OF PLANT, ANIMAL OR OTHER OBJECTS, INCLUDING LIVE SEEDS OR DISEASE ORGANISMS, UNLESS EXPRESSLY PROVIDED FOR IN THE MANAGEMENT PLAN.
8. PROVIDE THE FOLLOWING:
 - A) SPECIAL MANAGEMENT TO TRANSIENT SPECIES ONLY WHEN THERE IS A WELL DEFINED NEED;
 - B) SPECIAL MANAGEMENT FOR BALD EAGLE NESTS AND COLONIAL WATER BIRD NESTING SITES WHERE APPROPRIATE;
 - C) REVIEW OF DNR PERMITS AND ACTIONS TO MINIMIZE ADVERSE EFFECTS ON A DESIGNATED SNA.
9. INVOLVE USERS, LOCAL RESIDENTS, AND SPECIAL INTEREST GROUPS IN THE MANAGEMENT OF THE SNA AND ENFORCEMENT OF RULES.
10. ESTABLISH A WORKING RELATIONSHIP WITH ADJACENT LANDOWNERS SO AS TO MINIMIZE OR ELIMINATE THOSE LAND USE PRACTICES HAVING AN ADVERSE IMPACT ON THE SNA.

To ensure the preservation of SNA resources and provide for use of the area it is the DNR's policy to:

11. LIMIT HUMAN USE ON SNAs TO THE AMOUNT THE RESOURCE CAN TOLERATE WITHOUT DAMAGE TO SPECIAL FEATURES.
12. PROVIDE FOR THE INTERPRETATION OF THE SPECIAL FEATURES AND THEIR MANAGEMENT.

13. SEEK INPUT FROM USERS, LOCAL RESIDENTS AND SPECIAL INTEREST GROUPS IN DECISIONS REGARDING MUST SUITABLE USE(S).
14. REQUIRE USERS ENGAGED IN SCIENTIFIC STUDY TO MAKE INFORMATION OBTAINED ON THE SNA AVAILABLE TO THE DNR AND ENCOURAGE USERS TO MAKE THEIR STUDIES AVAILABLE TO THE SCIENTIFIC COMMUNITY THROUGH REPORTS OR PUBLISHED ARTICLES.

To fulfill these general policies the DNR will:

15. ENCOURAGE:
 - A) ACTIVITIES WHICH CAN OCCUR EQUALLY WELL ON LESS VULNERABLE OUTDOOR AREAS TO BE CONDUCTED ELSEWHERE;
 - B) SCIENTIFIC STUDIES, PHOTOGRAPHY, AND KEEPING OF PHENOLOGICAL RECORDS AND FAUNAL AND FLORAL LISTS FOR LONG TERM RESEARCH AND EDUCATIONAL BENEFITS;
 - C) APPROPRIATE USERS AND PUBLIC SUPPORT RATHER THAN UNRESTRICTED PUBLIC USE.
16. PROHIBIT THE FOLLOWING ACTIVITIES UNLESS NECESSARY FOR MANAGEMENT PURPOSES OR SPECIFICALLY AUTHORIZED BY THE MANAGEMENT PLAN: COLLECTING PLANTS AND ANIMALS, HUNTING, FISHING, CAMPING, PICNICKING, HORSEBACK RIDING, MOTORIZED VEHICLE USE WITH THE EXCEPTION OF PARKING FACILITIES AND SIMILAR ACTIVITIES.
17. ASSURE STRUCTURES, TRAILS AND SIGNS ARE AS SPECIFIED IN THE MANAGEMENT PLAN AND IN KEEPING WITH THE NATURAL SURROUNDINGS AND PRESENT ONLY SO FAR AS REQUIRED FOR RESOURCE PROTECTION AND PROVISION OF BASIC USER NEEDS.
18. ADAPT INTERPRETIVE TECHNIQUES AND MATERIALS TO THE USER.
19. LIMIT OR EXCLUDE USE FROM AN AREA FOR AN APPROPRIATE PERIOD OF TIME WHEN IMPORTANT NATURAL FEATURES ARE THREATENED AS A RESULT OF SUCH USE.

20. CLEARLY POST THE PROCESS FOR OBTAINING A VISITOR USE PERMIT WHEN REQUIRED, AT THE ENTRANCE TO THE SNA.
21. NOTIFY ADJACENT LANDOWNERS AND INTERESTED PARTIES PRIOR TO IMPLEMENTING MAJOR MANAGEMENT ACTIONS.
22. ERECT BOUNDARY SIGNS AS SPECIFIED IN THE MANAGEMENT PLAN TO DISCOURAGE ENCROACHMENT AND TRESPASS ONTO THE SNA AND ONTO ADJACENT PROPERTY BY SNA USERS.
23. REQUIRE A "PACK OUT WHAT YOU BRING IN" LITTER PHILOSOPHY AND ENFORCE LITTER REGULATIONS.
24. FENCE ONLY WHEN NECESSARY TO CORRECT PERSISTENT ENCROACHMENT OR TRESPASS PROBLEMS TO THE SNA OR ADJACENT PROPERTY.
25. REGULATE USE BY EMPLOYING, SINGLY OR IN COMBINATION, METHODS THAT INCLUDE BUT ARE NOT LIMITED TO THE FOLLOWING:
 - A) NO ACCESS RESTRICTIONS;
 - B) ACCESS BY PERMIT ONLY;
 - C) ACCESS ON DESIGNATED TRAILS ONLY;
 - D) TEMPORAL OR SPATIAL ZONING.
26. REQUIRE:
 - A) REVIEW OF ALL RESEARCH PROPOSALS FOR THE SNA WITH EMPHASIS ON THE PROPOSED RESEARCH METHODOLOGY;
 - B) IF NECESSARY, BONDING OF RESEARCHERS TO GUARANTEE CLEAN-UP FOLLOWING COMPLETION OF THE PROJECT(S).

Other Management Considerations

If and when Twin Valley Prairie is designated an SNA the lease will influence the management of the tract. The lease states:

1. Management planning is a joint and cooperative responsibility of the DNR and the Nature Conservancy.
2. The DNR will notify TNC thirty days prior to any proposed change in the rules and regulations. The Conservancy will then notify the DNR within thirty days if the change is acceptable or not.
3. The DNR will not cause or permit to be caused any act constituting harm or destruction of the unit.
4. The DNR shall not apply or permit application of any chemicals, including herbicide and insecticide, unless it has been provided for in the management plan or unless written permission has been first obtained from the Conservancy.
5. If consistent with the management plan a permanent recognition sign shall be erected by the DNR on the unit.
6. Upon request the DNR shall provide TNC with an annual report on use management of the unit.
7. The Conservancy shall have access to the unit at any time.
8. TNC may, with the consent of the DNR, lease all or any portion of the unit for purposes consistent with the management plan.
9. Both TNC and the DNR can terminate the lease when there is a breach of the contract.

Finally, several Minnesota statutes may affect the management of Twin Valley Prairie. They include:

1. Collecting and taking of wild animals;

Under state law (M.S. 98.48) special permits are required from the DNR, Division of Fish and Wildlife, for the collection or taking of protected wild animals.

2. Endangered species:

The Endangered Species Act (M.S.A. 97.48B) states that no endangered wild animal may be taken except under special circumstances. The DNR, Division of Fish and Wildlife, may undertake programs or promulgate rules and regulations which also affect the management of endangered or threatened species.

3. Conservation of certain flowers:

Under state law (M.S. 17.23) no member of the Orchid or Trillium families, or any species of Lotus (Nelumbo lutea), Gentian (Gentiana), Arbutus (Epigaea repens) or Lily (Lilium) can be taken or gathered in any manner from public land without the permission of the Commissioner of Agriculture and then only for scientific and herbarium purposes.

4. Control of noxious weeds:

It is the duty of all land owners, according to state law (M.S. 18.181), to eradicate or otherwise destroy all noxious weeds. Section 18.315 also states that towns and cities may take steps to control noxious weeds on state lands within the territorial limits of the towns or cities provided that the managing agency fails to take action within fourteen days of receiving notice to cut or control the weeds. The following plants are considered noxious weeds statewide: Field Bindweed; Hemp; Poison Ivy;

Leafy Spurge; Perennial Sowthistle; Bull Thistle; Canada Thistle; Musk Thistle; and Plumeless Thistle. In addition, in Norman County Hoary Allisum is classified as noxious weed.

II. MANAGEMENT ACTIONS FOR TWIN VALLEY PRAIRIE

Introduction

This section describes the specific actions to be implemented on Twin Valley Prairie. The actions are grouped into three broad categories: resource management actions, use management actions, and monitoring actions.¹ The resource management actions, in general, are primarily directed at inventorying, preserving, perpetuating, and restoring the tract's natural resources. Use management actions are directed primarily at the problems caused by, and needs of, the visitors. Monitoring actions are directed at insuring that both resource and use management actions are being effectively implemented, identifying unforeseen changes occurring on the site, and recording the results of management implementation. Under each management action there is a brief statement expanding on the action and the need for action. In parentheses there are numerical references to the various TNC guidelines and SNA policies each action is designed to carry out.

Within each of the resource, use and monitoring action categories the actions are subgrouped when possible according to function. The actions are not listed in order of priority.

1. It should be noted that these categories are artificial: use management actions affect resource management actions and vice versa. However, for the purposes of discussion it is convenient to follow this convention.

Ownership modifications are of special concern to adjacent landowners, managing agencies, users and interested parties. Ownership modifications, including fee title purchase and conservation easements, which are taken to protect a resource, facilitate management, or enhance use are therefore listed separately after the management actions have been outlined. In addition, modifications whose purpose is to protect "new" resource(s) outside the tract are noted here.

RESOURCE MANAGEMENT ACTIONS

Action 1. Develop and implement a wildfire suppression plan (TNC guideline 8; SNA policy 4).

Wildfires may threaten human health and property adjacent to the tract. However, the practices used to suppress wildfires may be more damaging to the site than the fire itself. Fire control should be to safely prevent the spread of the fire outside of the tract's boundaries, and be designed to minimize the damage produced by fire suppression activities. Several steps will be taken to achieve this goal.

Local fire authorities, the fire chief of the local fire department and the DNR area forester, should be annually contacted about control methods to use should a wildfire start on or spread into the tract. These authorities should be made aware of the nature of the tract and TNC's concern about

what suppression methods are used on the site. They should be asked to consider using natural fire breaks and backfires, rather than heavy equipment and fire plows, to contain the fire. The fire authorities should have the names and telephone numbers of the local volunteer manager and TNC preserve management coordinator to contact for assistance in the event of a fire. A map should be provided showing the tract's boundaries, access points, and fire breaks (if present).

Adjacent landowners should also be provided with the names and phone numbers of the local fire department, volunteer manager and TNC preserve management coordinator to contact in case of a fire. If a wildfire does occur on the tract the neighbors can serve as an "early warning network", alerting the proper authorities. During extreme fire danger periods neighbors and visitors should be alerted to prevent man-caused fires and to be on the lookout for fires.

Finally, the site's perimeter firebreaks, shown in Figure 1 on page 22, should be annually inspected and maintained to reduce the possibility of wildfires moving onto or off the preserve. The firebreak on the north boundary should be annually mowed and raked in the fall. Another firebreak will be necessary on the east boundary unless the adjacent land is acquired. This firebreak should also be annually mowed and raked.

- Action 2. Periodically burn segments of Twin Valley Prairie (TNC guidelines 3 and 4; SNA policies 2, 3, and 6.)

Areas like Twin Valley Prairie are thought to have burned on a regular basis before white settlement.¹ After white settlement, however, fire was suppressed. Prescription burning reinstates a natural ecological process, regulates plant succession, maintains the area's open character, thins woodland and suppresses brush, restores disturbed areas, suppresses alien (non-native) species, perpetuates fire-dependent plants, removes built-up fuel (and thus reduces the wildfire hazard), and improves the habitat for certain animals.

Twin Valley Prairie is divided into two burn units (See Figure 1).² The interior firebreak separating the two units should be mowed and raked the fall before a scheduled spring burn. The small southern unit will be the first area burned. It should be burned in early to mid May for 3-4 years in succession (recovery phase). Thereafter, the south unit will be burned once every four years between April 10-30 in an average year (maintenance phase).

1. See for instance J. T. Curtis, *The Vegetation of Wisconsin* (Madison Univ. of Wisconsin Press, 1959), and R. Daubenmie, *Ecology of fire in grasslands*, *Advanc. Ecol. Res.* 5 (1968), 209-266. A survey at the preserve prior to the initiation of prescribed burning revealed old charred stumps. This also suggests the occurrence of fires in the past.
2. This prescription burn plan was developed by Mark Heitlinger, TNC Minnesota Coordinator of Preserve Management, and is based on: 1) his knowledge and experience in burning similar areas; 2) an assessment of the tract's soils and vegetation, and 3) the conditions required to burn safely.

Once the south unit is on the four year maintenance burn schedule, the prescribed burn recovery phase will commence on the north unit—i.e., the north unit will be burned for 3-4 successive years in early May, then once every four years in April. Under no circumstances will both the north and south units be burned together in the spring of the same year.

TNC procedures for prescription burning should be followed for all planned burns: 1) a prescribed burning proposal must be prepared and approved by authorized TNC personnel; 2) all conditions described in the proposal, including the crew, fire boss, equipment, weather, fire-breaks, DNR permits, courtesy notifications, and publicity, must be in effect for a burn to occur. Following a burn, a prescribed burning report must be submitted to the Nature Conservancy office. (See Appendix III, Procedures for prescription burning, in the Manual for stewardship of Nature Conservancy Lands in Minnesota, for more information.)

Action 3. Mow an area(s) on the tract for Prairie Chicken booming displays (TNC guidelines 1, and 2; SNA policies 2 and 3).

This action will provide additional habitat which the Prairie Chickens require. It thus will help insure that the chickens continue to breed on the preserve. The number of areas to be mowed, area size, location (the chickens prefer short grass prominent knolls), mowing frequencies, mowing procedures, etc., will have to be worked out. Dr. Dan Svedarsky, University of Minnesota (Crookston), should be consulted on the answers to these questions.

- Action 4. Maintain the fence on the north side of the tract (TNC guidelines 3 and 4; SNA policies 2, 3, 7(E) and 24.

Cattle graze on a pasture to the north of Twin Valley Prairie. The fence on the tract's north boundary prevents these cattle from grazing on the prairie. Therefore, it is important to maintain a four-strand barbed wire fence in good condition here. Fences should be inspected monthly to insure that nothing is leaning on or covering the fences, posts are firm, and wires are adequately strung.

- Action 5. Remove the interior fences in the north half of the east side (TNC guideline 7; SNA policies 3, 6(c) and 7(B)).

This fence is presently in disrepair. It is unnecessary, and an obtrusive sign of past human use. Also, the fence presents a potential safety hazard to visitors on the site. Before the fence is removed, however, the location of the fence line should be recorded for future reference.

- Action 6. Collect additional information on the site's flora (SNA policy 1).

The 1979 inventory did not thoroughly survey Twin Valley Prairie's sedges. This gap in the tract's baseline data should be corrected. Also, the 1979 inventory team identified several species on the tract's releve plots, but did not collect specimens of the species. These species should be verified, preferably outside of the releve plots.

USE MANAGEMENT ACTIONS

- Action 7. Request the adjacent farmers to not drive their vehicles through the tract (TNC guidelines 3, and 4; SNA policies 3, 10, 11, and 16).

In 1979 a farmer reportedly drove his tractor through the south half of the east boundary and got stuck in the tract. This activity is not appropriate for a natural area; all motorized vehicles are prohibited on the preserve. Posting the tract, educating the farmers about the area and its sensitivity to disturbance, and requesting that farmers take care to not drive on the preserve, will probably prevent this unauthorized activity in the future. Legal action should be taken as a 1st resort if motorized trespass continues to be a problem.

- Action 8. Develop and implement a parking plan (TNC guidelines 9 and 10; SNA policies 15(C) and 25).

Visitor access is an important management consideration. Presently there is no designated place to park—people park on the road, (which causes a safety problem) on the field road on the east boundary (blocking the farmer's access for his vehicles), and on the field on the southwest corner of the north half (trespassing on adjacent property). A parking area should be developed on a relatively flat, dry area. It should be kept small (i.e., space for four to six cars or a bus) to keep costs down, minimize impacts on the tract and discourage inappropriate public use. Two options are possible

for parking: an easement can be obtained from the adjacent landowner so cars can park in the southwest field (See Figure 1 on page 22), or a parking area could be developed on the preserve. The DNR Bureau of Engineering should be consulted about the parking area location, design, and surfacing. Gates or fencing may be needed to keep visitors from driving beyond the parking area and to control access to the site.

Action 9. Erect and maintain a main recognition sign near the parking area (TNC guidelines 7, 9, and 10; SNA policies 3, 7, 15, and 16).

An interim TNC recognition sign should be erected on the site. The sign should follow standard TNC design. It should be visible from the road, note the owner and purpose of the area and direct visitors to the registration box. If and when Twin Valley Prairie is designated an SNA this sign will be replaced with an SNA sign. As noted in The Nature Conservancy-DNR lease the SNA sign should state the land was acquired by TNC and managed as an SNA by the DNR. The sign should be annually touched up with Olympic wood stain, and the letters repainted. Other maintenance actions should be taken as required.

Action 10. Post new signs on all the tract's boundaries and maintain the signs (TNC guidelines 3, 4, 7, 8, 9, and 10; SNA policies 3, 7, 15, 16, and 22).

All of the tract's boundaries should be posted to prevent inadvertent encroachment by adjacent landowners, minimize unauthorized activities, (e.g., hunting), and to identify the area's boundaries to users and managers. If the tract is not designated an SNA in the near future, new signs will be posted on an experimental basis on all the tract's boundaries. These new signs will be more attractive and less negative than the old TNC signs they replace. TNC's present signs emphasize what activities are prohibited on the tract. The new sign will help promote TNC's cause to the local community and help form a positive image of the tract and its managers. The signs should be set no more than one-tenth mile apart; if visibility is obstructed they should be set closer together. At corners posts should be set so that signs are nearly touching and at the same angle as the boundary line. All signs and posts should be checked annually and repaired and replaced when necessary. As noted above, the new signs are an experiment; if problems develop on the tract then the signs may have to be changed.

The above action does not apply if Twin Valley Prairie is designated an SNA. The SNA Program will then determine what action to take on posting. All TNC signs will be phased out.

- Action 11. Erect a registration box and maintain the box and its supplies (TNC guidelines 4, 6, 7, 9, and 10; SNA policies 3, 4, 7, 9, 12, 13, 15, 16, 23, and 26.)

The registration box should be of standard TNC design. It should be erected in a conspicuous location approximately fifty feet from the parking area. The registration box should be annually touched up with Olympic wood stain; other maintenance actions should be taken as required. During the spring, summer and fall the box should be checked bi-weekly to see that adequate copies of maps, brochures, registration sheets and other relevant information notices (including notices on upcoming special events, the nearest DNR or volunteer information source, the SNA rules and regulations (if appropriate) and/or TNC rules and regulations) are present.

Two sets of 5 x 7 standardized comment cards will also be kept in the box. One set of cards will be available for users to write comments on management and use of the tract (e.g., problems observed on the tract, proposals for management, evaluation of the managers). The other set of cards will be available for users to write observations on the site's natural features. These cards will ask: the observer's name and address; what species were seen; the number of individuals seen; where the species were observed (space can be left for a sketch); and other remarks (e.g., presence of nesting activity, territorial behavior, identifying marks of unknown species). The back of the cards will have instructions and note the purpose of the cards. A list of those species which are of particular interest to managers and scientists could also be included here. The observation cards, the management comment cards and the registration sheets can provide valuable monitoring data to managers. It is therefore important to collect the cards, and the registration sheets, and keep them for analysis.

- Action 12. Develop and distribute a map showing the tract's boundaries and general features of interest (TNC guidelines 6, 7, and 10; SNA policies 12, and 15(C)).

This map should be distributed to users, potential users, adjacent landowners and interested parties until a Twin Valley Prairie brochure is developed. The map can be used to increase visitor appreciation of the area, and answer questions which visitors and landowners may have.

- Action 13. Develop a brochure on Twin Valley Prairie and distribute it to users, potential users, adjacent landowners and other interested parties (TNC guidelines 4, 6, 7, and 10; SNA policies 3, 4, 7, 8, 12, 15, 16, 23, and 26).

The brochure should include an accurate map of the area, a description of Twin Valley Prairie's history, natural features and significance, and a discussion of the impacts caused by people. It shall describe the Nature Conservancy-SNA Program (if appropriate), note conducted tours, promote a "pack out what you bring in" litter philosophy, identify people to contact for more information about the site, and encourage visitors to register, provide comments, and become involved in managing the area. Finally, the brochure should note Nature Conservancy and/or SNA rules and regulations governing use, including the requirement that all researchers obtain permission prior to conducting research on the area.

- Action 14. Encourage local middle and secondary schools, regional education institutions, and researchers to use the site if appropriate (TNC guidelines 6 and 10; SNA policies 4, 12, and 15).

Bemidji State University, Moorhead State University, North Dakota State University (Fargo), the University of Minnesota (Crookston), the University of North Dakota (Grand Forks), the Minnesota Environmental Education Board's region I coordinator in Bemidji, and all middle and secondary schools within the vicinity of Twin Valley Prairie (up to thirty miles away) should be periodically contacted. These groups should know of the site's existence, its potential for teaching such topics as native flora and fauna, ecology and geology, and the names of whom to contact for more information (i.e., the local volunteer manager, TNC preserve management coordinator, DNR regional naturalist). An effort should be made to meet annually with all teachers and researchers who express an interest in the site. Educational and research opportunities can be promoted at these meetings. However, the sensitivity of the resources and user responsibility in caring for the land must also be stressed. Use should only be encouraged if appropriate, i.e., if such use cannot occur equally well on other less vulnerable areas. All teachers and researchers should be aware of site rules and regulations, such as the need to obtain a permit prior to collecting or conducting research in the area, before they step onto the tract. Before a class comes to the tract teacher workshops should be held so that the teachers are trained and well-informed about the area. When the class comes to the site managers or scientists should, if possible, also be present to assist the teachers.

- Action 15. Conduct guided field walks on Twin Valley Prairie (TNC guidelines 5, 6, and 10; SNA policies 4, 12, 13, and 15(C)).

The guided walks can be used to educate visitors about the area's resources, inform visitors about the Nature Conservancy-SNA Program (if appropriate), obtain visitor feedback on management, and make visitors feel like land stewards—involved in managing the site and responsible for its well-being. (See also Action 22.) The number of conducted tours depends on time and money limitations, and the impact of the tours on the area. Late May through October are ideal times to lead walks on the tract. News releases should be sent to the local media to publicize the walks, and a reporter(s) should be periodically asked to participate in the walks.

- Action 16. Remove the two shredded plastic bags from the area, and conduct additional litter cleanup operations as needed (TNC guidelines 4 and 7; SNA policies 3, 6(c) and 23).

The approximate locations of the two plastic bags are shown in Figure 1 on page 22. These bags are unsightly and detrimental to the purposes which Twin Valley Prairie serves; they should be removed. Although there presently is not a litter problem on Twin Valley Prairie, litter cleanup operations may become necessary in the future. Users will be encouraged to look for and dispose of litter properly.

MONITORING ACTIONS

- Action 17. Recruit a local volunteer manager preferably living within three to four miles of the tract (TNC guidelines 1, 2, 3, 4, 5, 6, 7, 8, and 10; SNA policies 1, 2, 3, 4, 5, 7, 8, 10, 13, 15, 16, and 21).

Volunteer managers must have the time, interest and willingness to become intimately involved with the protection and management of the site. Their job is primarily to: 1) maintain the registration box supplies and collect registration sheets and comment cards; 2) monitor the tract for signs of misuse or management problems and communicate them to TNC (a "watchdog" function); 3) facilitate communications between TNC, local residents, and other parties; 4) aid professional resource managers when requested; and 5) orient new managers to the site and the local community. One possible volunteer manager candidate is Robert Visser. Mr. Visser, who lives in Ada, should be asked if he would accept the position.

- Action 18. Develop and maintain a close relationship with local and regional government officials, natural resource management professionals, and other appropriate individuals (TNC guidelines 5, 6, and 8; SNA policies 4, 5, 9, 13, and 21).

Local and regional governmental officials (e.g., the mayor, county assessor, county board members) and resource management professionals (e.g., the county extension agent, DNR area wildlife manager, Soil Conservation Service district conservationist, U. S. Fish & Wildlife Service

managers) should be annually contacted and informed about the site. These individuals are all concerned with natural resources in their respective capacities. They should be aware of the site, its importance, and major management actions which are planned for or being implemented on the tract. This action can help eliminate public suspicions and misconceptions, build trust and rapport, and increase community support. It is also a way of monitoring what the public feels about the site and the managers.

Keeping in close contact with local and regional professional resource managers is also important. These individuals, if they are aware of the site and interested in its preservation, can provide valuable expertise and manpower, and lend equipment if needed for management. As local residents they can help generate community support for the tract. Cooperative management efforts can also sometimes be used to solve problems which affect (or could affect) several sites in the area, including the preserve.

Action 19. Contact the local DNR conservation officer (C.O.) and request his assistance in managing the site (TNC guidelines 2, 3, and 4; SNA policies 4, 7, 16, and 23).

This action should be taken at least once per year. Since the C.O. is the primary natural resource enforcement officer it is important to bring the site to his attention and familiarize him with its resources and problems. This action is also necessary to obtain advice on management, such as on enforcement activities.

- Action 20. Hold periodic meetings for the local residents (TNC guidelines 5, 6, 7, 8, and 10; SNA policies 3, 4, 5, 9, 10, 13, and 21).

Meetings will be publicized through news releases sent to the local media (a reporter might also be asked to attend). They will be held at least once per year at a time and place convenient for local residents, perhaps in conjunction with a field trip or other activity; special circumstances, such as the implementation of a major management action, may warrant more than one meeting. These meetings can be used to enlist support for project work (e.g., monitoring), as a forum to discuss management decisions, problems, and actions, or to encourage landowners to adopt various practices. It is particularly important that adjacent landowners and frequent users be present at these meetings since their actions can have a large impact on the tract and vice versa. All comments regarding management should be recorded.

- Action 21. Maintain close contact with all scientists who are using the site for educational and research purposes (TNC guidelines 4, 5, and 6; SNA policies 1, 2, 3, 4, 5, 9, 12, 13, and 15).

Scientists, as trained observers, can provide valuable information and insights on managing the site. Data gathered from scientific studies are also important for monitoring the site. Thus all scientists using the site will be annually contacted and consulted about their studies, data, and conclusions. Researchers should also be consulted about natural changes

and human impacts they discover while on the tract, and be encouraged to offer input into managing the tract. Finally, research information should be accumulated, stored in a site file, and shared with interested parties.

Action 22. Periodically inspect the site (TNC guidelines 1, 2, 3, 4, 7 and 8; SNA policies 1, 2, 3, 5, 6(C), 7, 11, 16, and 23).

The site shall be thoroughly inspected at least once per month for human impacts (e.g., vandalism, unauthorized trails, trampling of plants, littering, the disturbance of sensitive resources), signs of violations in rules and regulations (e.g., hunting, snowmobiling, horseback riding), and natural changes in the tract (e.g., insect infestations). If urgent action is required on the site TNC should be contacted immediately. Otherwise, records should be kept of observations for the annual status report.

The inspections are also an opportunity to gather feedback from users in the area concerning the site and management actions. On randomly selected days the number of visitors in the area could be counted for a comparison with the number that registered. Visitors observed violating rules and regulations should be tactfully asked to correct their behavior, e.g., remove rubbish dumped on the site. Serious problems requiring immediate attention should be referred to the DNR conservation officer or county sheriff. A report should be submitted to TNC if further action is advisable.

- Action 23. Develop and implement a vegetation monitoring program (TNC guidelines 1, 2, 3, and 4; SNA policies 1, 2, 3, and 5).

Changes in vegetation can significantly affect all the other features of a natural area. Thus a monitoring program is necessary to keep track of vegetative changes occurring on the tract. The releve plots and photopoints set up in the 1979 SNA inventory should be periodically sampled every year. Color IR aerial photographs should be taken of the site once every five years. Additional monitoring programs may be developed to further record changes in the vegetation.

- Action 24. Develop and implement monitoring programs for Cypripedium candidum (TNC guidelines 1 and 4; SNA policies 2, 3, and 5).

The White Lady-Slipper is a proposed nationally threatened plant. It has been listed as element of potential state significance, according to the Minnesota Heritage Program, and therefore warrants special attention. An annual record should be kept of the site's population, consisting of: a stem count; a count of plants which flower or fruit, maps showing the plants' location, and any trends which are identified. Mark Heitlinger and other botanists will provide information on exactly what techniques and procedures to follow on the tract.

- Action 25. Develop and implement monitoring programs for the Dakota Skipper Greater Prairie Chicken, Marbled Godwit, Prairie Vole and Sandhill Crane (TNC guidelines 1 and 4; SNA policies 2, 3, and 5).

These species have been identified on, adjacent to, or in the vicinity of the tract by the 1979 SNA inventory team or by others within the last two years. They have been listed by the Minnesota Heritage Program as elements of potential state significance, and therefore warrant special attention.

A site record will be kept, and periodically updated, on each species' population. The record should include information on population abundance (estimates or counts), breeding status, site location, and trends. Once every five years in late May or early June (between 8 A.M. and 6 P.M.) a cable will be dragged over the prairie to determine what bird species are nesting here. This method will provide useful information on all the tract's birds.¹ The DNR regional wildlife manager, Carrol Henderson (DNR Supervisor of Non-game Wildlife), and other experts (e.g., Robert Dana on the Dakota Skipper) will be asked to provide detailed information on what monitoring techniques and procedures to use on Twin Valley Prairie.

1. See Kenneth F. Higgins et al, Construction and operation of cable-chain drag for nest searches, Wildlife Leaflet 512 (Washington, DC: U.S. Fish & Wildlife Service, 1977).

- Action 26. Develop and implement a water table monitoring program (TNC guideline 4; SNA policies 1, 2, 3, and 5).

Presently there is no information on the tract's water table. Changes in the water table may adversely affect the tract's biota. Therefore, the depth of the groundwater should be measured annually using the method described by Turnock & Lawrence.¹ Analysis of this data will show if any changes are occurring, the magnitude of the changes, and possibly provide clues on the cause of the change (e.g., climate, irrigation).

- Action 27. Submit an annual written report to TNC and the SNA Program (if appropriate) (TNC guidelines 1, 2, 3, and 4; SNA policies 1, 2, 3 and 5).

The annual report shall note completed management actions, progress made in implementing other actions, number of users and violations (compared against preceding years), solicited and unsolicited comments regarding management, research proposals and studies underway, changes in the resources, problems identified by managers, local residents and researchers, and recommendations for changes in the management plan.

1. William Turnock & Donald B. Lawrence, Measurement of the level of groundwater at the Cedar Creek Forest (Mimeo, 1953). For more information contact the Sherburne National Wildlife Refuge where this method was also used.

OWNERSHIP MODIFICATIONS:

Two ownership modifications are called for in the Twin Valley management plan, although one of these modifications may not be necessary. Figure 1 shows the locations of the two areas. The parcel on the north half of the east boundary, shaped like a triangle, should be acquired. This land would greatly facilitate prescribed burning in the northeast part of the tract. The second ownership modification depends on where the parking area is located: it may be necessary to acquire an easement if the field in the southwest corner is judged the best spot for parking.

III. REVIEW OF THE PLAN

The actions outlined in this plan must be considered provisional, not definitive, and should be reviewed periodically to see that they are still relevant in light of current conditions. Changes in the site's resources, users, and other management considerations are bound to occur. If warranted, the plan's management actions can and should be modified so that they more effectively and/or efficiently implement TNC guidelines and SNA policies (if appropriate). All proposed actions should be primarily directed at protecting and preserving elements which are a significant part of Minnesota's natural diversity. In any event the plan should be thoroughly reviewed and updated at a minimum of every ten years.

The 1979 Resource Inventory

for

Twin Valley Prairie

Norman County, Minnesota

NW $\frac{1}{4}$ of E $\frac{1}{2}$ of SW $\frac{1}{4}$, Section 23

Township 143 North, Range 45 West

Syre Quadrangle

Prepared by

The Scientific and Natural Areas Section

Division of Parks and Recreation

Minnesota Department of Natural Resources

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INTRODUCTION

Scope and Organization

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

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

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

Chapter served as inventory advisors. Michael Rees, student intern, The Nature Conservancy, provided editorial assistance. Other individuals who assisted in the preparation of the inventory are mentioned in the appropriate sections. Their help is gratefully acknowledged.

Description of Study Area

Twin Valley Prairie is a 240 acre unit in southern Norman County, approximately 29 miles northeast of Moorhead, Minnesota. The area's climate is mid-continental, relatively cool and moist, with warm summers and cold winters. A prominent glacial Lake Agassiz beach ridge and associated marsh are found on the site. The beach ridge is visible as a broad, linear swell of wave deposited sands and gravels. Poorly to excessively drained soils formed on Twin Valley Prairie in coarse beach ridge and outwash material under tall prairie grasses and wetland vegetation. Present vegetation is primarily native prairie, sedge meadow, and marsh communities.

The flora and fauna of Twin Valley Prairie are mostly typical of native Minnesota grassland. Species observed on the tract include: 170 vascular plants, 27 butterflies, 39 birds, 6 mammals, and 4 amphibians.

Twin Valley Prairie is in a small grain, potato, sunflower, legume seed, and hay production area. A small portion of the natural area has been plowed, and larger areas were hayed prior to preservation. No evidence of domestic grazing was found.

Preliminary Assessment of Significance

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

Twin Valley Prairie is notable as a tract of native prairie on and adjacent to a Glacial Lake Agassiz beach ridge. Six species of national and/or state significance were identified on the site during the 1979 inventory. The White Lady-Slipper (Cypripedium candidum), restricted to wet prairie-calcareous soil habitats (Gleason & Cronquist, 1963), has been proposed for federally threatened status by the Smithsonian Institute (Ayensu & DeFilipps, 1978). The Dakota Skipper butterfly (Hesperia dacotae), apparently confined to undisturbed prairie (Howe, 1975), has been proposed for federally threatened status by the U. S. Fish and Wildlife Service. The Minnesota Natural Heritage Program lists White Lady-Slipper, the Greater Prairie Chicken (Tympanuchus cupido), the Sandhill Crane (Grus canadensis), the Marbled Godwit (Limosa fedoa), the Prairie Vole (Microtus ochrogaster), and the Dakota Skipper as potential elements of state significance. Greater Prairie Chickens were observed booming on cultivated fields adjacent to the site in 1979. In addition, a positive nesting record was obtained for this species on Twin Valley Prairie.

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

A well developed Lake Agassiz beach ridge crosses the site. The ridge has restricted drainage flow, causing a marsh to form adjacent to it. Although Lake Agassiz beach ridges and associated marshes are a common topographic feature in the Red River Valley, many have been cultivated or destroyed by graveling operations. Twin Valley Prairie's beach ridge and marsh are significant as topographically undisturbed landforms supporting native vegetation. The natural area supports one wetland and three prairie vegetation types representative of varying moisture conditions. Cat-tails (Typha latifolia and T. angustifolia), American Great Bulrush (Scirpus validus), and Buxbaum's Sedge (Carex buxbaumii) dominate in wetland areas. Sedges and Cord Grass (Spartina pectinata) dominate in seasonally wet areas, Big Bluestem (Andropogon gerardi), Cord Grass, and Mat Muhly (Muhlenbergia richardsonis) are found on mesic sites, and Big Bluestem, Tall Meadow Rue (Thalictrum dasycarpum), and Wolfberry (Symphoricarpos occidentalis) are found in the driest areas.

ABIOTIC FACTORS

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

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

CLIMATE

Methods

Climatological data were gathered by researching reports from the National Oceanic and Atmospheric Administration (NOAA), Minnesota Agricultural Experiment Station, and Soil Conservation Service (SCS). Most numerical data were obtained from the NOAA station at Ada, approximately 12 miles northwest of Twin Valley Prairie.

Regional Climate

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

DISCUSSION

The mean temperature for June, July, and August in the Twin Valley Prairie area is 68°F; the December, January and February mean is 10°F. On the average, there are 15 days above 90°F in the summer and 55 days below 0°F in the winter. The average duration of the freeze-free season is 125 days. The length of the total crop season, which includes the growing period for both cool and warm season plant species, averages 190 days (Baker and Strub, 1936b).

About 75%, or slightly over 18 inches, of the area's annual precipitation (water equivalent) falls during the period of April through September. June is the wettest month, with numerous thunderstorms accounting for an average of 4.2 total inches of rain. There are about 34 thunderstorms per year. Rainfall intensities of 1.9 inches per day every year, 3.5 inches per day every ten years, and 4.6 inches per day every 50 years are expected to occur. The precipitation during the winter months usually falls as snow, with an average seasonal total of 36 inches. About 110 days a year have a ground snow cover of 1 inch or more. Precipitation of 0.01 inch or more can be expected about 102 days a year. Total annual evaporation equals or exceeds total annual precipitation in the area. Prevailing winds blow from the west and northwest, except during late summer and early fall, when they shift to the southeast.

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

Table 1. Selected Weather Data for Ada.

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

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

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

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

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

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

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GEOLOGY

Methods

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

Historical Geology

Glaciation during the past 2 million years (the Pleistocene Epoch) has dominated development of the landscape of Minnesota. The most recent ice advances of the Wisconsin Stage of glaciation are responsible for the majority of the state's landforms. Northwestern Minnesota was subjected to glaciation by two major ice lobes during the Wisconsin Stage. Both left characteristic deposits of grey, calcareous glacial drift. Before 35,000 B.P. (years before present) (Bray, 1977), the Wadena lobe advanced southeastward out of Manitoba into the Red Lakes lowland area. This lobe eventually covered much of west and central Minnesota about as far south as Mankato. Following retreat of the Wadena lobe, the Des Moines lobe advanced southward from Manitoba, scouring out the Red River lowland before reaching a terminus near Des Moines, Iowa about 14,000 B.P. (Wright, 1972).

As the Des Moines lobe retreated northward, it paused briefly near Brown's Valley, Minnesota, where it formed a small recessional moraine.

This landform, called the Big Stone moraine, served the purpose of damming southward drainage from the ice front into the Red River lowland and thus forming Glacial Lake Agassiz about 12,400 B.P. (Elson, 1967).

As the ice front retreated further, Lake Agassiz grew, eventually becoming larger than all the modern Great Lakes combined. The level of Lake Agassiz fluctuated repeatedly throughout its 5,000 year history, due to various factors such as minor glacial readvances and the opening of different drainage outlets. Each of the many distinguishable lake levels is assigned a name, such as the "Herman phase". The lake drained out of the Minnesota part of the Red River Valley about 8,300 B.P.; it emptied completely about 7,300 B.P. (Elson, 1967; Wright, 1972).¹ Contemporary evidence of Lake Agassiz includes old shorelines marked by beach ridge deposits, delta deposits formed where tributary streams entered the lake, and lacustrine sand, silt, and clay deposits. A small, but well-developed Lake Agassiz beach ridge traverses Twin Valley Prairie, with numerous other beach ridges found in the area. A wet marsh area associated with the beach ridge is also present on the tract.

Beach ridges are formed when waves attach a parent material (usually glacial till, such as grey drift) that will yield sand and gravel-size particles. Wave action washes out the smaller silt and clay particles, leaving the sand and gravel portion of the drift piled in a ridge on the shore. The silts and clays are carried basinward and eventually settle out as level lacustrine deposits. Lake Agassiz beach ridges are typically 2 to 15 feet high, but may be as high as 30 feet. Width ranges from about 150 to 500 feet, although several ridges may be grouped into complexes a half

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

mile or more wide (Elson, 1967). They were formed at the shoreline at different times and at many locations and levels in the Lake Agassiz basin. Beach ridges are good indicators of former water levels. The beach ridge at Twin Valley Prairie is part of a group of disjunct beaches in the area; it is not traceable for more than a few miles.

Twin Valley Prairie was submerged under Lake Agassiz waters during the stages of the lake called the Herman, Norcross, and Tintah phases. Water depths on the site probably ranged from greater than 100 feet during the highest level Herman phase to less than 20 feet during the Tintah phase. Total time of submergence was approximately 1000 years (Elson, 1967; Upham, 1896). During this time the grey drift on the tract was gently reworked by relatively shallow Lake Agassiz waters. Some fine sediments were carried away to deeper waters, some were deposited on the preserve from shallower waters. Thus, prior to beach ridge formation, the glacial till at the site consisted of somewhat coarse, slightly reworked material mantled by layers of fine sand deposits.

Sometime between 12,000 and 11,000 B.P. (Elson, 1967), Lake Agassiz was at the Tintah level, and its shoreline was located just east of Twin Valley Prairie. Shores of the next named level, the Campbell phase, are west of the natural area. Therefore, the beach ridge on the natural area was deposited during a phase of Lake Agassiz intermediate to the Tintah and Campbell phases. At this time the glacial and lacustrine sediments on the site were reworked into a low, smoothly rounded ridge of gravel and sand. A depressional trough area was produced on the landward side of the beach ridge because of the piling of sand and gravel on the sloping drift deposits (see Hydrology Section).

Topography and Bedrock

Maximum relief of the site is between 10 and 20 feet; the crest of the beach ridge is at slightly more than 1035 feet, the marsh area is at about 1030, and the west slope of the beach ridge drops rapidly to 1025 feet and less. To the east of the beach crest the land is wet and marshy; west of the crest is drier, better drained land. The Lake Agassiz beach ridge is visible as a prominent wavelike swell, the axis trending in a north-south direction.

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

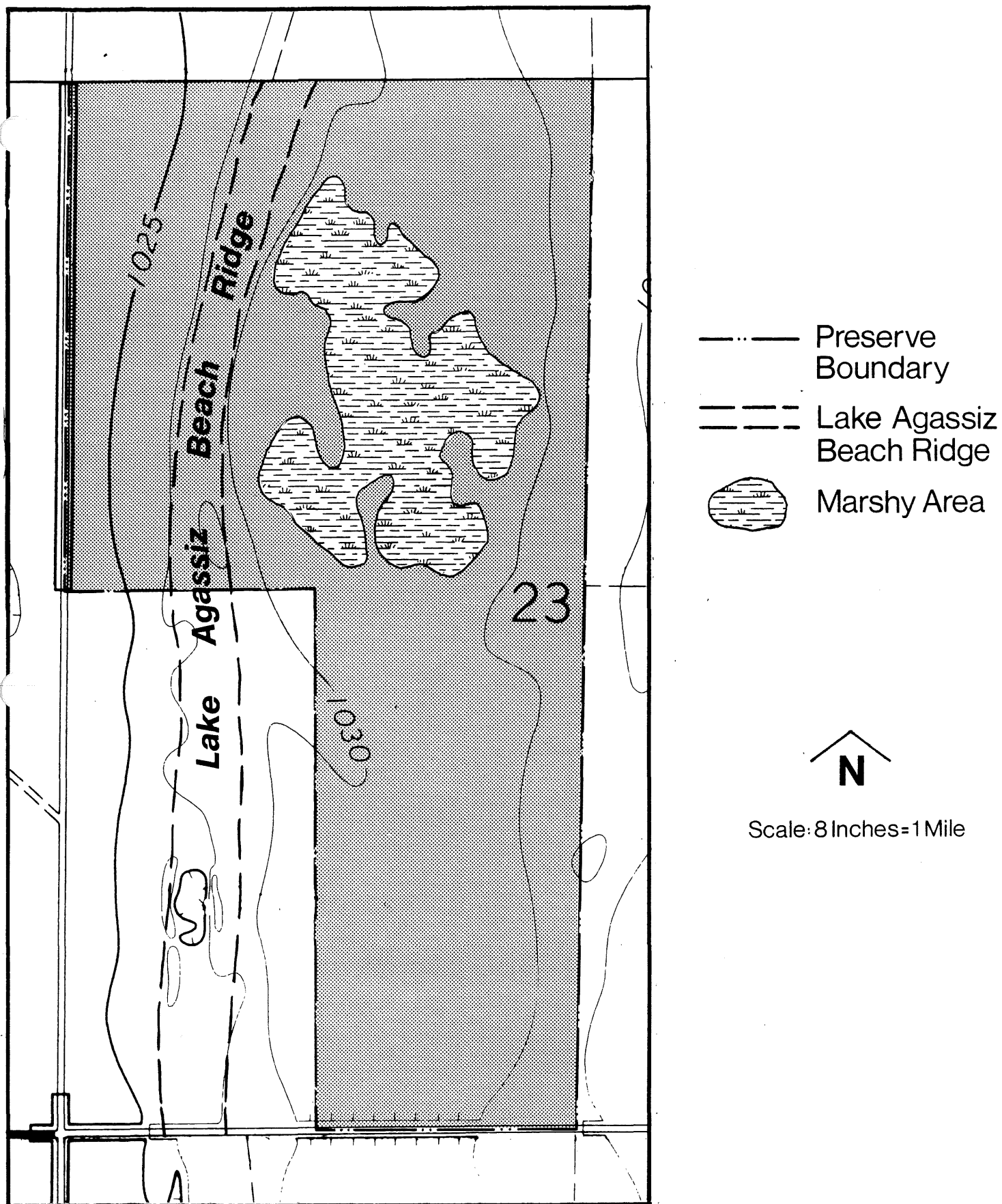


Figure 1. Topography of Twin Valley Prairie. Adapted from U.S. Geological Survey - Syre Quadrangle (1:24000) 1965.

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SOILS

Methods

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

Soils of Twin Valley Prairie

Twin Valley Prairie lies in an area of coarse to fine textured prairie soils and organic soils of glacial lake plains (Arneman, 1963). The site's soils formed in water-worked loamy glacial till, lacustrine sand deposits, and gravelly beach ridge formations associated with Glacial Lake Agassiz. Two soil associations and thirteen soil series are present on the tract.

Coarse textured soils of the Sioux-Syrene association (SCS, 1974) are found in glacial lake beach ridges and outwash areas. They cover the majority of the preserve. Most are well drained, but some poorly drained soils are found in depressional areas associated with beach ridges. This condition exists at Twin Valley Prairie (see geology section). Ulen-Arveson association soils (SCS, 1974) border on the eastern edge of the tract. They are found in areas of lacustrine fine sand deposits close to old shorelines of Lake Agassiz, and are more poorly drained than the Sioux-Syrene soils.

All soil series present, except the Markey and Marsh soils, are

1. Donald Barron, SCS, Thief River Falls, and Ray Diedrick, Soil Specialist, SCS, St. Paul, provided valuable help for this section.

mollisols, characterized by nearly black, friable surface horizons rich in organic matter. Soils of the Markey series are histosols, or wet peat and muck soils. Areas mapped as marsh are unclassified as soils due to year round wetness and extreme variability in soil materials.

Vallers, Arveson, Mavie, Rockwell, and Syrene series soils (typic calciaquolls) consist of poorly drained, seasonally wet soils with a near surface horizon of calcium carbonate accumulation and grey subsurface horizons. Topsoil is coarse to fine loamy in texture, with sandy and gravelly subsoil. All have moderately alkaline surface layers. The Hamerly and Grimstad series (aeric calciaquolls) are similar to these soils, but are better drained and aerated.

Poorly drained Hamar and Kratka series soils (typic haplaquolls) are characterized as seasonally wet mollisols with horizons in which materials have been altered or removed, but no clay or calcium carbonate has accumulated. Neutral to mildly alkaline surface layers are found in these sandy and loamy soils.

Soils directly associated with the Glacial Lake Agassiz beach ridge processes on Twin Valley Prairie are the Sioux and Markey series. The excessively drained, sandy and gravelly Sioux soils (udorthentic haploborolls) are found along the beach ridge crest. They are cool region mollisols with no horizon of clay accumulation and neutral to mildly alkaline surface layers. Markey series (terric borosaprists) are found bordering the marsh area adjacent to the beach ridge. Sandy mineral deposits underly fifty inches of organic muck in these very poorly drained soils. The flooded marsh soils are not described. Kittson soils (aquic haploborolls) are similar to those of the Sioux series, but are less well drained and loamier in texture.

Two soil complexes are mapped on Twin Valley Prairie. The Arveson and Hamar complex consists of a mixture of Arveson and Hamar series soils, and occupies small poorly drained depressional areas usually surrounded by better drained, coarser soils. Percentages of the two series within this complex varies considerably. The Rockwell and Kratka series complex occupies similar areas. Commonly these two complexes are found together.







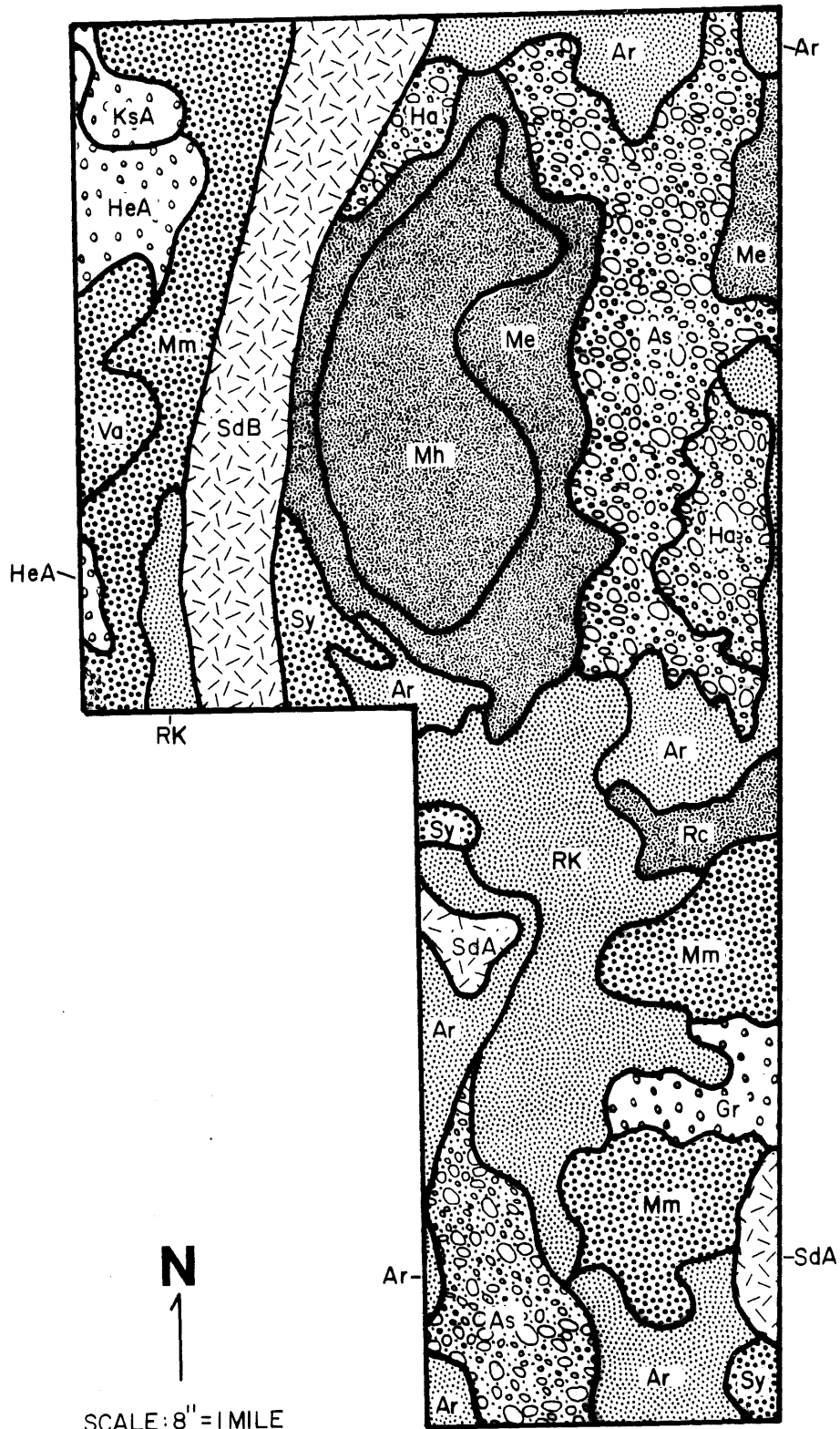
<u>KEY</u>			
<u>DRAINAGE SYMBOL</u>	<u>DRAINAGE CLASS</u>	<u>SOIL SERIES</u>	<u>MAP SYMBOL</u>
	Excessively Drained	Sioux	SdA SdB
	Moderately Well-Somewhat Poorly Drained	Hamerly Grimstad Kittson	HeA Gr KsA
	Somewhat Poorly-Poorly Drained	Hamar	Ha As
	Poorly Drained	Vallers Mavie Syrene	Va Mm Sy
	Poor-Very Poorly Drained	Kratka/Rockwell Arveson	RK Ar
	Very Poorly Drained	Markey Rockwell Marsh	Ma Rc Mh

Figure 2. Soil and drainage classes for Twin Valley Prairie.



Key to Table 2

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

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

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

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

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

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

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

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

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

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

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

COMPONENT IN STATE: Extent of acreage in state.¹

M-Major: 100,000 acres or more.

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

m-Minor: 10,000 acres or less.

LOCATION IN STATE:¹

NW - Northwestern Minnesota

W - Western Minnesota

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

TABLE 2. SOIL CHARACTERISTICS OF TWIN VALLEY PRAIRIE

	SOIL SERIES # ACRES PERCENT	DRAINAGE CLASS	DEPTH TO WATER TABLE	PARENT MATERIAL	LANDSCAPE POSITION	TEXTURE		VEGETATION		COMPONENT IN STATE	LOCATION IN STATE
						TOPSOIL	SUBSOIL	ORIGINAL	PRESENT		
typic calciaquals - 86.3 acres, 36%	Arveson ¹	P- VPD	0-3.0'	calcareous lacustrine fine sand	depressions in glacial lake and outwash plains 0-2% slopes	loam	loam, sandy loam & fine sand	tall grass prairie, reeds and sedges	prairie	I	NW
	Mavie	PD	0-3.0'	gravelly outwash over loamy till	glacial lake beach and interbeach areas 0-2% slopes	loam	grav- elly sandy loam and loam	tall grass prairie, reeds and sedges	prairie	I	NW
	Rockwell ²	VPD	0.3.0'	lacustrine fine sand over loamy till	glacial lake plains and interbeach areas 0-1% slopes	sandy clay loam	fine sand and loam	tall grass prairie, reeds and sedges	prairie	I	NW
	Syrene	PD	0-3.0'	loamy over gravelly lacustrine deposits	glacial lake plains and beach ridges 0-2% slopes	loam	grav- elly loamy sand	tall grass prairie, reeds and sedges	prairie, sedge, meadow	I	NW

1. Also mapped in complex with Hamar series, covering 31.1 acres, 13.0% of preserve.

2. Also mapped in complex with Kratka series, covering 24.2 acres, 10.1% of preserve.

TABLE 2. SOIL CHARACTERISTICS OF TWIN VALLEY PRAIRIE Continued

TYPICAL SOILS OF THE SOUTHWESTERN PART OF THE STATE												
	SOIL SERIES # ACRES PERCENT	DRAINAGE CLASS	DEPTH TO WATER TABLE	PARENT MATERIAL	LANDSCAPE POSITION	TEXTURE		VEGETATION		COMPONENT IN STATE	LOCATION IN STATE	
						TOPSOIL	SUBSOIL	ORIGINAL	PRESENT			
aquic haploborolls	typic calciaquolls	Vallers	PD	2.0-6.0'	calcareous glacial till	glacial ground moraines 0-2% slopes	silty clay loam	clay loam over loam	tall grass prairie, reeds and sedges	prairie	M	NW & W
	aeric calciaquolls 6.9 acres, 2.9%	Hamerly	MW- SPD	2.0-6.0'	water-worked loam and clay loam till	upland till plains 0-5% slopes	sandy loam	loamy fine sand and loamy sand	tall grass prairie	prairie	M	NW & W
		Grimstad	MW- SPD	2.5-6.0'	fine sand over loamy till and lacustrine sediments	glacial lake plains 0-4% slopes	sandy loam	loamy fine sand and loamy sand	tall grass prairie	prairie	I	NW
		Kittson 3.5 acres 1.5%	MW- SPD	2.5-6.0'	water-worked loam and clay loam till	glacial lake plain and interbeach areas 0.4% slopes	loam	loam and clay loam	tall grass prairie	prairie	M	NW

TABLE 2. SOIL CHARACTERISTICS OF TWIN VALLEY PRAIRIE Continued

	SOIL SERIES # ACRES PERCENT	DRAINAGE CLASS	DEPTH TO WATER TABLE	PARENT MATERIAL	LANDSCAPE POSITION	TEXTURE		VEGETATION		COMPONENT IN STATE	LOCATION IN STATE
						TOPSOIL	SUBSOIL	ORIGINAL	PRESENT		
typic haplaquolls	Kratka	P- VPD	0-3.0'	lacustrine sand over loamy till	depressions in glacial lake plains 0-1% slopes	loamy sand	fine sand and loam	tall grass prairie, reeds and sedges	sedge meadow, prairie	M	NW
	Hamar 6.9 acres 2.9%	SP- PD	0-2.0'	reworked sandy lacustrine and outwash sediments	glacial lake plains and uplands 0-2% slopes	loamy fine sand	fine sand	tall grass prairie, reeds and sedges	prairie, sedge meadow, marsh	I	NW
borosaprists	Markey 24.2 acres 10.1%	VPD	0-1.0'	organic material over mineral deposits	beach ridge and outwash plain depressions 0-2% slopes	muck	muck and sand	cat-tails, reeds and sedges	prairie, sedge meadow, marsh	M	NW W & N
udorthentic haploborolls	Sioux 27.6 acres 11.5%	ED	6.0'	gravelly outwash	glacial lake beach ridges and outwash areas 2-36% slopes	sandy loam	grav- elly loam & grav- elly sand	tall grass prairie	prairie, prairie/ low shrub	M	NW & W

TABLE 2. SOIL CHARACTERISTICS OF TWIN VALLEY PRAIRIE Continued

land type				SOIL SERIES # ACRES PERCENT	
			Marsh 29.3 acres 12.2%		
			VPD	DRAINAGE CLASS	
			0-5.0' above soil level	DEPTH TO WATER TABLE	
			variable	PARENT MATERIAL	
			depressional areas	LANDSCAPE POSITION	
			un- clas- sified	TEXTURE	TOPSOIL
			un- clas- sified	SUBSOIL	
			cat-tails, reeds, and sedges	VEGETATION	
			marsh	PRESENT	
			M	COMPONENT IN STATE	
			State- wide	LOCATION IN STATE	

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HYDROLOGY

Methods

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

Hydrology of Twin Valley Prairie

Past geologic events associated with Glacial Lake Agassiz are primarily responsible for the hydrologic conditions present at Twin Valley Prairie today. The waters of Lake Agassiz reworked glacial till on the tract into a complex mixture of sands and gravels of varying proportions. The morphology of these sands and gravels and the soils formed in them dictates the flow patterns of both surface and subsurface waters at the site. No permanent bodies of water exist on the tract, although a seasonally wet marsh is present.

Twin Valley Prairie's surface runoff is affected by the presence on the tract of a Lake Agassiz beach ridge. The slight east to west decline in elevation of the site is interrupted by the relief of the north-south trending beach ridge, which acts as a topographic barrier to westward drainage flow. Surface runoff is trapped in the shallow trough parallel to the upslope, east-facing side of the beach ridge. The trough, because it is a depressional area, has a relatively high water table which may intersect the surface at times. The combination of a seasonally high water table and restricted drainage has produced a poorly drained marsh in the trough area. The

majority of the tract east of the beach ridge is fairly wet; driest conditions are found along the beach ridge crest.

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

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VEGETATIONAL COMPONENTS

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

VEGETATIVE COMMUNITIES

Methods

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

Releves were conducted on selected communities to supplement field inspection and provide further information on species composition. Visual estimates were made of the abundance (% cover) of each species found in a prescribed plot. Plot locations were chosen to represent homogeneous stands of vegetation within a community type. Releves were conducted in mid-July and late August according to the methods described by Heitlinger (1979). All releve data is given in Appendix 1.

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

Overview of Regional Plant Communities

Twin Valley Prairie is located in the middle of the Red River Valley landscape region, just west of the prairie-forest transition zone (Figure 3). Prior to European settlement, this area was tall grass prairie with some wet prairie, sloughs, and marshes where soils or topography reduced drainage (Marschner, 1930) (Figure 4). European settlers converted most of this prairie to farm land, however, examples of the original vegetation can still be found on the area today.

Results

The vegetative communities of Twin Valley Prairie are mapped in Figure 5. The area is primarily composed of wetlands and prairie, as described below.

PRAIRIE: 150 acres, 62% of preserve.

Common grasses are Mat Muhly (Muhlenbergia richardsonis), Quack Grass (Agropyron repens), Big Bluestem (Andropogon gerardi), and Cord Grass (Spartina pectinata). Common forbs include Tall Meadow Rue (Thalictrum dasycarpum), Prairie Sunflower (Helianthus laetiflorus), Blazing Star (Liatris pycnostachya) and Golden Alexander (Zizia aurea). Source of information: field inspection and releve TVP-2.

SEDGE MEADOW: 47 acres, 20% of preserve.

The Meadow is dominated by Sedges (Carex sp.) and Cotton Grass (Eriophorum angustifolium). These areas are wet in the spring, but dry by late summer. Source of information: field inspection.

MARSH: 31 acres, 13% of preserve.

The marsh is dominated by Bulrushes (Scripus sp.), Broad-leaved Cat-tail (Typha latifolia), and Sedges (Carex sp.). Though water levels decreased throughout the season, a small amount of open water was found in late summer. Source of information: field inspection.

PRAIRIE/LOW SHRUB: 12 acres, 5% of preserve.

This community occurs on the beach ridge running north-south through the preserve. The vegetation is similar to that of the prairie, except that Tall Meadow Rue (Thalictrum dasycarpum) and Wolfberry (Symphoricarpos occidentalis) are more abundant. Disturbances caused by pocket gophers and other animals are more abundant here resulting in small patches of weedy species and low shrubs. Source of information: field inspection.

Minnesota's Landscape Regions

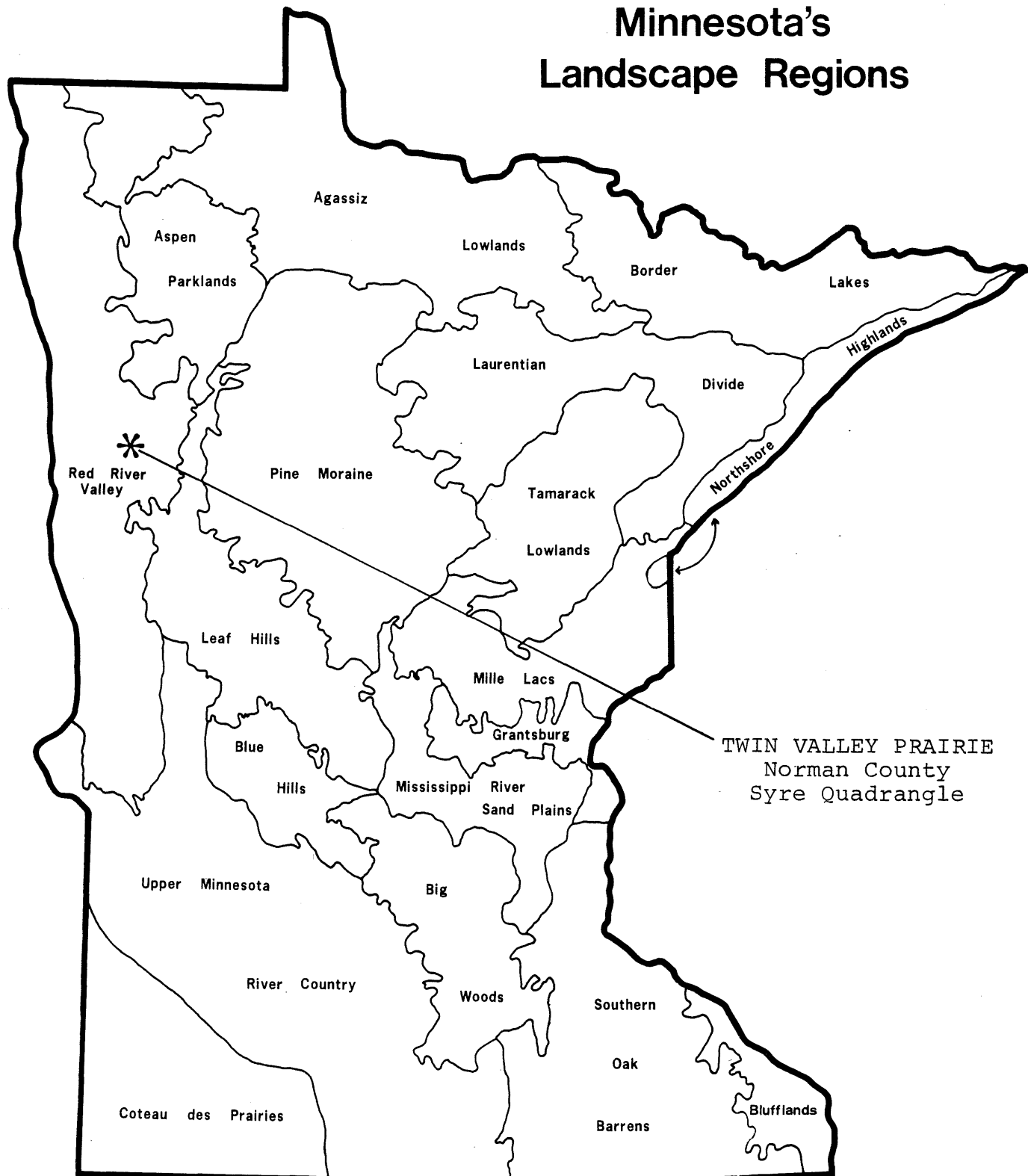
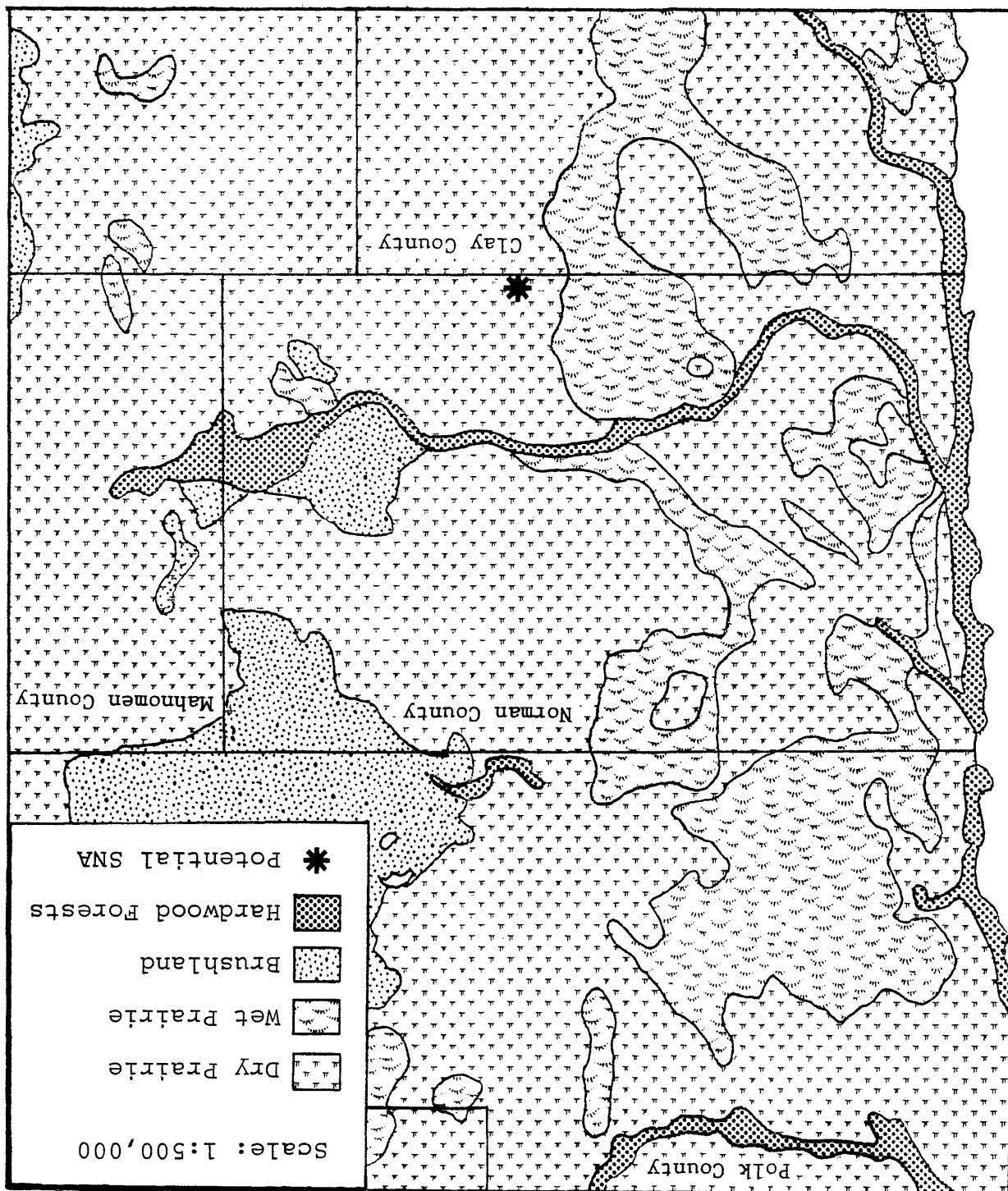


Figure 3. Twin Valley Prairie in relation to Minnesota's landscape regions. Adapted from T. Kratz and G.L. Jensen, an ecological geographic division of Minnesota (Unpublished, 1977).

Figure 4. The original vegetation of northwest Minnesota including Twin Valley Prairie. Adapted from F.J. Marschner, The Original Vegetation of Minnesota, 1:500,000.



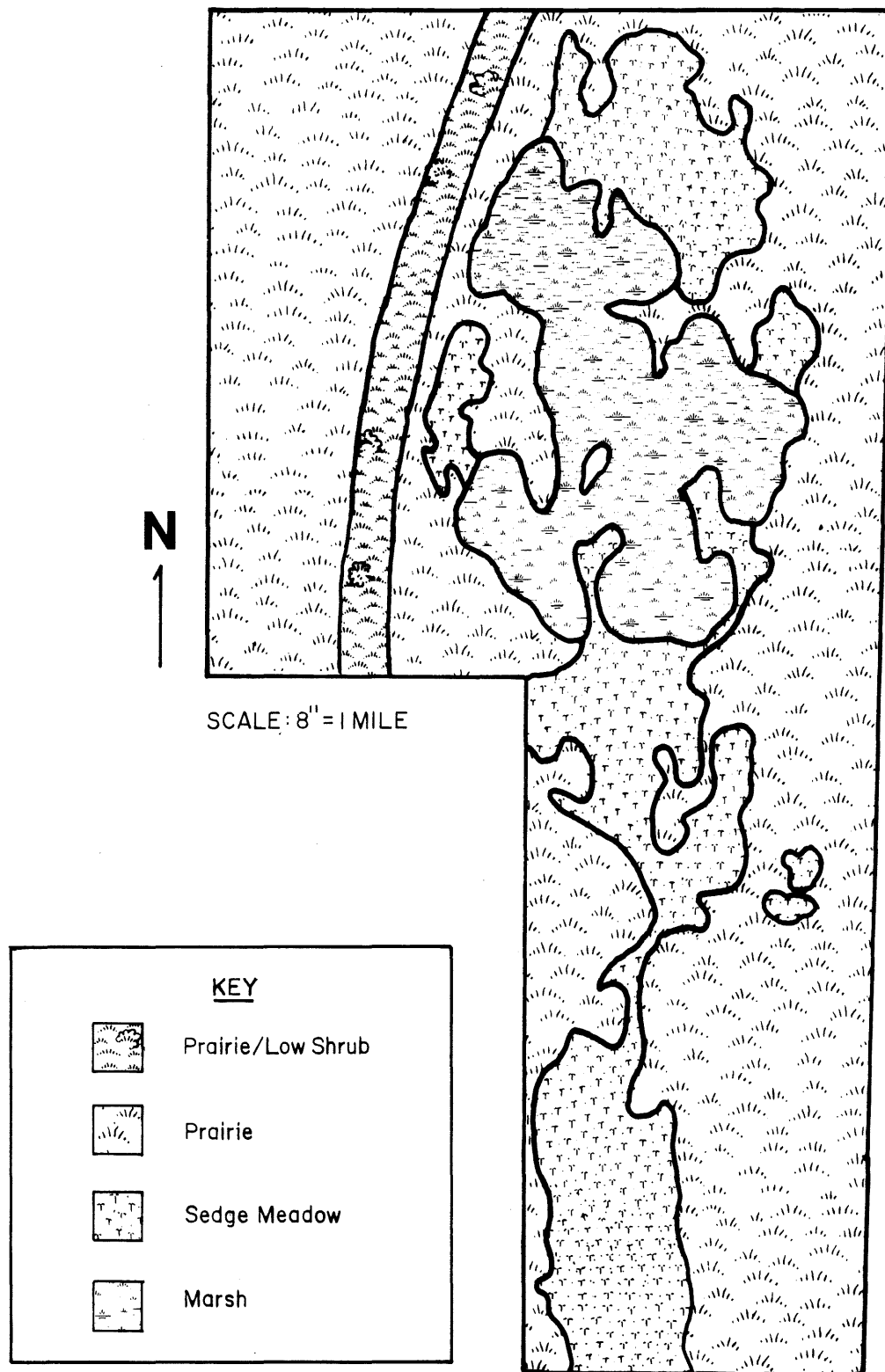


Figure 5. Vegetation communities identified on Twin Valley Prairie.

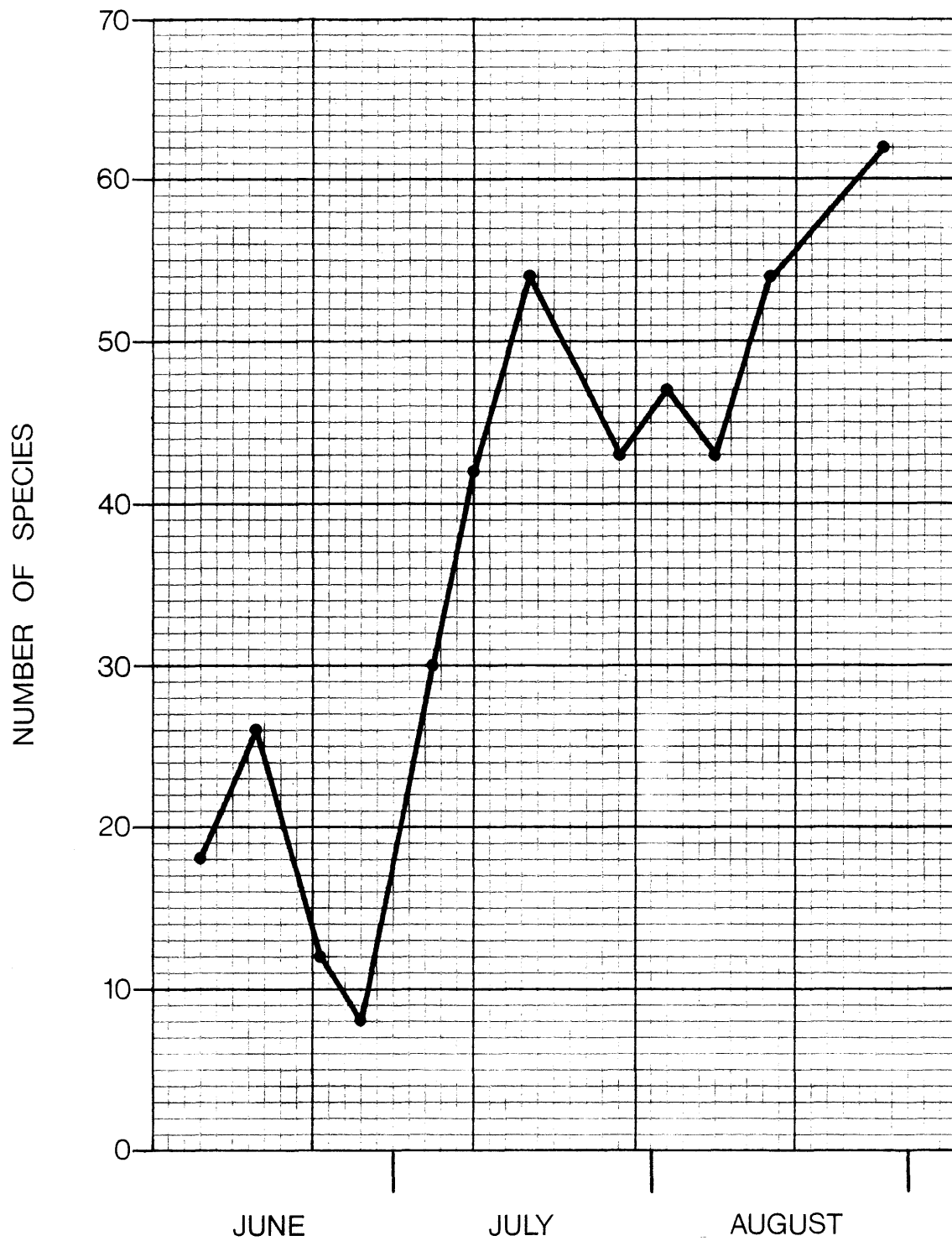


Figure 6. The 1979 blooming phenology on Twin Valley Prairie. Graph illustrates the number of floral species in bloom on each visit to the preserve.

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FLORA

Methods

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

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

Plants were identified using several references (cited at the end of this section). John W. Moore, retired Associate Scientist, University of Minnesota, identified 32 specimens. Gerald Wheeler, graduate student, Botany Department, University of Minnesota, identified all species of the genus Carex. Dr. Gerald Ownbey, Curator of the Herbarium, University of Minnesota, verified the remaining specimens. Any specimens identified in the field, but not collected, are indicated as such in the list.

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

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

Results

Table 3 is an annotated list of the plants identified on the tract.¹ A total of 170 vascular plant species,² representing 41 families, were recorded on the unit in 1979. fourteen of these species are alien. The families with the largest number of species were; Asteraceae with 43 species (25% of total), Poaceae with 25 species (15% of total), and Fabaceae with 14 species (8% of total). A predominance of these three families is typical of the flora of prairie communities.

Figure 6 illustrates the number of species in flower on each visit to the preserve. A total of 161 species were included. The peak of blooming occurred in August.

1. Nomenclature is according to Gleason and Cronquist (1963).
2. This total does not include additional plant species identified in releve plots.

Table 3. Annotated List of Plants for Twin Valley Prairie

Format. Scientific name. Common name. Collection number of voucher specimen. Community in Twin Valley Prairie. Designated "alien" or "possible alien" if not native to Minnesota. Special significance of collection, if any. Asterisk (*) if specimen was identified by John Moore. A (+) indicates a species was noted but not collected.

MONOCOTYLEDONAE - Monocots

ALISMATACEAE - Water Plantain Family

Alisma plantago-aquatica L. - Water Plantain. #129. Marsh.

AMARYLLIDACEAE - Amaryllis Family

Hypoxis hirsuta (L.) Cov. - Yellow Star-Grass. #21. Prairie.

CYPERACEAE - Sedge Family

Carex argyrantha Tuckerm. (C. foenea Willd. misapplied) - Dry-Spiked Sedge. #2. Prairie.

Carex buxbaumii Wahlenb. - Buxbaum's Sedge. #14. Marsh.

Carex diandra Schrank. - Lesser Panicked Sedge. #193. Prairie.*

Eleocharis erythropoda Steud. (E. calva Torr. in Fernald, 1950) - Marsh

Spike Rush. #3. Prairie. *

Eriophorum angustifolium Honck. - Tall Cotton Grass. #33. Marsh. *

Scirpus validus Vahl. - American Great Bulrush. #104. Marsh. *

IRIDACEAE - Iris Family

Sisyrinchium campestre Bickn. - Blue-Eyed Grass. #19. Prairie.

JUNCACEAE - Rush Family

Juncus balticus Wills. var. littoralis Engelm. - Baltic Rush. #8. Prairie. *

Juncus torreyi Cov. - Torrey's Rush. #146. Moist Prairie. *

JUNCAGINACEAE - Arrow Grass Family

Triglochin maritima L. - Arrow Grass. #29. Marsh.

LILIACEAE - Lily Family

Allium stellatum (Ker.) - Prairie Wild Onion. #131. Dry Prairie.

Allium textile A. Nels. & Macbr. - Onion. #24. Prairie.

Lilium philadelphicum L. - Wood Lily. #76. Dry Prairie.

Zygadenus elegans Pursh. - White Camas. #54. Prairie.

ORCHIDACEAE - Orchid Family

Cypripedium candidum Muhl. - White Lady-Slipper. #20. Prairie.

Threatened Species; Smithsonian Institute List. Potential Heritage Element.

POACEAE - Grass Family

Agropyron repens (L.) Beauv. - Quack Grass. #61. Shrubby Area. Alien.

Agrostis stolonifera L. (A. alba L. in Fernald, 1950) - Red Top. #115. Dry Prairie. *

Andropogon gerardi Vitm. - Big Bluestem. #143. Dry Prairie.

Andropogon scoparius Michx. - Little Bluestem. #171. Prairie. *

- Bouteloua curtipendula (Michx.) Torr. - Side-Oats-Grass. #134. Dry Prairie - Beach Ridge. *
- Bromus kalmii Gray. - Kalm's Brome. #113. Dry Prairie - Beach Ridge. *
- Calamagrostis inexpansa Gray. - Northern Reed Grass. #99. Dry Prairie. *
- Deschampsia cespitosa (L.) Beauv. var. glauca (Hartm.) Lidm. - Tufted Hair Grass. #108. Dry Prairie. *
- Elymus canadensis L. - Canada Wild Rye. #177. Prairie. *
- Elymus interruptus Buckl. - Interrupted Wild Rye. #97. Prairie *
- Hordeum jubatum L. - Foxtail Barley. #52. Dry Prairie. +
- Koeleria cristata (L.) Pers. - June Grass. #185. Prairie - Beach Ridge. *
- Muhlenbergia racemosa (Michx.) BSP. (M. glomerata (Willd.) Trin. in Fernald, 1950). - Swamp Satin Grass. #152. Dry Prairie.
- Muhlenbergia richardsonis (Trin.) Rydb. - Mat Muhly. #174. Prairie. *
- Panicum capillare L. - Witch Grass. #190. Prairie. *
- Panicum lanuginosum Ell. var. implicatum (Scribn.) Fern. (P. implicatum Scribn. in Fernald, 1950) - Panic Grass. #79. *
- Panicum leibergii (Vasey) Scribn. - Leiberg's Panic Grass. #64. Prairie. *
- Panicum virgatum L. - Switch Grass. #165. Damp Prairie. *
- Pleum pratense L. - Timothy Grass #74. Dry Prairie. Alien. *
- Poa pratensis L. - Kentucky Blue Grass. #4. Prairie. Possible Alien. *
- Poa pratensis L. (P. pratensis . var. angustifolia (L.) Sm.) - Lawn Blue Grass. #179. Prairie. Possible Alien. *
- Sorghastrum nutans (L.) Nash - Indian Grass. #151. Dry Prairie. *
- Spartina pectinata Link. - Cord Grass. #103. Marsh. *
- Stipa comata Trin. & Rupr. - Needle and Thread Grass. #96. Dry Prairie. *
- Stipa spartea Trin. - Porcupine Grass. #60. Prairie. *

TYPHACEAE - Cattail family

Typha angustifolia L. - Cattail. #107 Ditch

Typha latifolia L. - Broad Leaved Cattail +

DICOTYLEDONEAE-Dicots

ANACARDIACEAE - Cashew Family

Rhus glabra L. - Smooth Sumac. #123. Dry Prairie.

APIACEAE - Parsley Family

Cicuta maculata L. - Water Hemlock. #80. Prairie.

Zizia aptera (Gray) Fern. - Golden Alexander. #22. Disturbed Area.

APOCYNACEAE - Dogbane Family

Apocynum sibiricum Jacq. var. cordigerum (Greene) Fern. - Indian Hemp. #56. Prairie.

ASCLEPIADACEAE - Milkweed Family

Asclepias incarnata L. - Swamp Milkweed. #102. Marsh.

Asclepias ovalifolia L. - Dwarf Milkweed. #63. Prairie.

Asclepias syriaca L. - Common Milkweed. #90. Dry Prairie.

Asclepias verticillata L. Whorled Milkweed. #173. Prairie.

ASTERACEAE - Composite Family

Achillea millefolium L. - Yarrow. #47. Prairie.

Agoseris glauca (Pursh.) D. Dietr. - Prairie Dandelion. #41. Dry Prairie.

Ambrosia psilostachya DC. - Ragweed. #160. Dry Prairie - Beach Ridge.

- Antennaria neglecta Greene. - Pussy Toes. #18. Prairie.
Artemisia campestris L. (A. caudata Michx. in Fernald, 1950) - Tall Wormwood. #158. Prairie - Beach Ridge.
Artemisia dracunculus L. (A. glauca Pall. var. dracunculina (S. Wats.) Fern. in Fernald, 1950) - Silky Wormwood. #158. Prairie - Beach Ridge. *
Artemisia frigida Willd. - Mugwort. #161. Dry Prairie - Beach Ridge.
Artemisia ludoviciana Nutt. - Prairie Sage. #176. Prairie.
Aster ericoides L. - Heath's Aster. #166. Dry Prairie.
Aster junciformis Rydb. - Rush Aster. #164. Marsh. *
Aster laevis L. - Smooth Aster. #136. Dry - Disturbed Old Road.
Aster ptarmicoides (Nees) T. & G. - Upland White Aster. #126. Dry Prairie.
Aster ptarmicoides (Nees) T. & G. x Solidago riddellii Frank. (Hybrid). #194. Prairie.
Aster sericeus Vent. - Silky Aster #180. Prairie.
Chrysopsis villosa (Pursh) Nutt. - Golden Aster. #183. Prairie - Beach Ridge.
Cirsium arvense (L.) Scop - Canada Thistle. #89. Dry Prairie. Alien.
Cirsium flodmanii (Rydb.) Arthur - Flodman's Thistle. #68. Dry Prairie.
Echinacea purpurea (L.) Moench. - Purple Cone Flower. #95. Dry Prairie.
Erigeron strigosus Muhl. - Daisy Fleabane. #121. Dry Prairie.
Gaillardia aristata Pursh. - Blanket Flower. #46. Dry Prairie.
Helenium autumnale L. - Sneezeweed. #155. Dry Prairie.
Helianthus laetiflorus Pers. - Prairie Sunflower. #135. Dry Prairie.
Helianthus maximiliani Schrader. - Maximilian's Sunflower. #154. Dry Prairie.
Hieracium canadense Michx. - Canada Hawkweed. #147. Wet Prairie.
Krigia biflora (Walt.) Blake. - Dwarf Dandelion. #40. Dry Prairie. *
Lactuca pulchella (Pursh) DC. - Wild Blue Lettuce. #120. Dry Prairie.
Liatris aspera Michx. - Rough Blazing Star. #181. Prairie - Beach Ridge.
Liatris punctata Hook. - Dotted Blazing Star - #182. Prairie - Beach Ridge.
Liatris pycnostachya Michx. - Blazing Star. #118. Dry Prairie.
Prenanthes racemosa Michx. - Glaucous Rattlesnake-Root. +
Ratibida columnifera Nutt. Woot. & Standl. - Prairie Coneflower. #141. Prairie.
Rudbeckia hirta L. - Black-Eyed Susan. #81. Prairie. Possible Alien.
Senecio pauperculus Michx. - Western Ragwort. #23. Disturbed Area.
Solidago canadensis L. var. gilvocanescens Rydb. - Plains Goldenrod. #128. Dry Prairie. *
Solidago gigantea Ait. - Late Goldenrod. #133. Dry Area.
Solidago graminifolia (L.) Salisb. - Lance-Leaved Goldenrod. #132. Dry Area.
Solidago missouriensis Nutt. - Missouri Goldenrod. #157. Dry Prairie - Beach Ridge.
Solidago nemoralis Ait. - Gray Goldenrod. #170. Prairie.
Solidago riddellii Frank. - Riddell Goldenrod. #188. Prairie.
Solidago rigida L. - Hard-Leaved Goldenrod. #156. Prairie - Beach Ridge.
Sonchus arvensis L. - Sow Thistle. #106. Wet Prairie. Alien.
Tragopogon dubius L. - Goat's Beard. #53. Dry Prairie. Alien.
Vernonia fasciculata Michx. - Western Ironweed. #168. Wet Prairie.

BORAGINACEAE - Borage Family

Lithospermum canescens (Michx.) Lehm. - Hoary Puccoon. #10. Prairie - Beach Ridge.

Lithospermum incisum Lehm. - Narrow-Leaved Puccoon. #11. Prairie - Beach Ridge.

BRASSICACEAE - Mustard Family

Brassica kaber (DC) L. Wheeler (B. Kaber (DC) L. Wheeler var. pinnatifida (Stokes) Wheeler) - Charlock. #91. Prairie. Alien. *

Erucastrum gallicum (Willd.) O. E. Schulz. - Bracted Rocket. #139. Disturbed Area. Possible Alien.

Sisymbrium altissimum L. - Tumbling Mustard. #82. Prairie. Alien. *

CAMPANULACEAE - Harebell Family.

Campanula rotundifolia L. - Harebell. #59. Prairie.

CAPRIFOLIACEAE - Honeysuckle Family

Symphoricarpos occidentalis Hook. - Wolfberry. #86. Prairie.

CARYOPHYLLACEAE - Pink Family

Cerastium arvense L. - Field Chickweed. #1. Prairie.

CONVOLVULACEAE - Morning-Glory Family

Convolvulus sepium L. - Hedge Bindweed. #83. Prairie. Possible Alien.

FABACEAE - Bean Family

Amorpha canescens Pursh. - Lead Plant. #112. Dry Prairie - Beach Ridge.

Amorpha nana Nutt. - Dwarf False Indigo. #30. Wet Prairie. +

Astragalus agrestis Dougl. - Milk-Vetch. #50. Dry Prairie.

Astragalus canadensis L. - Canada Milk-Vetch. #125. Dry Prairie.

Astragalus crassicaulis Nutt. - Prairie Plum. #16. Prairie.

Glycyrrhiza lepidota Pursh. - Wild Licorice. #88. Damp Prairie.

Lathyrus palustris L. - Marsh Vetchling. #34. Wet Prairie.

Lotus corniculatus L. - Bird's Foot Trefoil. #105. Wet Prairie - Ditch.

Medicago sativa L. - Alfalfa. #142. Dry Prairie. Alien.

Melilotus alba Desr. - White Sweet Clover. #84. Prairie. Alien.

Melilotus officinalis (L.) Desr. - Yellow Sweet Clover. #72. Dry Prairie - Beach Ridge. Alien.

Petalostemum candidum (Willd.) Michx. - White Prairie Clover. #98. Dry Prairie.

Petalostemum purpureum (Vent.) Rydb. - Purple Prairie Clover. #117. Dry Prairie.

Psoralea argophylla Pursh. - Silver Leaf Scurf Pea. #122. Dry Prairie.

GENTIANACEAE - Gentian Family

Gentiana procera Holm. - Smaller Fringed Gentian. #187. Prairie.

Gentiana puberula Michx. - Downy Gentian. #172. Prairie. *

LAMIACEAE - Mint Family

Lycopus americanus Mulh. - Cut-Leaved Water Horehound. #127. Dry Prairie.

Lycopus asper Greene. - Western Water Horehound. #150. Wet Low Area.

Mentha arvensis L. - Wild Mint. #137. Wet Prairie.

Prunella vulgaris L. - Self-Heal. #78. Prairie.

Pycnanthemum virginianum (L.) Durand & Jackson. - Mountain Mint. #119.
Dry Prairie.

Stachys palustris L. - Woundwort. #65. Marsh.

Teucrium canadense L. - American Germander. #130. Wet Prairie.

LENTIBULARIACEAE - Bladderwort Family

Utricularia vulgaris L. - Greater Bladderwort. #138. Marsh.

LOBELIACEAE - Lobelia Family

Lobelia kalmii L. - Kalm's Lobelia. #192. Prairie.

Lobelia spicata Lam. - Lobelia. #111. Dry Prairie.

ONAGRACEAE - Evening-Primrose Family

Gaura coccinea Pursh. - Scarlet Gaura. #49. Dry Prairie.

Oenothera biennis L. - Common Evening-Primrose. #145. Dry Prairie.

Oenothera serrulata Nutt. - Evening-Primrose. #77. Dry Prairie.

OXALIDACEAE - Wood-Sorrel Family

Oxalis stricta L. - Yellow Wood-Sorrel. #144. Dry Prairie - Beach Ridge.
Possible Alien.

Oxalis violacea L. - Prairie Wood-Sorrel. #13. Prairie - Beach Ridge.

POLEMONIACEAE - Phlox Family

Phlox pilosa L. - Phlox. #75. Dry Prairie.

POLYGALACEAE - Milkwort Family

Polygala senega L. - Seneca Snakeroot. #31. Wet Prairie.

POLYGONACEAE - Smartweed Family

Polygonum natans Eat. - Water Smartweed. #149. Wet Low Area.

PRIMULACEAE - Primrose Family.

Lysimachia quadrifolia L. - Whorled Loosestrife. #110. Wet Prairie.

Lysimachia thyrsiflora L. - Tufted Loosestrife. #38. Marsh.

RANUNCULACEAE - Crowfoot Family

Anemone canadensis L. - Canada Anemone. #45. Dry Prairie.

Anemone cylindrica Gray - Thimbleweed. #58. Prairie.

Delphinium virescens Nutt. - Larkspur. #85. Prairie.

Ranunculus flabellaris Raf. - Yellow Water-Buttercup. #36. Marsh.

Thalictrum dasycarpum Fisch. & Ave-Lall. - Tall Meadow Rue. #55.
Prairie.

ROSACEAE - Rose Family

Fragaria virginiana Duchesne. - Wild Strawberry. #9. Prairie.

Geum triflorum Pursh. - Prairie Smoke. #12. Prairie - Beach Ridge.

Potentilla anserina L. - Silver-Weed. #42. Wet Prairie.

Potentilla arguta Pursh. - Tall Cinquefoil. #87. Prairie.

Potentilla pensylvanica L. - Prairie Cinquefoil. #116. Dry Prairie.

Rosa suffulta Greene. - Wild Prairie Rose. #62. Prairie.

Spiraea alba DuRoi. - Meadow Sweet. #109. Marsh.

RUBIACEAE - Madder Family

Galium boreale L. Northern Bedstraw. #32. Dry Prairie.

SALICACEAE - Willow Family

Populus deltoides Marsh. - Cottonwood. #44. Dry Prairie.Populus tremuloides Michx. - Quaking Aspen. #73. Dry Prairie.Salix bebbiana Sarg. - Beaked Willow. #70. Wet Prairie.Salix discolor Muhl. - Pussy-Willow. #35. Wet Prairie.Salix humilis Marsh. (S. humilis Marsh. var. Microphylla (Anderss.) Fern. in Fernald., 1950) - Upland-Willow. #71. Wet Prairie.Salix petiolaris Sm. (S. gracilis Anderss. in Fernald, 1950) - Slender-Willow. #66. Wet Prairie.Salix rigida Muhl. - Heart-Leaved Willow. #43A. Wet Prairie.

SANTALACEAE - Sandalwood Family

Comandra umbellata L. - Bastard Toad Flax. #27. Prairie.

SAXIFRAGACEAE - Saxifrage Family

Parnassia glauca Raf. - Grass of Parnassus. #189. Prairie.Ribes americanum Mill. - Wild Black Currant. #7. Rocky Area.

SCROPHULARIACEAE - Figwort Family

Castilleja coccinea (L.) Spreng. - Painted Cup., #6. Prairie.Pedicularis canadensis L. - Lousewort. #28. Prairie.Pedicularis lanceolata Michx. - Swamp Lousewort. #167. Damp Prairie.Penstemon gracilis Nutt. - Beard-Tongue. #48. Dry Prairie.Veronicastrum virginicum (L.) Farw. - Culver's Root. #124. Dry Prairie.

SOLANACEAE - Nightshade Family

Physalis virginiana Mill. - Virginia Ground Cherry. #94. Dry Prairie.

VIOLACEAE - Violet Family

Viola nephrophylla Greene. - Northern Bog Violet. #5. Prairie.Viola pedatifida G. Don. - Prairie Violet. #17. Prairie.

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

APIACEAE

Zizia aurea

ASTERACEAE

Senecio cf. plattensis

GENTIANACEAE

Gentiana cf. clausa

POACEAE

Calamagrostis cf. neglectaGlyceria striata

SCROPHULARIACEAE

Castilleja sessiliflora

Sources of Information

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ZOOLOGICAL COMPONENTS

Animals are an important part of virtually all of Minnesota's natural areas. Their diversity is determined by both abiotic and vegetational components of the environment. Reciprocally, the zoological components may have a limited effect on the vegetational and abiotic resources of an area; seed dispersal, soil aeration, and water levels, for example, are often influenced by animals. In addition, certain animal species, by their presence or absence, are considered ecological indicators that provide information on changes occurring in the area.

An inventory of butterflies, birds, mammals, amphibians, and reptiles was conducted to: 1) document the area's species diversity, 2) obtain baseline data so changes can be discerned, and 3) identify rare, sensitive, or representative species and communities.

BUTTERFLIES

Methods

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

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

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

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

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

Butterfly Discussion

Twenty-seven butterfly species were identified on Twin Valley Prairie during the 1979 inventory. Table 4 lists all the species, recorded in phylogenetic order.¹

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

Table 4. Butterflies Observed on Twin Valley Prairie

HESPERIIDAE

Atrytonopsis hianna (Scudder) - Dusted SkipperAtrytone delaware (Edwards) - Delaware SkipperPolites themistocles (Latreille) - Tawny-edged SkipperPolites mystic (Scudder) - Long DashHesperia pawnee Dodge - Pawnee Skipper✓ Hesperia dacotae (Skinner) - Dakota Skipper - Natural Heritage Element *Oarisma poweshiek (Parker) - Poweshiek SkipperPyrgus communis (Grote) - Checkered Skipper *

PAPILIONIDAE

Papilio polyxenes asterius Stoll - Black Swallowtail

PIERIDAE

Pieris rapae (Linnaeus) - Cabbage ButterflyColias eurytheme Boisduval - Alfalfa ButterflyColias philodice Godart - Common Sulphur

LYCAENIDAE

Plebejus melissa (Edwards) - Melissa BlueCelastrina argiolus (Linnaeus) - Spring Azure

NYMPHALIDAE

Limenitis archippus (Cramer) - Viceroy *Vanessa atalanta (Linnaeus) - Red Admiral *Vanessa cardui (Linnaeus) - Painted LadyPhyciodes tharos (Drury) - Pearl CrescentBoloria selene (Denis & Schiffermuller) - Silver-bordered FritillaryBoloria bellona (Fabricius) - Meadow FritillarySpeyeria idalia (Drury) - Regal Fritillary *Speyeria cybele (Fabricius) - Great Spangled FritillarySpeyeria aphrodite (Fabricius) - AphroditeEuptoieta claudia (Cramer) - Variegated Fritillary

DANAIDAE

Danaus plexippus (Linnaeus) - Monarch

SATYRIDAE

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

* Observed on the tract, but not collected.

Sources of Information

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BIRDS

Methods

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

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

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

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

summarized on a single map at the end of the breeding season. A minimum of two noncontemporaneous occurrences of a particular species was used as a guideline for inferred breeding of that species. Additional species observed outside of the established stations were also recorded.

Species identification was based on visual observations, songs, and/or nest characteristics. Locating nests was done on an incidental basis throughout the field season.

Results

The results of the 1979 bird inventory are presented in the form of an annotated list, Table 5.¹ Thirty-nine species of birds, representing 18 families, were observed on, above, or adjacent to Twin Valley Prairie. Five species were found nesting on the area with 12 others recorded as inferred breeders.

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

Key to Table 5.

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

DATE: Date of first observation.

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

Mh - Marsh

Pr - Prairie

WMe - Wet Meadow

ShTh - Shrub Thicket

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

M - Migrant

P - Permanent Resident

S - Summer Resident

WV - Winter Visitant

BREEDING STATUS:

- Positive Nesting-0

nest with eggs, adult sitting on nest
constantly or eggshells near nest; young
in nest; downy young or young still
unable to fly seen away from nest (Green
and Janssen, 1975).

- Inferred Nesting-0

adults seen building nest, in distraction
display, carrying fecal sac, or carrying
food; fledglings seen in area (Green and
Janssen, 1975).

- Inferred Breeding-0

based on the Point Count Method
(Robbins, 1978), a minimum of two
noncontemporaneous occurrences of a
species at a given observation station.

TABLE 5. ANNOTATED LIST OF BIRDS OBSERVED AT TWIN VALLEY PRAIRIE

<u>FAMILY/SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>DATE</u>	<u>HABITAT</u>	<u>RESI- DENCY</u>	<u>BREEDING STATUS</u>	<u>REMARKS</u>
<u>ARDEIDAE</u> <u>Botaurus lentiginosus</u>	American Bittern	27 April	Mh	S	0	
<u>ANATIDAE</u> <u>Anas platyrhynchos</u>	Mallard	25 May		S		Observed flying
<u>Anas acuta</u>	Pintail	10 July		S		Observed flying
<u>Anas discors</u>	Blue-Winged Teal	15 May	Pr Mh	S	0	Wounded bird act
<u>ACCIPITRIDAE</u> <u>Circus cyaneus</u>	Marsh Hawk	15 May		S		Observed flying
<u>TETRAONIDAE</u> <u>Tympanuchus cupido</u>	Greater Prairie Chicken	15 May	Pr	P	0	15 eggs in nest 6/? Eggs hatched 6/16 Natural Heritage Element
<u>GRUIDAE</u> <u>Grus canadensis</u>	Sandhill Crane	15 May	Mh	M		Natural Heritage Element
<u>RALLIDAE</u> <u>Rallus limicola</u>	Virginia Rail	15 July	WMe	S		
<u>Porzana cerolina</u>	Sora	25 May	WMe Mh	S		
<u>CHARADRIIDAE</u> <u>Charadrius vociferus</u>	Killdeer	25 May	Pr Mh	S		
<u>SCOLOPACIDAE</u> <u>Capella gallinago</u>	Common Snipe	15 May	WMe Mh	S	0	
<u>Bartramia longicauda</u>	Upland Sandpiper	15 May	Mh WMe Pr	S	0	Wounded bird act
<u>Limosa fedoa</u>	Marbled Godwit	25 May	WMe Mh	S		Natural Heritage Element
<u>PHALAROPODIDAE</u> <u>Steganopus tricolor</u>	Wilson's Phalarope	25 May	Pr WMe Mh	S	0	1 nest with 2 eggs 6/6
<u>Lobipes lobatus</u>	Northern Phalarope	15 May	WMe	M		

TABLE 5. ANNOTATED LIST OF BIRDS OBSERVED AT TWIN VALLEY PRAIRIE

Continued

<u>FAMILY/SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>DATE</u>	<u>HABITAT</u>	<u>RESI- DENCY</u>	<u>BREEDING STATUS</u>	<u>REMARKS</u>
LARIDAE <u>Chidonias niger</u>	Black Tern	25 May		S		Observed flying
COLUMBIDAE <u>Zenaida macroura</u>	Mourning Dove	25 May	Pr WMe	S	0	
TYRANNIDAE <u>Tyrannus tyrannus</u>	Eastern Kingbird	25 May	ShTh Pr	S	0	
HIRUNDINIDAE <u>Stelgidopteryx ruficollis</u>	Rough-Winged Swallow	15 May		S		
<u>Hirundo rustica</u>	Barn Swallow	15 May	Pr	S		Observed flying
TROGLODYTIDAE <u>Telmatodytes palustris</u>	Long-Billed Marsh Wren	13 June	Mh	S	0	
<u>Cistothorus platensis</u>	Short-Billed Marsh Wren	13 June	Mh	S		
TURDIDAE <u>Turdus migratorius</u>	American Robin	6 June	ShTh	S		
PARULIDAE <u>Geothlypis trichas</u>	Common Yellowthroat	6 June	WMeMhShTh	S		
<u>Setophaga ruticilla</u>	American Redstart	25 May		S		Observed flying
ICTERIDAE <u>Dolichonyx oryzivorus</u>	Bobolink	15 May	WMe	S	0	
<u>Sturnella magna</u>	Eastern Meadowlark	21 June		S		
<u>Sturnella neglecta</u>	Western Meadowlark	15 May	Mh Pr	S	0	
<u>Xanthocephalus xanthocephalus</u>	Yellow-Headed Blackbird	15 May	WMeShThMh	S	0	
<u>Agelaius phoeniceus</u>	Red-Winged Blackbird	27 April	WMe Pr Mh	S	0	2 nests 2 eggs 6/13 nest 4 eggs 6/6
<u>Euphagus cyanocephalus</u>	Brewer's Blackbird	6 June	Pr	S	0	Nest material in mouth 6/6
<u>Molothrus ater</u>	Brown-Headed Cowbird	15 May	Pr	S	0	1 egg in with Red-Winged Blackbird 6/6

TABLE 5. ANNOTATED LIST OF BIRDS OBSERVED AT TWIN VALLEY PRAIRIE
Continued

<u>FAMILY/SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>DATE</u>	<u>HABITAT</u>	<u>RESI- DENCY</u>	<u>BREEDING STATUS</u>	<u>REMARKS</u>
FRINGILLIDAE						
<u>Passerculus sandwichensis</u>	Savannah Sparrow	27 April	ShTh Mh Pr	S	0	2 nests 3 eggs, 4 eggs 6/6
<u>Ammodramus savannarum</u>	Grasshopper Sparrow	21 June	ShTh Pr	S	0	
<u>Ammospiza leconteii</u>	LeConte's Sparrow	25 May	Pr	S		
<u>Poecetes gramineus</u>	Vesper Sparrow	6 June	Pr	S		
<u>Spizella pallida</u>	Clay-Colored Sparrow	15 May	ShTh Pr	S	0	
<u>Melospiza georgiana</u>	Swamp Sparrow	15 May	ShTh	S		
<u>Melospiza melodia</u>	Song Sparrow	6 June	Pr	S		

Sources of Information

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

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

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

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

Additional Sources of Information

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

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

MAMMALS

Methods

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

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

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

Results

The results of the 1979 mammal inventory are presented in the form of an annotated list, Table 6.¹ Six species, representing four families were observed or captured on Twin Valley Prairie.

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

Table 6. Mammals identified on Twin Valley Prairie

SORICIDAE

Sorex cinereus - Masked ShrewBlarina brevicauda - Short-Tailed Shrew. Wet Prairie.

LEPORIDAE

Lepus townsendii - White-tailed Jack Rabbit. Dry Prairie. *

SCIURIDAE

Citellus tridecemlineatus - Thirteen-lined Ground Squirrel. Dry Prairie.

CRICETIDAE

Peromyscus leucopus - White-footed Mouse. Dry Prairie.Microtus ochrogaster - Prairie Vole. Wet Prairie, Marsh Edge. *

* Natural Heritage Element

Source of Information

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

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

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

AMPHIBIANS AND REPTILES

Methods

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

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

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

Reptiles were collected by hand or by the use of drift fences and snake traps. The snake traps were a wire mesh and wooden rectangular box (18"x30"x6") with lead-in funnels on each end. The traps were set along the sides of the drift fences, trapping snakes that had been diverted by the fence. These traps were used in conjunction with mammal trapping.

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

RESULTS

The results of the 1979 amphibian and reptile inventory are presented in the form of an annotated list, Table 7. Four amphibians were identified by chorus near Twin Valley Prairie.

Table 7. Amphibians and Reptiles Observed on Twin Valley Prairie

AMPHIBIA

AMBYSTOMATIDAE

Ambystoma tigrinum tigrinum - Eastern Tiger Salamander

HYLIDAE

Pseudacris triseriate maculata - Swamp Tree Frog

RANIDAE

Rana pipiens pipiens - Northern Leopard Frog (Heard in chorus)Rana sylvatica - Wood Frog (Heard in chorus)

Sources of Information

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

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

LAND USE HISTORY

Virtually all "natural areas" have been affected to some degree by the activities of people. Farming, grazing, logging, drainage of wetlands, and the suppression of fire are some of the ways people have affected the land. Knowledge of historical land use practices helps explain the present condition of the land and its resources. Surrounding land use practices also affect the viability of all natural areas.

Methods

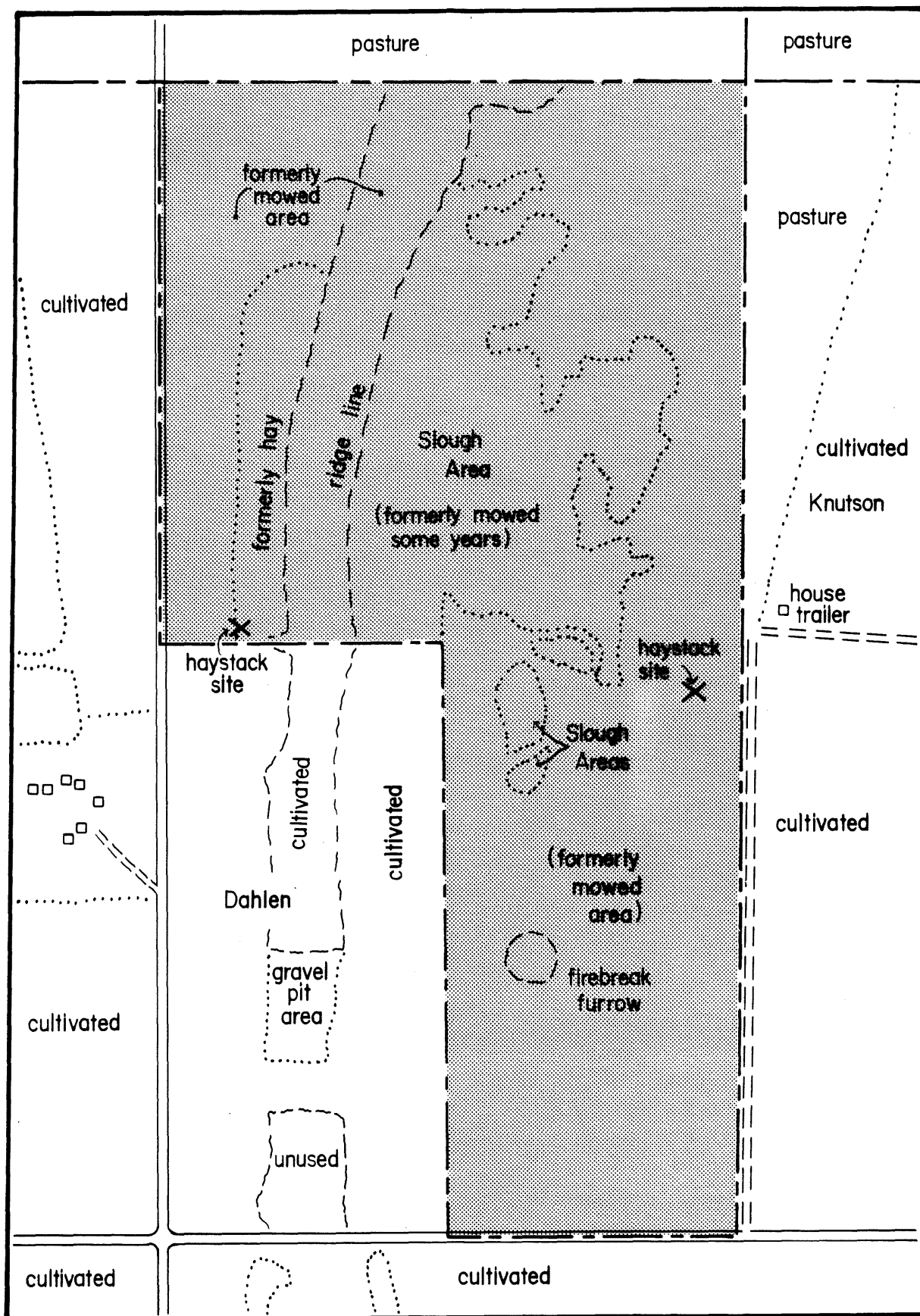
The land use information presented here is based on historical records, aerial photographs, inspections of the site, and interviews with the past owner, owners of land adjacent to the tract, and individuals who worked on Twin Valley Prairie. Detailed land use information prior to about 1930 was not available.

Recent Land Use History

The township in which Twin Valley Prairie sits was first settled permanently in 1880. With time, most of the land around the prairie was utilized for crop production and grazing. Today cultivated fields and pastures surround Twin Valley Prairie. Figure 7 shows the owners and some of the land uses in the vicinity of the tract.

Figure 7. Past and present land use practices in the vicinity of Twin Valley Prairie.

TWIN VALLEY



——— Property line
 - - - Field line
 . . . Improved road

N
 Scale: 8 inches = 1 mile

Twin Valley Prairie has also been affected by the activities of people. The 240 acre prairie was rented out to various farmers in the area by the owners.¹ Aerial photographs indicate that most of the tract has been mowed for at least forty years. From 1956 to 1976 the prairie was annually hayed. Figure 7 indicates that the entire tract, except for the wet area and the ridge, was mowed in 1974. During this same period however, the beach ridge was not mowed and the south section slough areas were cut only three times. The tall grass slough areas in the north section (east of the ridge) were always left unmowed. The wild prairie grasses in the drier areas were cut once each year for hay (in July and August), raked into windrows to cure for a day, and then baled. The hay was stockpiled in two locations, along the east border and just north of the southwest eighty acres (See Figure 7). During the winter, before April, the bales were loaded onto trucks and taken to market.

A small area on the west side of the beach ridge was plowed and seeded once with flax. This event occurred before 1956.

Several other actions have affected the landscape and vegetation of Twin Valley Prairie. County Roads 39 and 28 border the tract. It is not known when these roads were built, but they were upgraded in 1963. The culvert on County Road 28 was installed about 1975 by the township, while

1. Twin Valley Prairie has only had three owners since 1899. Mr. H. A. Powers took over the ownership of the tract from the Northern Pacific Railroad in 1899. In 1976 Harold Wayne Powers deeded the land to the Nature Conservancy.

the culvert on County Road 39 was installed sometime prior to 1956. Two fences were erected sometime in the past on the north and northeast boundaries. The northeast fence is now falling down. A circular furrow is present on the south end of the tract.

This "firebreak" was dug many years ago to protect loosely stacked hay. Two to three furrows run along the northeast boundary. They were probably caused by adjacent landowners driving their tractors through the area. There are also some small furrows on the east boundary, orientated east to west, but the cause of these furrows is unknown. A grassy road and what appears to be a ditch were observed on the tract in 1979.

The suppression of fire is one action which has affected all of Twin Valley Prairie, but which is not evident in Figure 7. Prior to European settlement fire is thought to have been a regular occurrence on areas like this. Without fire, one of the forces responsible for the creation and maintenance of the prairie was eliminated.

Appendix 1.

The following is a summary of the species identified in each releve plot during 1979. Releve plots were surveyed twice during the season; the dates and people conducting each survey are given in the heading. If the abundance of a species was recorded differently in the two surveys, the summary includes the greatest abundance noted. Species are grouped into grasses and forbs, or woody and herb categories. Species are then listed by abundance within each category.

A list of the symbols used in recording releve data are given below. Data is recorded in the following format:

Species name	<u>Height Class</u> cover-abundance/sociability
--------------	--

Coverage for height classes were also estimated and recorded in the blocks at the top of the list. It should be noted that stratification below 2 meters was not separated. Height class 3 represents the 0 - 2 meter strata.

SYMBOLS USED FOR RELEVÉ DESCRIPTIONS

Height Class (Stratification)Coverage for Height Classes

8	35 m	75%	continuous
7	20 - 35 m	50 - 75%	interrupted
6	10 - 20 m	25 - 50%	park like, patchy
5	5 - 10 m	5 - 25%	sparse
4	2 - 5 m	5%	sporadic to
3	0 - 2 m		very scarce

Cover-abundance, for species

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

Sociability (dispersion)

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

Certainty of Identification

- (no notation) positive
- ? some doubt

DATE: 18 Aug 1979

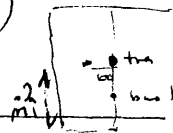
SURVEYOR: CBK

PLOT #: 2

LOCATION: TVP

100 paces west of top of Back Ridge

(2 mi NW of parking fence)



COVER TYPE: Prairie

SOIL SERIES:

PLOT SIZE: 20 m x 20 m

Height Classes

8 7 6 5 4 3 2 1

Coverage for Height Class -

					75%		
--	--	--	--	--	-----	--	--

Species

Remarks

GRASSES

<i>Andropogon gerardii</i>			✓		2/1	✓	Bl
<i>Spartina pectinata</i>			✓		2/1	✓	—
<i>Koeleria cristata</i> (June Grass)			✓		1/1	✓	
<i>Agropyron repens</i>			✓		2/1	✓	
<i>Danialum virgatum</i>			✓		1/1	✓	
<i>Sorghastrum nutans</i>			✓		1/1	✓	
<i>Andropogon scoparius</i>			✓		1/1	✓	
<i>Sphacelotus</i> - Muhlbg. var. <i>racemosa</i> ?			✓		1/1	✓	
<i>Calamagrostis neglecta</i>			✓		1/1	✓	
" <i>inexpansa</i>			✓		1/1	✓	

FORBS -

<i>Glyceria striata</i>			✓		1/1	✓	
<i>Solidago canadensis</i>	leafy	▽	✓		1/1	✓	
<i>Solidago graminifolia</i>			✓		1/1	✓	Bl
<i>Solidago nemoralis</i>			✓		1/1	✓	Bl
<i>liatris aspera</i>	round short petioled		✓		1/1	✓	Bl
<i>liatris pycnostachya</i> (Prairie)			✓		2/1	✓	Bl
<i>Thalictrum dasycarpum</i>			✓		1/1	✓	Fr
<i>Aster pharosoides</i> ?			+		1/1	✓	Bl
<i>Lysimachia quadriflora</i>			✓		1/1	✓	Bl / Fr
<i>Zizia aurea</i>			✓		1/1	✓	—
<i>Aster ericoides</i>			+		1/1	2 ✓	Bl
<i>Rudbeckia hirta</i>			✓		1/1	✓	Fr
<i>Rosa arkansana</i>			✓		1/1	✓	Fr
<i>Helianthus maximilian</i>			✓		1/1	✓	
<i>Zizia aptera</i>			✓		1/1	✓	
<i>Asclepias incarnata</i>			+		1/1	✓	
<i>Pycnanthemum virginiana</i> Vg Mt Mint			✓		1/1	✓	Bl
<i>lobelia spicata</i> Pale spoked lobelia			✓		1/1	✓	
<i>Cicuta maculata</i>			+		1/1	✓	Fr
<i>Apocynum sibericum</i>			+		1/1	✓	Fr
<i>Podolostemum purpureum</i>			✓		1/1	✓	Fr
Unknown <i>Juncus</i>			✓		1/1	✓	
" <i>pharosoides</i>			✓		1/1	✓	Bl
<i>Asclepias tuberosa</i> → <i>Apocynum</i>			✓		1/1	✓	—
<i>Helianthus laetiflorus</i> Stiff <i>laetiflorus</i> Sunflower			✓		2/1	✓	
<i>Helenium autumnale</i> Sneeze weed			✓		1/1	✓	Bl
<i>Helianthus alba</i>			✓		1/1	✓	Bl

DATE: June 21, 1979SURVEYOR: JB, JH, CKPLOT #: 2LOCATION: (NW Bird Station #2) Twin Valley PrairieCOVER TYPE: Prairie

SOIL SERIES: _____

PLOT SIZE: 20 m x 20 m

Height Classes

ask

8 7 6 5 4 3 2 1

Coverage for Height Class -

						75%		
--	--	--	--	--	--	-----	--	--

Species

Remarks

						2/1	✓		Bl
						1/1	✓		Bl
						1/1	✓		Bl
						2/1	✓		
						+2	✓		Bl
						+1	✓		Bl
6	(bare?)	shorter leaves (horn)	MADE	MADE		2/1	✓		Gr
		Yellow ^{stems} Grass	Hyperis			1/1	✓		Bl
		Solidago	sp's			1/1	✓		Gr
		Rosa	arkansana			2/1	✓		Gr
		Cardellina	sessiflora?			1/1	✓		Bl
		Blue eyed Grass	Sisyrinchium	sp		+1	✓		Bl
		Helianthus maximilianii	Maximilian Sunflower			+1	✓		Gr
		Zygadenus (elegans?)	White Camass?			+1	✓		Bl
		Apocynum	sibericum?			+1	✓		Gr
		Solidago	rigida?			+1	✓		Gr
		Asteraceae	son. old			2/1	✓		dd
		Agropyron	sp.		3/1	1/1	✓		dd
		Senecio	platensis (Ragwort?)			+1	✓		Bl
		Agrostis	sp.?			+1	✓		dd
		Spartina	pectinata			r/1	✓		dd
		Comandra	umbellata			+2	✓		Bl
		Andropogon	gerardi			+1	✓		dd
		Equisetum	sp.			+1	✓		Gr
		Asclepias	sp?			r/1	✓		Bl
		Helianthus	sp.?			+1	✓		dd
		Cyperus	→ Carex sp.			1/1	✓		Gr
		Solidago	sp?						

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