THE NEBRASKA NATURAL HERITAGE PROGRAM

Two-year
Progress Report

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EXECUTIVE SUMMARY

Since European settlement, human activities have totally eliminated the natural vegetation from approximately 50 percent of Nebraska's landscape, and of that remaining most has been heavily impacted. As a result, numerous plants and animals have been extirpated from the state and many others are threatened.

The destruction of Nebraska's natural diversity resulted in both public and private conservation groups recognizing the need for a centralized and accessible biological database for the state's rare species and natural community types. Toward this end, the Nebraska Natural Heritage Program (NENHP) was established in August, 1987 through a cooperative effort between The Nature Conservancy (TNC) and the Nebraska Game & Parks Commission (NG&PC).

The NENHP provides the only comprehensive system for identifying the ecologically significant components of Nebraska's natural diversity. The inventory focuses on individual components or elements of natural diversity, those features (plants, animals, and natural communities) of particular interest because they are exemplary, unique, or endangered on a state or national basis. The NENHP's inventory is ongoing, with an information base that can be readily updated as new information becomes available and consists of computerized, manual, and map files.

Much has been accomplished during NENHP's initial 23 months of operation. Some of the primary achievements include: 1) completion of element lists for Nebraska which include 423 plant and 179 animal species, 2) development of a natural community classification system for the state, 3) completion of 600 Element State Ranking forms, 4) compilation of over 1000 abstracts on information sources on Nebraska's natural diversity, 5) completion of global vertebrate characterization abstracts for all vertebrates in the state, and 6) computerization and mapping of over 2,100 element occurrence records.

The NENHP's database is now fully operable and available for data users. The database was used to produce the first edition of the Nebraska Natural Diversity Scorecard, a document that provides a framework for land protection efforts in the state. The database has been used for environmental impact assessments and academic research. The NENHP has received numerous requests for information from state & federal agencies, educational institutions, industry, consulting firms, and private organizations.

Transfer of administration of the NENHP to the NG&PC will take place in July, 1989. Continued funding for the Program has been provided as part of the NG&PC's general budget. The three person staff will be incorporated into the NG&PC's Nongame Program.

PREFACE

This technical report describes the purpose and progress of the Nebraska Natural Heritage Program. It has been prepared in fulfillment of contractual obligations and as a basis for future discussion. The report is intended to serve both as a reference document and as a proposal for future activities.

The Nebraska Natural Heritage Program completes its initial 23 months of operation in June 1989 with the submission of this document to the Nebraska Game and Parks Commission.

This progress report was prepared by the staff of the Nebraska Natural Heritage Program with the assistance of the National Office of The Nature Conservancy. The report follows established formats used in preparation of other State Heritage Program reports by The Nature Conservancy. We are particularly indebted to the Michigan, North Dakota, Arkansas, and Iowa Natural Heritage Programs for their fine reports, which served as our models. Comments on this document would be appreciated and should be directed to the Director of Heritage Operations of The Nature Conservancy or to the Nebraska Natural Heritage Program.

The efforts of the Heritage Program will be continued through fiscal year 1990 under the Nebraska Game and Parks Commission. Funding is provided through general fund appropriations by the State Legislature and the Nongame Checkoff Fund.

ACKNOWLEDGEMENTS

The Nebraska Natural Heritage Program would not have been possible without the support and assistance of many individuals and organizations. Most will remain nameless; others cannot be left unnamed.

Funding for the initial two years was provided through several sources. The Nebraska Game and Parks Commission provided in-kind services and approximately one-half of the total budget through general funds and the Nongame Checkoff Fund. The remaining funds were provided by the U.S. Fish and Wildlife Service's Section 6 fund and private contributions raised by The Nature Conservancy. Major donors include the Peter Kiewit Foundation, Burlington Northern Foundation, Woods Charitable Fund, Conagra Charitable Fund, Hitchcock Foundation, Cooper Foundation, Lincoln Foundation, and individual contributors.

The Nebraska Natural Heritage Program represents a manifestation of research by literally hundreds of individuals. We are grateful for the quantities of information and assistance we received from state and federal agencies, private organizations, staff, students, and curators at various universities and state colleges, both in-state and out-of-state, and private individuals.

We are very grateful for the untiring support expressed in all stages of program development by current and former staff of The Nature Conservancy's National Office, Midwest Regional Office, and Nebraska Field Office. In addition, we would like to acknowledge the Nebraska Chapter of The Nature Conservancy Board of Trustees, particularly Gail Yanney and Charles Wright,for their efforts in fund raising and transferring the Program to the Nebraska Game and Parks Commission.

We acknowledge and thank the strong support and guidance of the Nebraska Game and Parks Commission. They were very gracious in their help and services, making our endeavor much easier to accomplish. Special thanks goes to Ross Lock, Nongame Specialist, and Bill Bailey, Assistant Director.

Lastly, we thank Debbie Hegi for typing this document.

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INTRODUCTION

Nebraska's natural landscape has been modified extensively since settlement of the state. Of the approximately 14 million acres of tallgrass prairie that once covered the entire eastern third of Nebraska less than 5 percent has escaped conversion to cropland. Much of what remains has been severely impacted by overgrazing. Nearly all of the state's forests have been logged or grazed in the past 125 years. All but 10% of Nebraska's Rainwater Basin wetlands have been destroyed or greatly modified by draining, filling, dredging, or siltation. Along with this loss of native habitat has gone a significant number of plant and animal species. For example, more than 15 species of vertebrates have been extirpated from the state since settlement.

Yet hidden among today's human-dominated features are precious remnants of Nebraska's ecological heritage. Viable populations of rare plants and animals still occur within the state's borders. The ecological processes responsible for our rich soils, productive grasslands, and clean water are revealed in remnants of undisturbed land. A few of Nebraska's natural features are of worldwide significance. Nebraksa's Sandhills region is one of the nations largest tracts of relatively undisturbed native grasslands. Blowout penstemon (*Penstemon haydenii*), a species that occurs in sand blowouts, is known from only eight sites in the Nebraska Sandhills and nowhere else in the world.

By preserving these treasures, we will maintain genetic reservoirs that may be drawn upon in the future as new sources of food, medicine, or other products are needed. Natural areas also serve as psychological refuges for people, providing needed contrasts to our highly modified environment. Once destroyed, Nebraska's natural features cannot be fully restored. Unless critical sites are carefully protected, their resource potential, utility for education and research, recreational, aesthetic, and cultural values could be lost forever.

Effective conservation of Nebraska's natural diversity requires many levels of action. First, we must properly manage features that already occur on publicly owned lands or privately owned preserves. If we hope to protect high quality examples of many other natural communities and rare species, new areas must be acquired. Given the limited funds devoted to conservation efforts, these sites must be chosen selectively. The site selection effort for the new Nebraska Registry Program must be carefully planned to maximize investments of time and personnel. Inadvertent destruction of natural features can be consistently avoided, if sensitive areas are identified well in advance of planning for economic development. Each of these measures requires a common foundation: accurate, up-to-date information. Without such information, conservation policies are ineffective,

dollars are wasted, and key elements of Nebraska's natural heritage will disappear needlessly.

The need for a centralized and accessible biological database in Nebraska has been recognized by both public and private conservation organizations. Toward this end, the Nebraska Natural Heritage Program (NENHP) was established in August, 1987 by a cooperative effort between The Nature Conservancy (TNC) and the Nebraska Game & Parks Commission (NG&PC). Three staff members were hired by The Nature Conservancy and operation of the Program began approximately two months later. The Program is housed at the Nebraska Game & Parks Commission Headquarters in Lincoln, Nebraska. Funding for the initial two years was derived from public and private sources. The NG&PC provided in-kind services and approximately one-half of the total budget. The other half of the budget was provided by The Nature Conservancy through private donations. Transfer of administration from The Nature Conservancy to the Nebraska Game & Parks Commission will take place in July, 1989. Continued funding has been provided as part of the Nebraska Game & Parks Commission's general budget. The three person Heritage staff will become incorporated into the Nebraska Game & Parks Commission's Nongame Program.

The comprehensive inventory of ecological resources provides a continuous process for identifying natural areas and for setting land protection priorities in the state. The inventory focuses on individual components or "elements" of natural diversity, those natural features of particular interest because they are exemplary, unique, or endangered on a state or national basis. Information on the status and distribution of these elements is collected and stored in an integrated data management system. Elements include high quality examples of Nebraska's rare plant and animal species, natural communities, and other special features such as colonial bird nesting sites.

Program Objectives

In order to create a system for identifying and protecting the most significant natural areas in Nebraska and to fulfill the contract agreement with the NG&PC, the Nebraska Natural Heritage Program set out to meet the below listed objectives.

1) Create an operations center consisting of maps, files, library, etc.

2) Produce Heritage "Operations" and "Administration" manuals specific for Nebraska.

3) Compile and maintain lists of rare, endangered, threatened, and peripheral plant and animal species in Nebraska.

4) Complete 600 Element State Ranking forms (forms assessing element rarity within Nebraska) for rare plant and animal species and natural communities.

5) Complete a list of all vertebrate species found in Nebraska and Vertebrate Characterization Abstracts (general, range-wide level information) for each.

6) Develop a natural community classification system for Nebraska which is compatible with The Nature Conservancy's national community classification system.

7) Set up a manual data management system to consist of:
   a. Geographical Manual File
   b. Managed Area File
   c. Element File
   d. Source Abstract File
   e. Map File

8) Set up an automated data management system to include:
   a. Element Occurrence Record File
   b. Managed Area File
   c. Element Tracking File
   d. Source Abstract File
   e. Vertebrate Characterization File
   f. Linkage to TNC's national databases

9) Gather and enter element occurrence records:
   a. 2,000 fully transcribed
   b. 1,750 mapped
   c. 1,500 computerized

10) Compile and enter Source Abstracts for 500 sources of data.

11) Complete Managed Area Records for 200 state, federal, and private conservation areas.

12) Write and distribute biweekly reports on the NENHP's progress.

13) Respond to information requests as best current database development will allow.

14) Produce a "Natural Diversity Scorecard" (a prioritized listing of areas needing protection) for Nebraska.

15) Produce a 2-year progress report, summarizing results of the initial data gathering and analysis, together with recommendations for future work.

The above listed objectives must be completed by June 30, 1989 to comply with requirements of the 2-year contract signed between The Nature Conservancy and the Nebraska Game & Parks Commission. Objectives one through fourteen have been achieved and are functioning components of the Nebraska Game & Parks Commission. The present document fulfills objective fifteen.

METHODOLOGY

The Nebraska Natural Heritage Program provides a comprehensive system for identifying ecologically significant natural features in the state. Based on the innovative methodology developed by The Nature Conservancy, the "Heritage System" emphasizes features that are exemplary, unique, or endangered on a statewide or national level. In Nebraska, components or elements of natural diversity include natural communities such as sandsage prairie or southeastern upland forest and species such as the interior least tern (*Sterna antillarum athalassos*) and blowout penstemon (*Penstemon haydenii*).

The element-based approach is an advance in the effort to ensure an objective, thorough assessment of a state's ecological diversity. Many inventories focus on sites rather than individual elements and are conducted over a set time period and are quickly outdated. The Nebraska Natural Heritage Program's inventory is ongoing, with an information base that can be readily updated as new information becomes available. The inventory has three main processes for identifying the portions of the landscape that best represent the full range of Nebraska's natural diversity: classification, inventory, and data analysis.

Classification Systems and Element Lists

Nebraska's natural diversity includes all its native plants and animals, and its terrestrial and aquatic communities. It would be impractical to gather information on all species. Further some species are clearly more vulnerable to extirpation than others and must be afforded special attention. For these reasons, two approaches to the classification of natural diversity have been employed: a "coarse filter" and a "fine filter".

The coarse filter approach is based on the premise that many plants and animals are either closely associated with particular habitats or community types or are common enough to require no specific protection measures. We assume that preserving viable examples of each natural community type will simultaneously preserve many species that live in these communities. Of course, natural communities are complex interacting units, significant in their own right. Their protection is intended not only to preserve the diversity of individual species, but to protect the full range of ecological communities, and their species assemblages, occurring in the state. An example of the "coarse filter" approach follows:

> Sandhill fens are a natural community type presently known to occur only near stream headwaters in the Sandhills of Cherry County. Abundant groundwater supplies provide the fens with a constant flow of cool

> water which saturates the spongy peat (partially decomposed plant material) soils. The fens provide a microhabitat for relict populations of rare plants and animals more characteristic of colder climates. Preserving good examples of sandhill fens will protect species that are closely associated with that community.

Some of our plants and animals, however, pass through the coarse filter. Such species are not regularly associated with a particular natural community type or are not necessarily protected by preserving a few examples of the characteristic natural community type. They must be treated on a species-by-species, or "fine filter", basis. An example of the fine filter approach follows:

> Blowout penstemon (Penstemon haydenii), a federally endangered species, is known only from eight sites in the Nebraska Sandhills. Blowout penstemon is closely associated with blowouts within sandhills prairie, but not all blowouts contain blowout penstemon. When The Nature Conservancy protected nearly 40,000 acres of sandhills prairie (Niobrara Valley Preserve in Brown, Cherry, and Keya Paha counties), habitat was preserved for typical blowout species and for many sandhill prairie species, but not for blowout penstemon. The penstemon slipped through the coarse filter, the natural community approach.
>
> Protection of the blowout penstemon requires a more narrow approach. We must know where they occur, what their habitat and management requirements are, and the locations where they can be protected. The largest known population of blowout penstemon was protected by The Nature Conservancy's purchase of Graves Ranch, specifically to establish a preserve for this species.

The Nebraska Natural Heritage Program classification system groups elements into four classes: natural communities, special plants, special animals, and other natural features.

Natural Communities

The Nebraska Natural Heritage Program attempts to define all natural community types found in the state. A natural community is defined as a distinct and naturally recurring assemblage of populations of organisms naturally associated with each other and their physical environment. Natural communities, based on very broadly defined types of assemblages, embody the Program's coarse filter. They are defined by a combination of physiognomy, species composition, topography, and substrate. A natural community is named by its most characteristic biotic or abiotic features, such

as eastern floodplain forest, sandhills alkaline lake, or wet cliff. Complete descriptions of Nebraska's natural community types are presented in Appendix D.

There are a number of advantages to this general classification system. First, the terms are familiar enough to be acknowledged and understood by a wide audience, yet specific enough to be useful to ecologists. Second, the categories are broad enough to provide a nearly complete classification of Nebraska's natural diversity. Third, a habitat-based classification covers features not well characterized by vegetation such as aquatic communities, cliffs, and badlands, as well as vegetated areas where dominant species are not readily distinguishable. Fourth, a natural community classification can be developed faster than a plant community classification, and fewer future modifications are likely to be needed.

In some cases, Nebraska's current natural community classification lumps together quite different species assemblages. This limits its usefulness as a "coarse filter" for protecting ecological diversity. For example, the wet meadow natural community type may be dominated by rushes (*Juncus* spp.) in one area, sedges (*Carex* spp.) in another, and the ferns (*Thelypteris palustris* and *Onoclea sensibilis*) in still another. Protecting one wet meadow does not sufficiently cover the many types of wet meadows and associated species present in Nebraska.

As more information accumulates about Nebraska's natural areas, the NENHP community classification scheme will be refined. Natural community types will be added and others will be modified. Field workers are paying particular attention to dominant plant species, which may form a basis for subdividing certain existing categories.

Special Plants

In 1975 the Nebraska Legislature passed LB145, the "Nebraska Nongame and Endangered Species Conservation Act", to conserve species of wildlife and wild plants normally occurring within the state which may be found to be threatened or endangered. It charges the Nebraska Game and Parks Commission to perform those acts necessary for the identification, conservation, and protection of endangered and threatened plants and wildlife.

Subsequent to LB145, an advisory committee in 1976 suggested 29 species of plants as being rare in Nebraska. Additionally, over 240 species were included on a watch list of species requiring monitoring and additional research. This list represented one of the most recent multi-disciplined efforts at identifying the rare flora of the state and served as a starting point for the NENHP'S plant element tracking list (special plant list). In formulating NENHP'S current plant element list, a broad array of sources were

utilized to determine a plants' relative status in the state. These sources included individual researchers rare plant lists, reports of new state records, literature reviews, and correspondence with researchers. An initial draft of the list was then given to botanical authorities for review. After a review of comments and additional information, the current plant element tracking list was finalized. This list includes all federally listed species as well as species in the state that are rare or threatened due to low and/or declining populations, species of special concern, and species whose status is unknown. The plant element tracking list for the NENHP is presented in Appendix A.

Special Animals

State lists of endangered and threatened animal species were originally compiled under LB145 in 1977 by the Nebraska Game and Parks Commission. This list has since been revised and currently 9 animals are listed as endangered, 9 as threatened, 5 in need of conservation, and 26 as species of special concern. All vertebrates listed as endangered or threatened by the U.S. Fish and Wildlife Service are included on the state endangered and threatened animal list.

The first draft of the NENHP animal list was developed after a systematic review of existing lists and publications. More than 30 scientists and other knowledgeable individuals provided additional information and comments. Current lists of special vertebrates and invertebrates include all officially listed species as well as others that are rare, declining, of undetermined status, or otherwise of special concern in Nebraska. The current NENHP special animal list is presented in Appendix B.

Other Natural Features

The Nebraska Natural Heritage Program is equipped to collect information on other natural features that do not fit within the categories given above. These include rookeries, migratory bird concentration sites, and state champion trees. Because the NENHP has given a higher priority to rare plants and animals, and natural community types, other types of elements generally have not been assimilated into the database.

Inventory

Definition of Element Occurrence

The inventory phase of the program is a continuing process in which data is collected and compiled into a usable form. The basic unit of data collection is the "element occurrence", a location where an element has been observed, collected, or reported through secondary sources.

Element occurrence criteria differs from element to element. For instance, a reliable report of the prairie white fringed orchid (Platanthera praeclara) in a meadow at the Valentine National Wildlife Refuge could be recorded as an element occurrence because orchids are essentially sedentary and the meadow contributes to the survival of the species. A sighting of a peregrine falcon flying over a cornfield, on the other hand, does not qualify as an element occurrence; there is nothing about the cornfield which can be assumed to contribute to the survival of the bird. Element occurrences for some species and communities require special circumstances. Only critical winter roosts and nest records are recorded for bald eagles. Certain native grasses must be dominant for an area to qualify as an occurrence of wet-mesic prairie.

Element Ranking

In our data acquisition, field survey, and protection efforts elements should receive attention according to their relative rarity and endangerment throughout their entire range. A species or community found only in Nebraska and known from only one or two places deserves attention before an element which, while rare enough in the state to merit inclusion on the list, is common elsewhere. To rank elements in the relative order of their global (rangewide) and national importance, The Nature Conservancy has developed global and national ranking systems. Global ranks have been assigned to a large percentage of the NENHP's element species and communities by The Nature Conservancy. National ranks have been given only to a few species which are exotics or accidentals in North America. The global rank categories are listed below.

G1 = Critically imperilled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 = Imperilled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of factor(s) making it very vulnerable to extinction throughout its range.

G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range or because of other factors making it vulnerable to extinction throughout its range; (21 to 100 occurrences).

G4 = Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.

G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

GH = Of historical occurrence throughout its range, i.e., formerly part of the established biota, with the expectation of rediscovery (e.g., Bachman's warbler).

GU = Possibly in peril range-wide but status uncertain; need more information.

GX = Believed to be extinct throughout range (e.g., passenger pigeon) with virtually no likelihood that it will be rediscovered.

Because an element's status in a state is also of interest, a state ranking system has also been developed by The Nature Conservancy. Each element (plant, animal, and community) on the NENHP's element list has received a state rank. The ranks were assigned through use of an Element Ranking Form (ESR) (Figure 1). The ESR provides a brief summary of an element's range, status, and protection needs. For vertebrate species that occur in Nebraska but are not element species, state ranks have been assigned "by inspection" (i.e., ESR's are not completed, but a "best guess" determines the state rank). The state rank categories are listed below.

S1 = Critically imperilled in state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation from the state.

S2 = Imperilled in state because of rarity (6 to 20 occurrences
or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.

S3 = Rare or uncommon in state (to 100 occurrences).

S4 = Apparently secure in state, with many occurrences.

S5 = Demonstrably secure in state and essentially ineradicable under present conditions.

SA = Accidental in state, including species (usually birds or butterflies) recorded once or twice or at great intervals.

SE = An exotic established in state; may be native elsewhere in North America.

SH = Of historical occurrence in the state, perhaps having not been verified in the past 20 years, and suspected to be still extant.

SN = Regularly occurring, usually migratory and typically nonbreeding species for which no significant or effective habitat conservation measures can be taken in the state.

SR = Reported in the state, but without persuasive documentation which would provide a basis for either accepting or rejecting (e.g., misidentified specimen) the report.

SRF= Reported falsely (in error) from the state but this error persisting in the literature.

SU = Possibly in peril in state but status uncertain; need more information.

SX = Apparently extirpated from state.

Data Acquisition

Details about location, status, ownership, source of information, and other qualities of element occurrences are transcribed onto standardized Element Occurrence Records (EOR) (Figure 2), the principal units of inventory data storage and retrieval. Through an interactive computer system, EORs are easily updated when new information becomes available.

A great deal of element occurrence information is scattered among records of government agencies, conservation organizations, museums, libraries, and knowledgeable individuals. During the initial 2-year contract, sources that were expected to provide significant amounts of reliable element occurrence data were identified and investigated. Most records now in the NENHP database were derived from systematic searches of existing sources. Such information provides background for field surveys, identifies new sources of information, reveals gaps in current knowledge, and avoids duplication of past work.

Analysis of information from existing sources leads to a second, more specific phase of data collection. In this phase, old or incomplete records are investigated by field surveys or by further contacts with knowledgeable sources. These results, in turn, are used to reevaluate priorities and help guide future investigations (Figure 3).

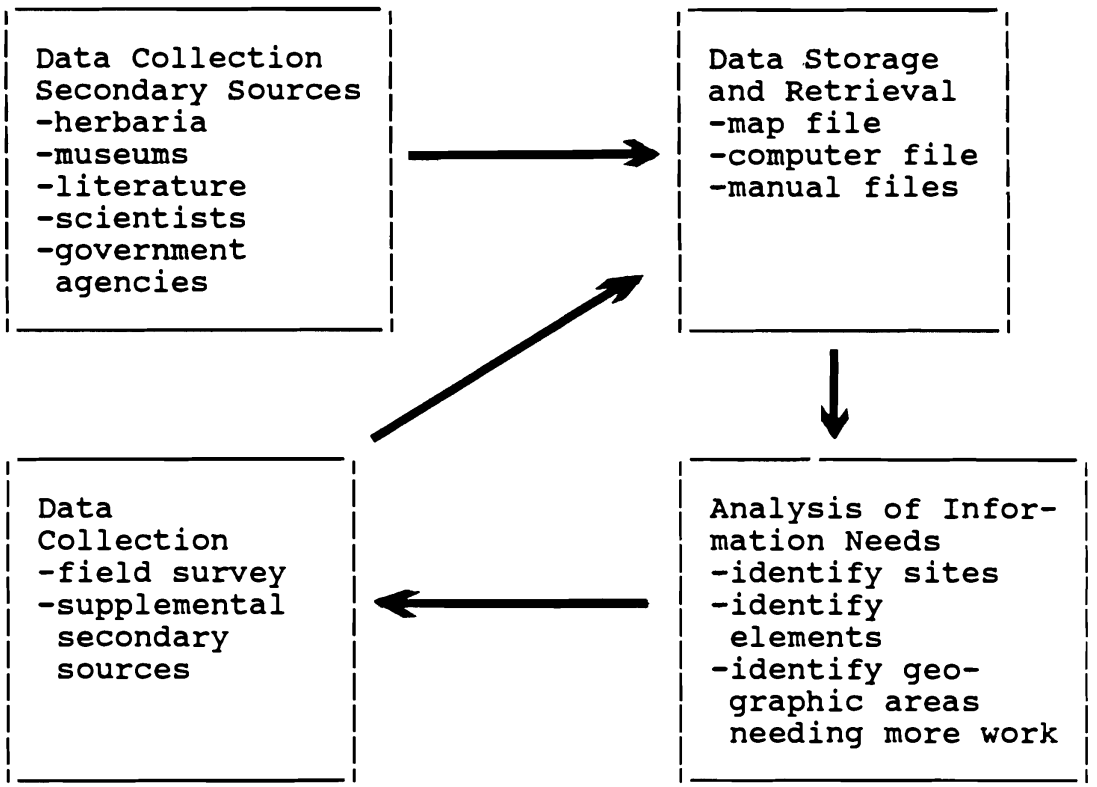
Figure 1. Sample State Element Ranking (ESR) Form.

ELCODE: PDSCR1L300
SNAME: PENSTEMON HAYDENII
STATE: NE
SEXEMPSITE: GRAVES RANCH PRESERVE-TNC
SESTEOS: B
SESTEOSCOM: 6 CONFIRMED SITES ARE KNOWN AND 1 NEW UNCONFIRMED EO, ALL CONFIRMED SITES ARE MONITORED ANNUALLY.
SABUND: C
SABUNDCOM: APPROX 4500+ PLANTS ARE KNOWN ALTHOUGH THIS NUMBER MAY FLUCTUATE WIDELY FROM YEAR TO YEAR.
SRANGE: A
SRANGECOM: THIS SPECIES IS ENDEMIC TO NEBRASKA, AND RESTRICTED TO THE VERY SMALL HABITAT AREA OF BLOWOUTS WITHIN THE SANDHILLS.
SPROTEOS: C
SPROTCOM: 4 SITES ARE PROTECTED, WITH 2 ADDITIONAL SITES POSSIBLY ON MA'S. THEY OCCUR ON TNC, NWR AND STATE PROPERTY.
STHREAT: A
STHREATCOM: DUE TO STABILIZATION OF THE SANDHILLS, THE NUMBER, SIZE AND CONTIGUOUS ASPECT OF BLOWOUT HABITAT HAS GREAT DECLINED.
SOTHCONSID: SPECIES IS EXTREMELY SENSITIVE TO COMPETITION FROM OTHER PLANTS AND IS ONE OF THE EARLIEST BLOWOUT COLONIZERS.
SRANK: S1 **SREVDATE:** 88-08-25
SREASONS: SPECIES IS A FEDERALLY LISTED ENDANGERED SPECIES, ENDEMIC TO NEBRASKA WITH VERY RESTRICTED HABITAT THAT IS THREATENED AND DECLINING. POPULATIONS ARE CONFINED TO A SMALL NUMBER OF SITES.
SPROTNEED: ALTHOUGH SEVERAL SITES ARE PROTECTED, ALL EO'S SHOULD BE AFFORDED SOME LEVEL OF PROTECTION.
SINVENNEED: CONFIRM NEW SITES, SURVEY FOR ADDITIONAL SITES AS OTHER POPULATIONS ARE LIKELY.
SSTEWNEED: MANAGE FOR BLOWOUTS TO MAINTAIN BARE SAND HABITAT FOR SEEDLING ESTABLISHMENT.
EDAUTHOR: FRITZ, MICHAEL I
EDITION: **UPDATE:** 89-03-01

Figure 2. Sample Element Occurrence Record (EOR).

EOCODE: ABNNB03070.001
NAME: CHARADRIUS MELODUS
COMNAME: PIPING PLOVER
MARGNUM: 1 **TENTEN:** 04,10 **IDENT:** Y **EORANK:** B
EORANKCOMM:
SURVEYDATE: 1983-06-16 **LASTOBS:** 1983-06-16 **FIRSTOBS:** 1982
GRANK: G2 **SRANK:** S2 **STATE:** NE
COUNTYNAME: NEBROW
QUADCODE: 4209977
QUADNAME: MEADVILLE **PRECISION:** SC
LAT: 424506 **LONG:** 995017 **S:** 0 **N:** 0 **E:** 0
W: 0 **TOWNRANGE:** 032N021W **SECTION:** 18 **MERIDIAN:** 6P
TRSCOMM: NW4 **PHYSPROV:** DT **WATERSHED:** 10150004
DIRECTIONS: NIOBRARA RIVER 2 MI. DOWNSTREAM FROM MEADVILLE [FROM S SIDE OF MEADVILLE BRIDGE FOLLOW ROAD E APPROXIMATELY 1 MI., HIKE TO RIVER THROUGH TREES, SITE IS SANDBAR ON S SIDE OF RIVER].
GENDESC: BROAD LOW SANDBAR ON S SIDE OF NIOBRARA RIVER, BORDERED ON N BY CHANNEL 2-4 FT DEEP 20-50 M WIDE; BORDERED ON S BY BRAIDED CHANNELS 1-2 FT DEEP 5-15 M WIDE.
ELEV: 2010 **SIZE:** 15
EODATA: 82-07-14: 14 ADULTS, 4 NESTS WITH 1,3,4 & 4 EGGS; 82-07-22: 16 ADULTS, 1 NEST, 4 EGGS; 83-06-16: 6 ADULTS, 1 NEST, 4 EGG ; 83-07-12: 2 ADULTS. MIXED COLONY WITH LEAST TERNS.
COMMENTS: 82-07-22 RECENTLY DISTURBED BY CATTLE, RACCOON AND COYOTE TRACKS ALSO PRESENT, 83-07-19 SANDBAR FLOODED.
MACODE1: **CONTAINED1:** **MACODE2:**
CONTAINED2: **MACODE3:** **CONTAINED3:**
ADDLMAS:
MORELAND: **MOREPROT:** **MOREMGMT:** **SITECODE:**
SITENAME: NIOBRARA R-MEADVILLE CROSSING
OWNER: GRAVES INC.
OWNERCOMM:
PROTCOMM:
MGMTCOMM: EXCLUDE CATTLE
MONITOR: STEUTER, AL **MONITORNUM:** 402 722-4440
BESTSOURCE: BROGIE, MARK A. BOX 316, CREIGHTON, NE 68729. HOME: (402) 358-5675, WORK: (402) 358-3663
SOURCECODE: PNDBRO02NEUS F83ELL01NEUS U82NVP01NEUS A83MOS01NEUS
DATASENS: Y **BOUNDARIES:** **PHOTOS:** **OWNERINFO:**
TRANSCRIBR: 88-03-03 MKC **CDREV:** Y **MAPPER:** 88-03-08 MKC
QC: Y **UPDATE:** 88-05-22 GAS

Figure 3. Data Cycles.



Stage 1, Data Collection. In the initial data-gathering phase, information is collected on as many significant elements as possible. Data on Element Occurrences are gathered from herbaria records, museum records, scientific literature, and scientists.

Stage 2, Data Storage and Retrieval. The Element Occurrence information is recorded in the map file, computerized, and cross-referenced in the various manual files of the NENHP database.

Stage 3, Analysis of Information Needs. After a comprehensive list of Element Occurrences is stored in the data system, 1) sites are identified that support elements worthy of closer inspection and 2) elements are identified that require further investigation to determine their statewide status.

Stage 4, Data Collection. In this data-gathering phase, intensive field surveys are conducted and secondary sources are searched for supplemental data to fill the information needs identified in Stage 3.

Site evaluation consists of field surveys, comparison with other occurrences (assigning an "element occurrence rank"), and determining appropriate element occurrence (EO) boundaries. The criteria used by Heritage Programs for assigning an EO rank to a site include quality; (representativeness of the occurrence especially as compared to EO specifications and including maturity, size, number, etc.), condition (how much the site and the EO itself have been damaged from its optimal condition and character), viability (the long-term prospects for continued existence of this occurrence), and defensibility (the extent to which the occurrence can be protected from extrinsic human factors that might otherwise degrade or destroy it). Results from site evaluations are added to the respective Element Occurrence Records, thus keeping the database as accurate and up-to-date as possible.

Many years will be required to assimilate all existing occurrence information for the 47 natural communities, 423 special plant species, and 179 special animal species being tracked by the NENHP. Field research involving previously known sites and new localities will require an even longer period. Given these constraints, the NENHP database must be developed according to systematic priorities if results are to achieve maximum effectiveness. The highest ranked (i.e. rarest and most endangered) elements have been given first attention during the NENHP initial 2-year period. Element ranks continue to guide data acquisition.

County Natural Areas Inventory

The County Natural Areas Inventory is a systematic effort to locate, evaluate, describe, and classify natural areas of statewide significance on a county by county basis. A natural area is defined as a tract of land or water that reflects as nearly as possible the conditions prior to European settlement. Natural areas contain one or more natural communities which exist in an undisturbed or relatively undisturbed natural state.

The systematic Natural Areas Inventory is a proven method of supplying up-to-date ecological information. In other midwestern states, county natural area inventories have provided accurate and detailed information about the location and characteristics of the state's natural community types. Natural communities represent the coarse filter for protecting natural diversity: by identifying and describing the best examples of all terrestrial and aquatic community types, perhaps 85-90 percent of the biological diversity of a state will also be identified and described. During the course of survey work the county natural areas inventory has also proven to be an effective method for discovering locations for rare plant and animal species.

The Illinois Department of Conservation completed the first systematic element inventory of a state's biological diversity in 1977. To preserve biological diversity in Illinois, the Illinois Natural Areas Program, The Nature Conservancy, and state regulatory agencies depend on the information generated by the inventory, 60 percent of which was unknown before the project began. Indiana was the second state in the nation to complete a systematic natural areas inventory. Sites identified by the inventory account for two-thirds of the natural areas being purchased during the $10-15 million Indiana Natural Heritage Protection Campaign. This land acquisition program is jointly funded by The Nature Conservancy and the State of Indiana to preserve Indiana's biological diversity. Recently, several states bordering Nebraska, including, Colorado, Iowa, Kansas, and Missouri have employed county natural areas inventories as tools to develop their statewide conservation strategies. Nebraska is one of the first natural heritage programs to conduct a systematic county natural areas inventory in its initial phase of operation.

The information generated by Natural Areas Inventories produce a nearly complete, up-to-date perspective on a county's biological diversity. The systematic inventory will prove to be an invaluable source of information to the Nebraska Game & Parks Commission and The Nature Conservancy in setting a statewide conservation strategy, and for environmental impact assessment.

Pawnee County was selected as the site for the trial county natural areas inventory because of its relatively close proximity to Lincoln and its potential for containing large remnant tracts of native tallgrass prairie and eastern deciduous forest. The methodology and techniques being used closely follows that developed from the highly successful projects in other states. The Pawnee County inventory, initiated in July of 1988, is a three phase project. First, color infrared photographs of the county were examined to select potential natural areas. Mid-May photos were used as these proved to be the most useful in distinguishing native warm season dominated prairies from exotic cool season dominated prairies and pastures. Native forested tracts were also easily identified from the photos. All potential natural areas were then plotted on 7.5 min. USGS topographic maps. The second phase of the inventory consisted of an aerial survey which was conducted in late September of 1988 and required roughly 5 hours of flight time. Transects of the county were flown to identify natural areas that have been destroyed or disturbed since the aerial photos were taken or that were not identified from the aerial photos. A preliminary rank of quality was also assigned to natural areas during this phase. The final phase of the inventory will consist of an on ground survey of all high quality and large (>20 acres) sites.

The effectiveness of the natural areas inventory techniques and methodology for eastern Nebraska will be evaluated at the end of the project. The initial results are promising. At the conclusion of phase 2 (flight transects) approximately 250 potential natural areas have been identified for Pawnee County. The majority of the sites are hayed tallgrass prairies, with lesser numbers of wet prairies, wet-mesic prairies, bur oak woodlands, and southeastern upland forests.

Source Abstract Database

As the NENHP acquired various sources of information on the elements of the state's natural diversity and other useful information, it was necessary to track information about these sources, such as what information they contain, how useful they are, where they are filed etc. Our means of tracking this information is the Source Abstract Database. It is a computerized database containing information on published and unpublished materials and knowledgeable individuals. The Source Abstract Database provides the NENHP with the following:

1. An easily accessible record of what sources we have in house, have consulted elsewhere, or plan to obtain.

2. The ability to produce computer-generated bibliographies on a wide variety of subjects (e.g., all the sources on birds).

3. An abstract for each source.

4. Through source codes, the ability to relate multiple sources to a single EOR.

5. Through the GEOGCOVER (geographic coverage) field the ability to relate sources to specific areas or regions.

Managed Area Database

The term "managed area" eludes any single, unqualified definition, but two are provided here to clarify what the term implies to a Heritage Program:

1. Usually a managed area will be in public or institutional ownership. In addition, the area has the distinction of being maintained in a manner that will protect the significant elements and features occurring within its boundaries, but this is not a necessary condition.

2. The area has a professional manager or managing agency <u>capable of</u> protecting element occurrences and other ecological attributes by adopting appropriate management strategies.

Information on Nebraska's managed areas is important to the NENHP for three major reasons. First, we are concerned with protecting the full spectrum of the state's natural diversity. A portion of this spectrum occurs on managed areas. It is essential to know which portion is protected so that efforts will not be wasted attempting to preserve diversity which has already been adequately protected.

Second, knowing where managed areas are and which element occurrences are on them makes possible the efficient use of protection capabilities. It is generally easier to increase the degree of protection of element occurrences on areas that qualify as "managed" than it is to preserve occurrences on land that has no protected status.

Third, managed areas are often a rich source of leads to element occurrences and other data because of the presence and interest of area managers.

Our initial data collection effort concentrated on those managed areas with the best protection within the state, including: Research Natural Areas, Wilderness Areas, TNC Preserves, National Wildlife Refuges, and State Parks. Our scope then expanded to include less well-protected areas, such as National Forests, State Wildlife Management Areas, State Recreation Areas, and Federal Waterfowl Production Areas. Ultimately, almost all federally-owned and state-owned lands, even those which do not merit any particular protected status (e.g., military bases), are considered managed areas. The type of information gathered for each area includes boundaries, management policies and practices, principal contacts, etc. Copies of "Managed Area Basic Records" are stored within computer and manual files. Managed area boundaries are mapped on U.S.G.S. topographic maps.

Characterization Abstracts

State and federal resource management agencies are frequently called upon to assess ecological impacts on all vertebrate wildlife resources, common species as well as rare ones. The Nature Conservancy, whose mission is the preservation of the entire spectrum of natural diversity, has responded to this growing need for information on all nongame fish and wildlife species. It has developed a computerized database known as the "Vertebrate Characterization Abstract" (VCA), which has been incorporated into the Nebraska Natural Heritage Programs database system.

The VCA is a record of attributes of each vertebrate species - taxonomy, phenology, distribution, habitat, etc. It complements the element occurrence database which provides specific information on individual occurrences of rare species. The VCA database allows the sorting of species into categories of

specified shared characteristics, such as area (county, watershed), habitat type, status, food habits, and daily and seasonal activity patterns. Comment fields contain detailed referenced information on management, migration, foods, reproduction, species ecology, range, and habitat.

Eventually there will be four additional characterization abstracts incorporated into the NENHP database system: the Plant Characterization Abstract (PCA), the Community Characterization Abstract (CCA), the Invertebrate Characterization Abstract (ICA), and the Non-Vascular Plant Characterization Abstract (NCA).

Data Management

Information collected by the NENHP is stored in three types of files. 1) U.S.G.S. topographic maps (7.5' and 15') are used to record locations of element occurrences and managed areas. 2) Manual files store copies of Element Occurrence Records, Managed Area Records, State Ranking Forms, Source Abstracts, field topographic maps, correspondence, and supplemental information about individual elements and managed areas. 3) Computer files provide ready access to Element Occurrence Records, Managed Area Records, Vertebrate Characterization Abstracts, State Ranking Forms, and Source Abstracts. Access to the TNC national database can be made through a computer modem. Components of the NENHP data storage system are shown in Figure 4 and a complete description of data management procedures are explained in a separate NENHP Operations Manual.

Data Analysis

A considerable portion of the NENHP staff time is spent on data analysis and review. Data analysis serves 1) to reorder research priorities (identify elements and areas needing more research), and 2) to identify natural areas. The latter aspect is described below.

Data Application

Identification of Critical Natural Areas

The inventory process involves two steps: 1) considering which species and natural communities are truly significant, and 2) evaluating sites where these elements are known or likely to occur. Results from both steps are summarized in a key document, the Natural Diversity Scorecard (Figure 5). Using a format developed by TNC, the Scorecard presents highly condensed information about places where priority elements are represented. Element ranks, element occurrences ranks, site names, precision, size, and protection comments are all included. The Natural Diversity Scorecard also monitors the progress of species and natural community protection efforts. This information helps

establish conservation priorities, which in turn help maximize allocations of time, money, and personnel.

The NENHP completed its first edition of the Nebraska Natural Diversity Scorecard in 1988. Like other features of the Heritage Program, the Natural Diversity Scorecard will be updated as new information becomes available. The Scorecard provides a framework for land protection recommendations in Nebraska. Its application will require efforts by the Nebraska Game and Parks Commission, The Nature Conservancy, U.S. Fish and Wildlife Service, U.S. Forest Service, conservation groups, private landowners, and many others.

Protection Planning

Once a critical area has been identified for one or more elements, a plan for protection of those elements needs to be developed. The NENHP has produced "site packages" for two particularly well documented and significant areas. Each package includes a discussion of the site's ecological significance, evidence of disturbance, management recommendations, a list of elements known from the site, and maps showing the ecological and ownership boundaries. Site packages are brief and considerably less detailed than full-fledged management plans, but they provide an initial stimulus for land protection.

Environmental Review

Another major goal of the Program is to make information available for environmental impact assessment. Data stored in the NENHP computerized portion of the database can be retrieved in many different ways. Agencies reviewing projects with potential environmental impacts can request information about a given watershed, county, township, section, landform region, or any area that can be defined by rectangular coordinates. Records of significant species or community types in the vicinity of a project area can help focus subsequent field surveys, if necessary. Because information in the NENHP database can be retrieved quickly, potential conflicts between development and protection interests can be averted early during project planning stages.

Research

The NENHP database and staff provide a valuable resource for public information and academic research. Whereas the inventory depends extensively on contributions from outside sources, the Program, in turn, is able to help guide research projects.

Figure 4. Components of the NENHP Database.

	ELEMENTS	ELEMENT OCCURRENCES	MANAGED AREAS	SOURCES
MANUAL FILES	Element Files 1) element folders 2) general folders 3) raw files	Geographic Manual Files (GMF) 1 folder/7.5-min. topo map contains area info., e.g., soils survey vegetation maps, field survey forms	Managed Area File 1 folder/area; contains general policy & management planning information, correspondance, etc.	Not a sperate manual file. Several files contain sources: reprint file, contact/ correspondence file. Filing location depends on content of source.
MAP FILE	County-of-Distribution Map One 1.5" x 11" element inventory-generated range map	7.5-minute USGS topographic quad maps Full state coverage; each EO is plotted, with boundaries if available; each map accompanied by a map margin sheet	Shares EO map file, 7.5-minute USGS topos; boundaries of each managed area are plotted on the maps	No map file for source.
COMPUTER DATA-BASES	Element Tracking data-bases codes, names, status Characterization abstracts (VCA, PCA, CCA) Taxonomy, phenology distribution, habitat	Element Occurrence Record (EOR) 1 record/EO; includes location, general description, condition dates, sources, land management, etc.	Managed Area Basic (MAB) 1 record/MA; gives information on managers, location etc.	Source Abstract (SA) Catalogs all sources reviewed and to be reviewed. Usefulness, filing location, full citation, are noted.
OTHER DATA-BASES, FILES OR FORMS	Global, National & State Ranking Databases (EGR, ENR, ESR) Summaries of element range, number & protection status used to determine priority for protection & inventory	Element Occurrence Log Sheet 1 log sheet/element; lists location of all occurrences of the element.		

Figure 5. Sample Page from the Nebraska Natural Diversity Scorecard.

NE Scorecard

Element Name Code	Rank	EO#	EO Rank	Site Name Code	Acres	Prec	Comments
Eastern woodland, Well drained rich woodland/savanna, midwest type							
ETW000EW00	G1/S2						
		001	AC	Steele City Canyon	150.0	SC	Suitable for registry or acquisition, good fen at site also
Tallgrass prairie, Tallgrass prairie, glaciated lower midwest type							
ETG000TG00	G2/S2						
		006	A	Krebs Prairie	15.0	SC	Owners interested in preservation, may build house on part
		004	B	Horsetail Prairie	180.0	SC	Site is large, could be registry or acqusition site
		005	B	Maskell Prairie	15.0	SC	Site may be suitable for registry or easements
		008	B	White Cloud Forest	12.0	SC	Owner is considering donating the tract to TNC
		001	BC	Hykes Prairie	10.0	SC	Owner is interested in some type of preservation
		007	BC	Roca Prairie	181.0	SC	Registry or easements are a possibility for the site
		002	U	Panko Prairie	29.0	SC	
Fen, Alkaline shrub/herb fen, midwest type							
EPHAS0FN00	G3/S1						
		003	A	Steele City Canyon	1.0	SC	Site is suitable for registry or easements
Sandhills fen, Rich scrub fen, northern great plains type							
EPSAS0SF00	G3/S1						
		001	BC	Minnechaduza Creek Fen	700.0	SC	TNC was once interested in acquisition of site
		002	BC	Hay Creek Fen		SC	Possible registry site, may be better sites for acquistion
Wet prairie, Wet prairie, glaciated lower midwest type							
EPHTF0WT00	G3/S1						
		001	A	Cedar Bluffs Prairie	30.0	SC	May be suitable for acquisition, field check first
Southeastern upland forest, Well drained forest, lower midwest type							
ETF000SE00	G3?/S2						
		001	AC	White Cloud Forest	1500.0	SC	Schulenberg may donate his tract to TNC

Data Users

Requests for data vary considerably in their level of detail. Often the user needs to know only whether or not state and federally protected species are known or expected to occur in an area. Other requests ask for specific localities of sensitive species or natural communities. In many cases, the biology and status of noted elements is needed as a necessary complement to locality data.

Users of the data are asked to demonstrate a valid use for occurrence information and to complete a data request form. Specific information about particularly rare or sensitive features is not provided when doing so might threaten a fragile population or community.

Data requests have been received steadily by the Nebraska Natural Heritage Program since late 1987. Individuals and organizations seeking information can be classified into one of the following groups: state and federal agencies, educational institutions, industry, consulting firms, and private organizations. The following examples should serve to illustrate the range of uses for the NENHP data.

1) Provided locations of federally endangered and threatened plants in Nebraska to the Environmental Protection Agency. Purpose of the study was to determine the effect of ozone depletion on federally endangered and threatened plants.

2) Provided locations of piping plover and interior least tern nesting sites on the Platte, Loups, Elkhorn, Niobrara, and Missouri rivers to U.S. Army Corps of Engineers. Purpose was to determine the impact of various fill and dredge projects on least tern and piping plover nest sites.

3) Provided information about significant plants, animals, and natural communities in portions of Douglas and Lancaster counties to Ecology & Environment, Inc. The purpose was to help prioritize toxic waste clean-up sites.

4) Provided information on significant species and habitats in 20 Nebraska counties to U.S. Ecology. The information was to aid in a site selection study to identify three candidate sites for a low-level radioactive waste facility.

5) Provided information on state and federally endangered and threatened species and wetlands within a portion of Cheyenne County to ENSR Consulting and Engineering. Information was to be used in a powerline corridor analysis.

6) Provided information on railroad right-of-way prairie studies in Nebraska to the University of Wisconsin-Madison.

7) Provided a list of the rare butterfly species of Nebraska to Morningside College, Iowa.

8) Provided locations of white ladys'-slipper (Cypripedium candidum) populations in Nebraska to the Nebraska State Wide Arboretum.

NATURAL DIVERSITY IN NEBRASKA

General Overview

Nebraska (76,483 square miles) lies upon a broad plain that slopes gradually from the Missouri River on the eastern border (elev. 840 ft. in Richardson County) to the foothills of the Rocky Mountains on the western border (elev. 5,424 ft. in Kimball County) (Baltensperger, 1984).

Native grasslands dominated the Nebraska landscape at the time of European settlement. Yet the early settlers did not encounter a flat monotonous sea of grass. Western extensions of eastern deciduous forest occurred along the Missouri River and its tributaries. The Pine Ridge escarpment in northwestern Nebraska was reminiscent of a montane landscape with its rock outcrops and pine woodlands. The steep springbranch canyons of the central Niobrara River Valley harbored relict stands of paper birch (*Betula papyrifera*) which were isolated in the canyons when the Wisconsin Glacier retreated northward approximately 12,000 years ago. Even the prairies of Nebraska were quite varied. Tallgrass prairie, with occasional oak woodlands, covered the rolling hills and valleys of eastern Nebraska. The loess hills and plains of south-central Nebraska were carpeted with mixedgrass prairie, interspersed among the plains were numerous Rainwater Basin marshes. The Sandhills covered vast stretches in the north-central portion of the state. The shifting upland dunes supported only a sparse cover of sandhills prairie and contained numerous blowouts. Interdunal valleys harbored a variety of communities including lakes, marshes, wet meadows, fens, and tallgrass prairie. The foothills of western Nebraska are covered with mixedgrass and shortgrass prairie.

Natural Regions

Four Natural Regions (Figure 6), based on geologic-biotic-climatic considerations, have been developed for Nebraska to aid in identifying natural community types and to direct natural area protection efforts.

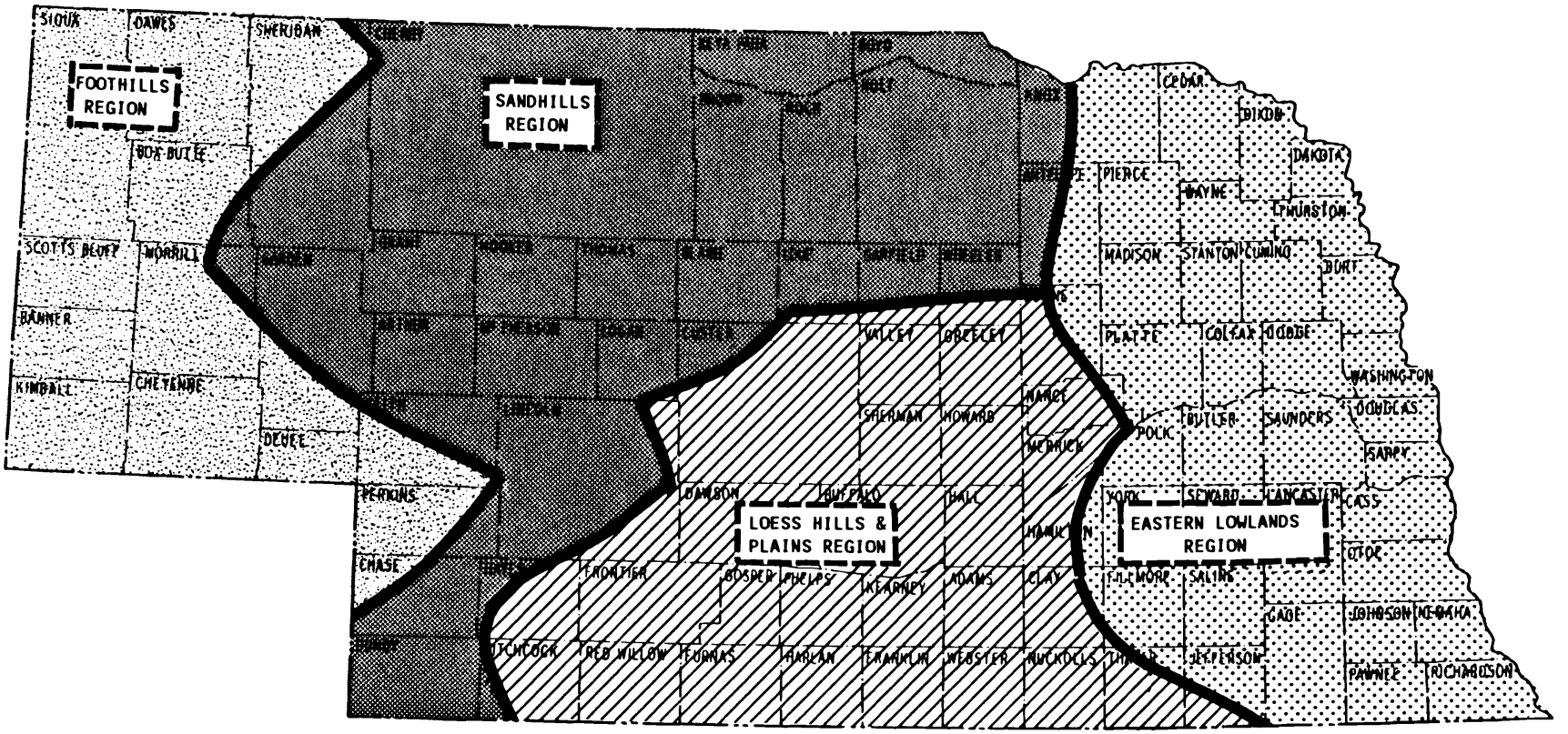
Eastern Lowlands Region. The bedrock in this Region is the oldest in Nebraska being of early Cretaceous, Jurassic, Permian, and Pennsylvanian origins. It has an extensive glacial till, covered by a loess mantle. The topography consists primarily of plains, rolling hills, and valleys. The area is generally of low elevation (1000 to 1800 ft.), high rainfall (mean annual precipitation > 24 in.), and high humidity. The presettlement vegetation consisted predominantly of tallgrass prairie with deciduous forest along major rivers. This Region contains many eastern species that reach their western distributional limits within the Region.

Loess Hills and Plains Region. The bedrock of this Region is primarily of late Tertiary (Ogalala) and mid Cretaceous (Niobrara and Pierre) origins with an extensive loess cover. The topography consists of plains, dissected plains, and valleys. The elevation (1800 to 3200 ft.), rainfall (mean annual precipitation 20 to 24 in.), and humidity are all intermediate to extremes that occur in the eastern and western portions of the state. The presettlement vegetation consisted predominantly of mixedgrass prairie.

Sandhills Region. The bedrock of this Region is primarily of late Tertiary (Ogalala) origins with an extensive cover of Pleistocene wind deposited sand. The topography consists primarily of sandhills - dunes and swales with some narrow elongated valleys. The area along the Niobrara River in northern Nebraska consists mainly of plains, dissected plains, bluffs, and escarpments and does not have an extensive sand cover. The elevation (2000 to 3800 ft.), rainfall (mean annual precipitation 20 to 24 in.), and humidity are all intermediate to extremes that occur in the eastern and western portions of the state. The presettlement vegetation consisted primarily of sandhills prairie on sand dunes and mixedgrass prairie in the northern portion of the Region.

Foothills Region. The bedrock of this Region is of late Cretaceous and Tertiary origins. The topography is very diverse consisting of rolling hills, bluffs, escarpments, valleys, valley-side slopes, plains, and dissected plains. The area is generally of high elevation (3600 to 5400 ft.), low rainfall (mean annual precipitation < 19 in.), and low humidity. The presettlement vegetation consisted primarily of shortgrass prairie and some mixedgrass prairie with western coniferous woodland on bluffs and escarpments. This Region contains many western and southern species that reach their distributional limits within the Region.

Figure 6. Natural Regions of Nebraska.



Landuse History

A large portion of the following text on landuse history was summarized from Baltensperger (1985).

Nebraska's first human inhabitants were nomadic big game hunters (paleoindians) who arrived in the state approximately 12,000 years ago. Hunter-gathers periodically occupied Nebraska for the next 9,000 years. Approximately 3,000 years ago the first semi-sedentary agricultural peoples settled in Nebraska. At the time of European contact the eastern half of the state was occupied by village dwellers and the western half by nomadic groups. Native cultures undoubtedly had some impact on the natural landscape of Nebraska. It is theorized that paleoindians were partially responsible for the extinction of several big game animals such as the mammoth and mastodon. Indian set fires undoubtedly played a role in limiting the spread of trees into the tallgrass prairie of eastern Nebraska.

European contact with the Plains did not occur until 1541, when Coronado set out too discover mineral wealth in the center of North America. Spanish and French trappers and traders were present in Nebraska during the 1700's. The American Fur Company had established a trading post at present-day Bellevue on the Missouri River during the 1830's. Perhaps as many as 50 whites were residing at Bellevue when the Nebraska Territory was created on May 30th, 1854 and opened to settlement. Several factors greatly stimulated settlement of Nebraska in the mid nineteenth century, these include: cessions of Pawnee claims to all lands north of the Platte River in 1857; the Homestead Act of 1862, which allowed acquisition of 160 acres if settlers resided upon the land for 5 years; and expansion of the railroads. By the 1880's the majority of Nebraska, excluding the Sandhills, was settled.

Ranchers had been in the Sandhills since the late 1850's or early 1860's, but they remained sparsely settled until passage of the Kincaid Act in 1904. This Act allowed homesteaders to claim up to 640 acres, instead of the 160 acres allowed by the Homestead Act. Drought forced most of the Kinkaiders out of the Sandhills by the mid 1930's, when they finally realized the land was not suitable for crop production.

Prior to white settlement demand on the state's resources were temporary and transitory. Settlement brought new stresses to the land. Prairies were plowed or grazed by cattle, forests were cut for lumber, and the rivers tapped for irrigation.

Present landuse in Nebraksa is influenced primarily by soils, vegetation, and climate. Rangeland makes up the largest single land use in the state, approximately 48 percent (Bose 1977). This is primarily in the Sandhills and northwestern Nebraska where the

majority of the native grasslands have remained intact. Land classified as cropland occupies 39 percent of the state. The eastern one-fourth of the state is characterized by non-irrigated crops, primarily corn and soybeans. Irrigated crops are abundant in loess soils of central Nebraska, sandy soils of southwest Nebraska, and the Platte River Valley. Much of the Panhandle is devoted to fallow wheat production. Other land uses in Nebraska are urban 6 percent, forested 2 percent, and pastureland (non-native grasses) 5 percent. The majority of the urban development is in the eastern fourth of the state and along the Platte River. Forested areas are used primarily for recreation, grazing, soil and water conservation, and some commercial logging.

Human activities have totally eliminated the natural vegetation from approximately 50 percent of the landscape. Tallgrass prairie, eastern Nebraska's characteristic vegetation, is represented by <5 percent of its original area, much of what remains is heavily overgrazed. Large areas of Nebraska's mixedgrass and shortgrass prairies have been converted to cropland or are heavily overgrazed. The wetlands associated with them have also been heavily disturbed. Only 10 percent of south-central Nebraska's original Rainwater Basin marshes remain undrained. The sandy soils of the Nebraska Sandhills, which are unsuitable for tillage, have saved the Sandhills prairie from the fate suffered by Nebraska's other prairie types. The Sandhills, approximately 18,000 square miles, have remained relatively undisturbed and natural except for valleys which are heavily utilized for hay production and grazing and some wetlands which have been impacted from the increase in center pivot irrigation.

Conservation efforts to preserve remnants of Nebraska's natural diversity have been initiated on many levels within the state. The U.S. Fish and Wildlife Service owns and manages six National Wildlife Refuges and numerous Waterfowl Production Areas totalling over 155,000 acres within the state. The Crescent Lake Refuge and Valentine Refuge protect large areas of sandhills prairie and wetlands. The Fort Niobrara Refuge includes the Fort Niobrara Wilderness Area. Nebraska's three National Monuments, administered by the National Park Service, include Scottsbluff National Monument, Agate Springs National Monument, and Homestead National Monument. The U.S. Forest Service manages approximately 350,000 acres of land within the state, including the Nebraska National Forest in Blaine, Dawes, Sioux, and Thomas counties; the McKelvie National Forest in Cherry County; and the Ogalala National Grassland in Dawes and Sioux counties. The Forest Service has also established the Signal Hill Research Natural Area, the Pine Ridge National Recreation Area, and the Soldier Creek Wilderness Area all within the Nebraska National Forest. The Nebraska Game and Parks Commission owns 100,000 acres of property in Nebraska, much of which remains in native vegetation. Publicly owned lands in Nebraska occupy approximately 3 percent of the total land surface.

Private Conservation Groups have also been active in Nebraska. The Platte River Whooping Crane Maintenance Trust and the Audubon Society are responsible for protecting thousands of acres of migratory bird habitat along the central Platte River. The Nature Conservancy has protected nearly 60,000 acres of biologically significant lands in the state, including the 52,000 acre Niobrara Valley Preserve which protects an ecologically unique portion of the Niobrara River Valley in north-central Nebraska.

Natural Communities

The NENHP recognizes 47 natural community types for Nebraska (Table 1): 23 terrestrial, 14 palustrine, 3 lacustrine, and 7 riverine. Initial data collection efforts have focused on relatively undisturbed occurrences of the highest ranked community types. Inventory of Nebraska's natural communities involves a variety of techniques. Results from previous surveys are available for some wetland, lake, stream, and grassland community types. Many of these sites recognized by earlier workers have not been visited by scientists for many years and need field verification. Important new leads have been provided by researchers, conservation officers, wildlife biologists, and private individuals. Aerial photographs and soil maps have been used to identify potential occurrences for some community types. The County Natural Areas Inventory, a systematic method of locating, evaluating, describing, and classifying natural community types is described in detail on pages 15-17 of this report.

The following discussion of natural community types does not reflect a priority listing. Descriptions of all natural community types are given in Appendix D.

Terrestrial Communities

Grasslands. Three tallgrass dominated prairie types have been described for Nebraska. Prior to European settlement tallgrass prairie covered the majority of the uplands and wet-mesic prairie occupied the valley bottoms in the eastern fourth of the state. Both types also extended westward along drainages. Sandhills wet-mesic prairie covered extensive areas of interdunal valleys and floodplains within the Sandhills Region.

Today only small, highly fragmented remnants of tallgrass prairie remain in eastern Nebraska. Plowing and overgrazing were the primary forces behind its destruction. Overgrazing, plowing, herbicide spraying, haying, and invasion of woody species and exotics continue to degrade the remnant tallgrass prairies, as well as most of the other grassland community types within the state. Some of the largest remnant tracts of tallgrass prairie occur in the southern tier of counties in eastern Nebraska including Pawnee, Gage, Jefferson, and possibly Thayer and

Table 1. Natural Community Types of Nebraska. With global and state ranks.

Community Name	Global Rank	State Rank
Terrestrial System		
Tallgrass Prairie	G2	S2
Wet-Mesic Prairie	G2	S2
Sandhills Wet-Mesic Prairie	G3?	S3
Northern Mixedgrass Prairie	G4	S4
Northwestern Mixedgrass Prairie	G4	S3
Loess Mixedgrass Prairie	G4	S3
Sandhills Prairie	G3?	S5
Sandsage Prairie	GU	S2
Shortgrass Prairie	GU	S3
Eastern Saline Prairie	G?	S2
Western Saline-Alkaline Prairie	G3?	S3
Tallgrass Savanna	G1	S1
Floodplain Savanna	G1	S1
Coniferous Savanna	GU	S4
Bur Oak Woodland	G1	S2
Northern Springbranch Canyon Woodland	G?	S2
Northwestern Canyon Bottom	G3	S2
Southeastern Upland Forest	G3	S2
Northeastern Upland Forest	G3	S2
Western Coniferous Forest	G3?	S2
Badlands	GU	S3
Dry Cliff/Rock Slope	G?	S4
Wet Cliff	G?	S3
Palustrine System		
Wet Prairie	G2	S1
Wet Meadow	G?	S4
Fen	GU	S1
Sandhills Fen	G3	S1
Spring Seep	GU	S3
Lowland Freshwater Marsh	GU	S3
Pond Marsh	G4	S3
Eastern Saline Marsh	GU	S1
Western Saline Marsh	G3?	S1?
Sandhills Freshwater Marsh	G3?	S3
Sandhills Alkaline Marsh	G3?	S3
Western Floodplain Woodland	GU	S4
Eastern Floodplain Forest	G3?	S2
Sandbar	G3?	S3

Lacustrine System

Sandhills Alkaline Lake	G?	S4
Sandhills Freshwater Lake	G?	S4
Floodplain Lake	G?	S2

Riverine System

Large Warmwater River	G?	S1
Warmwater River	G?	S3
Coldwater River	G?	S1
Warmwater Stream	G?	S4
Coldwater Stream	G?	S2
Small Warmwater Stream	G?	S4
Small Coldwater Stream	G?	S3

Nuckolls counties. This is due primarily to rough topography and poor soils of the area which have limited tillage. Many of these remnants are grazed and somewhat disturbed, but their large size makes them a high priority for protection. The potential exists for preserving large areas of tallgrass prairie in these counties, consisting of both grazed and hayed tracts. Hayed tallgrass prairies tend to have a higher native species diversity than grazed prairies. However, few hayed prairies larger than 100 acres still exist in Nebraska. The largest, and most well known, protected tallgrass prairie in the state is the 230 acre Nine-Mile Prairie in Lancaster County, owned by the University of Nebraska Foundation. Several other smaller remnants of tallgrass prairie are protected on lands owned by the Nebraska Game and Park Commission and other organizations.

Like tallgrass prairies, only small remnants of wet-mesic prairie have escaped plowing and overgrazing. Remnant wet-mesic prairies are most abundant along the central and lower Platte and Elkhorn rivers. Reduced instream flows in Nebraska's rivers threatens the future existence of wet-mesic prairies which often occur on subirrigated floodplains adjacent to the rivers. Reduced flows would result in lowering of groundwater table on which wet-mesic prairie species are dependent as a water source. Wet-mesic prairies are protected on the central Platte River near Grand Island on several tracts of land owned by private conservation organizations.

Sandhills wet-mesic prairie is the most abundant of the three tallgrass dominated prairie types. This is primarily because until recently the Sandhills were not considered productive agricultural land and were not plowed. The Sandhills wet-mesic prairies have not remained undisturbed. The valleys in which they occur are heavily utilized for hay production and grazing. Reduced groundwater levels resulting from center pivot irrigation is a major threat to the wet-mesic prairies in the Sandhills and

adjacent areas. Irrigation land in Wheeler County increased 3,414 percent between 1968 and 1980 (Novacek, 1986). Examples of sandhills wet-mesic prairie have been protected on the Crescent Lake and Valentine National Wildlife Refuges.

Three mixedgrass dominated prairie types have been described for Nebraska. Loess mixedgrass prairie once dominated extensive areas of loess soils in south-central Nebraska, northern mixedgrass prairie occupied a variety of sites in north-central Nebraska, and northwestern mixed grass prairie dominated on clay soils in the northwestern corner of the state.

In general, there are more remaining acres of the mixedgrass dominated prairie types than that of the tallgrass prairie types in Nebraska, primarily because the areas where they occur are less productive agriculturally. Large portions of the original loess mixedgrass prairie and northern mixedgrass prairie have been converted to cropland. Overgrazing has also allowed the invasion of exotic species. Northwestern mixedgrass prairie has been less affected by tillage than the other mixedgrass types due to its location in the xeric northwestern portion of the state.

Two types of "sand prairies" have been described for Nebraska: sandhills prairie and sandsage prairie. The Nebraska Sandhills (sandhills prairie) represents one of the largest, if not the largest, relatively undisturbed grassland ecosystem in North America, occupying approximately 18,000 square miles. The sandhills prairie is not threatened by the present grazing economy of the Sandhills. Sandhill ranchers generally practice good range management, and sandhills prairie is not susceptible to invasion by exotics. Large tracts of sandhills prairie are protected on Crescent Lake National Wildlife Refuge, Valentine National Wildlife Refuge, and The Nature Conservancy's Niobrara Valley Preserve. The Sandhills offer a unique opportunity to establish a large (hundreds of thousand of acres), naturally functioning grassland preserve.

Sandsage prairie occurs on rolling sandhills of Chase, Dundy, Hayes, Lincoln, and Perkins counties in southwest Nebraska. This is one of the largest areas of the sandsage prairie in North America, though much has been converted to cropland in recent years with the advent of center pivot irrigation. Sandsage prairie is a high priority community for research and inventory for the NENHP since little is known about its present abundance and condition, and there are no known protected sites.

Shortgrass prairie dominates a large portion of the Foothills Region of western Nebraska (there is some confusion as to whether shortgrass prairie in the Great Plains is a result of overgrazing and originally a layer of mid grasses was also present). Further research may result in reclassification of this community type.

Very little is known about the distribution and abundance of eastern saline prairie and western saline prairie in Nebraska.

Savannas. Savannas are grasslands interspersed with scattered trees or groves of trees, and are a fire dependent community. Few of Nebraska's natural communities are as poorly understood as tallgrass savanna and floodplain savanna. County survey records from the mid 1800's indicate that savanna-like areas occurred in the uplands bordering the Missouri River at that time (Rozmajzl, 1988). The original distribution and composition of tallgrass and floodplain savanna in Nebraska is difficult to establish because there are no known examples of these communities existing today. They have either been destroyed by conversion to cropland, cutting, or overgrazing, or have succeeded to woodland or forest communities due to fire suppression. Identifying and locating high quality examples of tallgrass savanna and floodplain savanna presents a major challenge for the NENHP.

Coniferous savanna is the most abundant savanna type in Nebraska, occurring in the Foothills Region of western Nebraska and along the Niobrara River as far east as Keya Paha County.

Woodlands and Forests. Four woodland and four forest community types have been described for Nebraska by the NENHP. Woodlands have a tree canopy coverage of 30-80 percent; the lower canopy branches are widely spreading; and there is nearly always only one prominent layer of woody plants. Forests have a tree canopy coverage of 50-100 percent; canopy branches are not widely spreading; and nearly always at least two layers of woody plants are prominent. This discussion includes terrestrial (upland) and palustrine (floodplain communities) woodland and forest community types.

The majority of Nebraska's woodland and forest community types have not been inventoried from an ecological perspective. In 1983, the U.S. Forest Service estimated that 718,000 acres of forested land, commercial and noncommercial, remained in Nebraska representing approximately 1.5% of the total land surface, compared to 903,300 acres in 1955 (Raile, 1983). Presettlement woodlands and forests occupied river floodplains, bluffs, and adjacent uplands primarily in the eastern half of the state, and rough rocky outcrops in the western portion of the state. Frequent prairie fires kept trees from expanding farther onto the prairies in the eastern part of the state.

A recent natural areas inventory in Illinois (White, 1978), a state with much more presettlement forests than Nebraska, showed that only about 1 out of every 100 acres of forest (identified by aerial photography) represented truly excellent examples of that state's natural forest communities. A similar situation most likely holds true for Nebraska's remaining woodlands and forests which have been heavily impacted by timber harvesting, clearing,

overgrazing, and invasion by exotic species in the last 125 years. Today many of Nebraska's woodlands and forests are young stands, having invaded areas that were kept treeless prior to settlement by frequent wildfires.

One of Nebraska's most significantly impacted forest types is eastern floodplain forest, which once occupied extensive areas of the Missouri River floodplain. Channelization and bank stabilization of the Missouri River greatly improved the suitability of the floodplain for agricultural production. This resulted in the clearing of large tracts of Missouri River floodplain forest. Bragg (1977) found that forest coverage within the Missouri River floodplain in Missouri declined from 76 percent in 1826 to 13 percent in 1972. Such figures are probably comparable for Nebraska. Large, mature and old growth stands of floodplain forest are extremely rare on the Missouri River floodplain.

Dewatering of the Platte River, as a result of water development projects, has resulted in increased tree growth on the central Platte River floodplain, an area that was almost treeless prior to settlement. The extent of floodplain woodland on the central Platte has actually increased in the last century.

Nebraska's unique woodland community type is the northern springbranch canyon woodland which occurs along a 30 mile stretch of the Niobrara River's south bluff and adjacent springbranch canyons in Brown, Cherry, and Keya Paha counties. This community type harbors a mixture of western montane, eastern deciduous, and northern forest species, whose ranges overlap within this section of the Niobrara River Valley. These woodlands were well inventoried by TNC during the 1982 survey of the Niobrara Valley Preserve and adjacent lands. Results of the natural community portion of that inventory have not yet been incorporated into the NENHP database. The majority of northern springbranch canyon woodlands are protected on the Niobrara Valley Preserve and Fort Niobrara National Wildlife Refuge.

Palustrine and Lacustrine Communities

Groundwater Seepage Communities. In 1988, eastern Nebraska's first fen was documented by the NENHP in Jefferson County. Fens are groundwater seepage communities with peat or muck soils. The NENHP has since received reports of other fens in Jefferson County, but these sites have not been field verified. Two fens were documented by the NENHP in Burt County in 1988. One had been severely impacted by peat mining activities during the 1970's, the other, located within a cornfield, has been severely disturbed by nearby agricultural activities.

Four occurrences of Sandhills fens have been documented (field surveyed) by the NENHP. All are located in Cherry County and have

been disturbed by ditching to make the sites more suitable for hay production. Maps showing the peat soils of Cherry County have been obtained from the Cherry County Soil Survey Office. Initial review of the maps indicated several other potential Sandhill fens. The examination of color infrared aerial photos and soil maps have proven an effective method for identifying fens for Heritage Programs in other Midwestern states. The primary threat to Sandhills fens appears to be from drainage and possible future peat mining. Fens and sandhill fens should receive high research and protection priority in Nebraska, since there are only a few documented occurrences of each type, none of which are protected.

Marshes and Lakes. One of Nebraska's rarest and most imperilled community types is the eastern saline marsh which is limited to Lancaster County in Nebraska. Prior to settlement, saline marshes were abundant in areas where Dakota sandstone was near the surface. Groundwater passing through the sandstone accumulates high concentrations of salts, which are deposited in the soil where seeps occur. The marshes are dominated by salt tolerant plant species. Urban development and drainage have destroyed or disturbed the majority of saline marshes in Lancaster County. The NG&PC will conduct an inventory of saline marshes in Lancaster County in the summer of 1989. Funding for the project will be provided by the Environmental Protection Agency.

Clements and Pound (1898) described saline marshes for the North Platte River Valley in western Nebraska. These marshes were described as having a species composition different from the saline marshes in Lancaster County and thus have been defined as a separate community type - western saline marsh. The status of western saline marshes is unknown. There have been no reports on western saline marshes in the literature since the original report by Pound and Clements. Soils maps of the North Platte River Valley should be examined for saline soil types and those areas field surveyed for the presence of saline marshes.

Wetlands of the Sandhills and Rainwater Basin are the best inventoried natural community types in the state. The National Wetlands Inventory has completed wetland inventories for the Rainwater Basin, Sandhills, and other smaller areas of Nebraska. This information has not yet been incorporated into the NENHP database. Runquist (1983) provides a summary of the wetland inventories conducted in the Sandhills. A survey of Sandhills and Rainwater Basin wetlands was conducted in the early 1960's by the Nebraska Game & Parks Commission (McMurtrey et al, 1972). The survey found 685 wetlands (classified as pond marshes by the NENHP) comprising 32,530 acres within the Rainwater Basin. This represented 18 percent of the original Rainwater Basin wetlands and 35 percent of the original wetland acres. In the early 1980's the basins were resurveyed by the Game & Parks Commission using SCS aerial photography and field surveys (Schildman and Hurt 1984). Only 10 percent of the original basins and 22 percent of

the original wetland acres remained. Draining has accounted for most of the destruction. Nearly all remaining wetlands have undergone reduction in size and loss of available water (Schildman and Hurt, 1984). As of 1984, 57 basins (15 percent) and 49 percent of the remaining wetland acres within the Rainwater Basin were publicly owned (Schildman and Hurt, 1984), primarily by the Nebraska Game & Parks Commission and the U.S. Fish & Wildlife Service.

Rundquist and Linden (1979) used digital landsat data for sandhills wetland classification and mapping. Results of this study indicate totals of 112,478 acres of "open water", which includes man-made lakes and reservoirs, rivers and streams, and natural lakes (sandhills alkaline lakes and sandhills freshwater lakes of the NENHP), 64,521 acres of marsh (sandhills alkaline marsh and sandhills freshwater marsh of the NENHP), and 1,130,954 acres of subirrigated meadow (wet meadow of the NENHP).

The ranching economy of the Sandhills has prevented the massive destruction of wetlands there, which has occurred in other areas of Nebraska. Results of the Nebraska Game & Parks Commission's, early 1960's, wetland inventory indicated 13,340 wetlands (including Type II, Type III, Type IV, and Type V wetlands as classified by Cowardin, 1979) comprising 155,380 acres in the Sandhills. At that time, they estimated that 185 sandhills wetlands, comprising 28,018 acres, had been destroyed since settlement of the Sandhills. Drainage by ditching and pumping of lakes has accounted for most of the destruction. Presently, wet meadows are the most threatened Sandhills wetland community. This is due to the recent increase in center pivot irrigation in the areas where they occur, especially the eastern Sandhills (Novacek, 1988). However, Christian (1982) states that wet meadows in Dundy County in southwest Nebraska have been almost completely eliminated due to center pivot development.

Though numerous sandhills wetlands of various types remain today and a large number are protected on National Wildlife Refuges, future demands for groundwater may significantly impact them since the majority are dependent on groundwater as their primary water source.

Riverine Communities

The Nebraska Department of Environmental Control is presently conducting an ecological stream inventory (biological and chemical parameters) for Nebraska. It is scheduled for completion in October, 1989 and should add greatly to the knowledge of riverine communities in Nebraska.

In Nebraska, the large warmwater river community type is represented only by the Missouri River. Channelization and dams

have caused extensive ecological damage to the Missouri River. Shallow and slow water habitats, oxbow lakes (floodplain lakes), and marshes (freshwater marshes) have been nearly completely eliminated on the channelized stretches of the river, and replaced by deep, swift water habitat, which is unsuitable habitat for many fish and invertebrate species. Several species of fish, whose ranges in Nebraska are generally limited to the Missouri River, are now classified as federal candidate species, these include the paddlefish, pallid sturgeon, lake sturgeon, sicklefin chub, sturgeon chub, and blue sucker. Two segments of the Missouri River, from Sioux City, Iowa to Gavins Point Dam and from the upper end of Lewis and Clark Lake to the South Dakota border, have remained unchannelized and undammed. The former segment is designated as a National Recreational River. The unchannelized segments are suffering from channel degradation due to downcutting of the River (upstream reservoirs allow silt to settle out of the water which increases its erosional power below the dams). Modification of seasonal flows by upstream dams has also adversely affected the ecology of the unchannelized segments. Protection of the unchannelized portions of the Missouri River and restoration of channelized portions is a high conservation priority in Nebraska.

Other river community types within the state have been degraded by channelization, reduced instream flows, and urban and agricultural pollution. Nebraska's only coldwater river, the North Platte River, has experienced reduced flows and complete dry-up resulting from in-state and out-of-state irrigation projects and dams. The Platte River, Nebraska's primary warmwater river, has been severely impacted by reduced instream flows and subsequent woody species encroachment of the channel. Nesting habitat of unvegetated sandbars, for the federally endangered interior least tern and federally threatened piping plover and roosting habitat for the federally endangered whooping crane has been greatly restricted on the central Platte River in recent years because of woody species encroachment. Several of Nebraska's warmwater rivers which occur within the Sandhills, including the Loups, Dismal, and Niobrara rivers have remained relatively undisturbed.

Nebraska's streams (warmwater stream, coldwater stream, small warmwater stream, and small coldwater stream) have also suffered deterioration from channelization, siltation, pollution, introduction of non-native fish, and reduced instream flows. Coldwater stream types are uncommon in Nebraska, generally being limited to western and northern Nebraska. Introduction of non-native fish species and siltation have severely impacted the native fish fauna of many of these streams. Many of eastern Nebraska's streams have been highly degraded from siltation and pollution from agricultural chemicals.

Special Plants

State Flora

A large portion of the information in this section was compiled from Petersen (1923), Weaver (1965), the Great Plains Flora Association (1977, 1986), Sutherland (1986), and Churchill (1989).

The Nebraska Natural Heritage Program is currently tracking 423 species, subspecies, and varieties of plants for Nebraska. This represents roughly 22% of the 1800+ species of plants that occur in the state. Of this total number, 15 species are Pteridophytes or the ferns and fern allies. Three species are junipers and pines of the Division Pinophyta, the Gymnosperms. Reflecting the ratio of non-flowering to flowering plants found under natural conditions, the vast majority of species being tracked belong to the Division Magnoliophyta - the flowering plants. Within this Division there are 295 species of the class Magnoliopsida (the Dicots) and 110 species belonging to the class Liliopsida (the Monocots).

Plant Tracking List. The plant element tracking list is intended and designed to be dynamic. One of the foremost parameters for a species being included on the element tracking list is the number of occurrences known for that individual species. As increased information on a species' abundance, distribution, and limiting factors is compiled, the true status of that species within the state becomes clearer. The increased information may result in a species being ranked higher or lower or ultimately being removed from the list due to high numbers and low threat. Conversely, this flexibility allows newly discovered species and species which are more rare or threatened than data previously indicated to be added to the list.

Approximately 27% of the plant element occurrences currently in the NENHP's database are from pre-1920, 19% are from 1920 to 1969, 27% are from 1970 to 1979, and 27% are current within the past 9 years. This reflects the historical pattern of collection in the state. A significant amount of botanical interest and activity is shown by the number of records prior to 1920. From 1920 to 1969 the amount of collecting within the state slowed dramatically. The increase in the 1970's reflects the large effort made by collectors to obtain distributional information for the Atlas of the Flora of the Great Plains (G.P. Flora Assoc.) published in 1977 and the subsequent Flora of the Great Plains (G.P. Flora Assoc.) published in 1986. A large portion of the data collected after 1980 is based on the botanical survey of The Nature Conservancy's Niobrara Valley Preserve. Currently there are only a few dedicated researchers who are actively collecting specimens and data on extant populations. Much of the collecting that has been done until the present has been broad-

based and general in both the species collected and the information recorded. The plant element tracking list will provide a focus for field research and data collection.

Information on element occurrences in the NENHP database has been compiled from a variety of sources. By enlarge, the preponderance of data has been obtained by the transcription of label information from herbarium specimens. Table 2 lists the herbaria that have been accessed. Secondary sources for occurrence records include the botanical survey for the Niobrara Valley Preserve, articles in scientific publications, reports on endangered species monitoring, correspondence with researchers, and a small number of records obtained from site surveys conducted by the NENHP staff.

Table 2. Herbaria Collections Accessed by NENHP

University of Nebraska-Lincoln, Nebraska Hall
University of Nebraska-Lincoln, Manter Hall
University of Nebraska-Lincoln, Kiem Hall
University of Nebraska at Omaha
Chadron State College
Kearney State College
Doane College
University of Kansas

Species Rarity. The primary criteria for a plant species being placed on the plant element tracking list is the presumed rarity of that species in the state. This rarity can be the result of a single or a combination of limiting factors. Natural factors limiting a species' abundance include, genetic restrictions on reproduction, low adaptability to changes in habitat, climatic changes, changes in edaphic factors, dependency on a highly specialized habitat, and other natural conditions affecting plant populations. Man-induced limiters include the loss of habitat through modification or destruction, plant mortality due to herbicides and pollution of a species' habitat, suppression of reproduction by grazing or haying, and exploitation of a species for commercial uses.

Natural Limiters

Endemism. Endemics are species which are restricted geographically and whose range is local or regional in distribution. Endemism can be the result of new species emergence, geographic isolation, species range senescence, or specificity to a very narrow habitat. Currently one plant species is known to be endemic to Nebraska. Blowout penstemon (*Penstemon*

haydenii) is restricted to actively eroding dunes or blowouts in the Sandhills prairie of the north-central and north-west portion of the state. There are five regional endemics whose distributions include portions of Nebraska. Silver-mounded candleflower (Cryptantha cana) is a long-lived perennial of dry sandy and gravelly soils of rangelands and slopes. It ranges from northeast Colorado into Wyoming and south-central Montana to south-western South Dakota, and throughout the panhandle of Nebraska. Although the number of occurrences for this element and its wide range would normally make this a low priority plant, Nebraska represents almost half of the total known populations and its continued viability here represents the global stronghold for the species. Fremont's leatherflower (Clematis fremontii) is a regional endemic of rocky prairie hillsides with limestone soil. Its main range of north-central Kansas extends into the first tier of counties in south-central Nebraska with several small disjunct populations in Missouri. Two subspecies and one variety also occur as regional endemics in Nebraska. Fremont's evening primrose (Oenothera macrocarpa subsp. fremontii) occupies habitat and range very similar to that for Clematis fremontii although no records are known outside of Kansas and Nebraska. Gaura neomexicana subsp. coloradensis is found in prairies and open wooded hillsides. It has a small distribution in southwest Wyoming, northeast Colorado, and the very southwest corner of the panhandle of Nebraska. Secund bladderpod (Lesquerella arenosa var. argillosa) is a variety endemic to western Wyoming, southwest South Dakota, and the northwest panhandle of Nebraska.

Disjuncts or relicts. These are represented by element occurrences in the state that are geographically isolated by several hundred miles or more from the species' main range where they are still widespread and abundant. These disjunct occurrences are usually very restricted and localized in their distribution and while the local populations can be numerous, they are most often characterized by low abundance. Many disjuncts and relicts are species which under past climatological conditions flourished in great numbers and had a wide distribution but with the slow transition to present day conditions have been reduced to small remnant populations. In some instances only one species will remain of the many species that comprised past plant communities.

Small clubmoss (Selaginella densa) occurs in Nebraska several hundred miles east of its main range and habitat of subalpine meadows and high upland prairies. Spreading loeflingia (Loeflingia squarrosa) is several hundred miles north and east of its main range in Oklahoma and Texas, southwestern Wyoming and southeast Oregon, and southward. Its habitat is the dry soils and barren sands of grasslands. Tapegrass (Vallisneria americana) is found growing in sandy soils of freshwater marshes in the sandhills of Nebraska, well to the west of its main range of northeast South Dakota, Minnesota, and south to eastern Texas and

Florida. Marsh St. John's-wort (Triadenum fraseri) and Canada rush (Juncus canandensis) both occur in habitats similar to tapegrass, however, their distribution in Nebraska is far to the south and west of their respective larger ranges of Minnesota to New York and southeast Canada, south to Illinois and Florida. Although Juncus scirpoides has a moderate distribution in marshes, wet prairies, and subirrigated meadows of the sandhills of north-central Nebraska, this is an isolated distribution hundreds of miles north of its closest southern occurrences in central Kansas and several hundred miles west of its normal range in Michigan.

Menzie's pink (Silene menziesii) and green pyrola (Pyrola virens) share similar habitats of upland woods in the northwest corner of Nebraska's panhandle while prairie star (Lithophragma parviflorum) and Cirsuim pulcherrimum occupy prairies and openings in woodlands with a similar state distribution. Dwarf pussytoes (Antennaria dimorpha) and Erigeron ochroleucus complete the transition to open dry and rocky prairies in the northwest panhandle of the state. What all of these have in common is that their distribution in Nebraska is well east and south of their commoner ranges of Montana, Idaho, western Wyoming, Colorado through Utah, and west to California.

Habitat specific. All plants have habitat requirements that influence a species range and abundance. For most plants these requirements are based on fairly wide parameters of soil types, annual precipitation patterns, and temperature. These broad parameters enable a plant to adapt to a wide variety of conditions and habitats and subsequently these species often have very large ranges with high overall population numbers. Other plants have an adaptive strategy of specialization that has enabled them to compete successfully in a certain habitat or niche. These species have narrowed their requirement parameters to specific needs such as saturated soils in marshes and wetlands, full shade, or rocky well drained soils. These species may also have large ranges although the occurrences of the plant may be limited to smaller local areas within the overall range. Population numbers can be quite large at these sites. Many of the state's relict or disjunct species are plants with this type of moderately restricted habitat requirement. Carrying this process one step further some plants have become highly specialized to a very narrow range of limiting factors. These requirements may vary from highly acidic soils to saturated peat soils, dry alkaline soils, wet alkaline and saline soils, bare blowing sand, bare sandstone cliffs, or cool, north-facing, fully shaded, spring-branch canyons. Again these species may have wide geographic distributions but they are very restricted and highly localized with populations of only a few individual specimens to hundreds or thousands of plants at a specific site.

In Nebraska there are a number of species that have very narrow habitat requirements. Often these restricted habitat types will support a complete plant community comprised of both more common, widespread species with only moderate restrictions and species that are highly restricted to a very narrow habitat. Nebraska's fens are characteristic of this type of occurrence. Numerous plants such as ferns, willows, sedges, rushes, and other forbs which are common to many other freshwater communities are found in fens. Northern bog violet (Viola nephrophylla), rush aster (Aster junciformis), long-leaved stitchwort (Stellaria longifolia), and crested shield-fern (Dryopteris cristata) typify part of the plant assemblage of many fens. Two species are found almost exclusively in fens; they are buck bean (Menyanthes trifoliata) and tall cotton-grass (Eriophorum polystachion). The eastern saline marsh is another community comprised of species with varying degrees of habitat limitations. Here, however, the divisions are very pronounced and well delineated. In the saline marsh community changes in species composition occur with elevation changes of as little as six to eight inches. At only slightly higher elevations the effects of dissolved salts in solution are less limiting and allow species such as salt marsh aster (Aster subulatus var. ligulatus), Texas dropseed (Sporobolus texanus), and seaside heliotrophe (Heliotropium curassavicum) to survive along with typical alkaline and saline tolerant species such as inland salt grass, spearscale, marsh elder, and sea blite. Only western glasswort (Salicornia rubra) inhabits the lowest elevations with the highest salinity concentrations.

Peripherals. The most common reason for including a species on the state element list is that the edge of the species range occurs just within the states' boundary. Although state boundaries are purely artificial from a natural perspective the listing of peripheral species within a state does have validity. As plants approach the edge of their range they are subjected to increased environmental and ecological stress and subsequently are less common so as to become rare and represent populations subject to increased pressure for adaptive change. Many peripheral species are widely distributed with large overall population numbers. Wild ginger (Asarum canadensis), paw paw (Asimina triloba), and round-headed prairie clover (Dalea multiflora) are typical of the type of species that are peripheral in the southeast corner of Nebraska and are quite common and abundant south and southeast of the state. Sego lily (Calochortus gunnisonii), smooth-barked cottonwood (Populus acuminata), owl clover (Orthocarpus lutea), and bristly gooseberry (Ribes setosum) are widespread and common in their main ranges north and west of Nebraska. Likewise, cyclanthera (Cyclanthera dissecta), smooth-four o'clock (Mirabilis glabra), and hedgehog cactus (Echinocerus viridiflorus), which are found primarily south and west, along with swamp lousewort (Pedicularis lanceolata), nannyberry (Viburnum lentago), and American lotus

(Nuphar luteum), which are found north and east, are all peripheral in Nebraska. Other species that are peripheral in Nebraska have small ranges and only moderate abundance. Clasping milkweed (Asclepias amplexicaulis), rayless aster (Chrysothamnus parryi subsp. howardii), and hawk's-beard (Crepis acuminata) typify species of this catagory. A few species such as pigeon grape (Vitis aestivalis), sharpwing monkey-flower (Mimulus alatus), and spikenard (Aralia racemosa) have distributions that are peripheral at one end of the state but also have separate and seemingly disjunct occurrences at other sites in the state.

External threats. Up to this point the factors which have made a species an element on the rare plant list have been the result of natural conditions and effects that have occurred over long time spans even on a geological time frame. With the colonization of North America and the settling of the Great Plains, the external factors causing species decline and extinction have escalated from geologic to historic to current time. The decline of species in North America has accelerated dramatically within the last 50 years. The prime causes for this decline are loss of habitat, direct mortality from over utilization and pesticide use, and secondary mortality from pollution and improper use and management. On a global scale different species are at higher risk than others. Endemics, with their small ranges and, in most cases, relatively low population numbers, are at greatest risk. Disjuncts, relicts, and species limited to specific habitats are subject to the next level of threat with peripheral species being the least threatened. On a state or local level this pattern does not hold true. Localized activities or developments peculiar to a state may prove a greater threat to peripheral species than to endemics. Historically the greatest threat and impact on Nebraska's native plant species and communities was the plowing of the prairies. Innumerable species have been dramatically affected by the loss of habitat, undoubtedly some have been extirpated or have become extinct. This destruction is still ongoing and due to the use of technology such as center-pivot irrigation, larger and larger areas are being developed.

Rattlesnake master (Eryngium yuccifolium), pink wild onion (Allium stellatum), white dog's-tooth-violet (Erythronium mesochoreum), and long-haired hawkweed (Hieracium longipilum) are representative of tallgrass prairie species threatened by the destruction of the eastern prairies. In the Sandhills, slender plantain (Plantago elongata) is one of several plants threatened by land development. Some species are depleted by over-utilization, such as the cutting of Shumard's oak (Quercus shumardii), white oak (Quercus alba), blackjack oak (Quercus marilandica), and mockernut hickory (Carya tomentosa) for lumber and firewood. This not only impacts these species directly but also adversely effects the habitat and survivability of many other eastern deciduous forest species such as wild yam (Dioscorea villosa), showy orchis (Galearis spectabilis), may

apple, (Podophyllum peltatum), bloodroot (Sanguinaria canadensis), and elm-leaf goldenrod (Solidago ulmifolia). The removal or clearing of "brush" from savannas and riparian areas is a threat to species of these transition zones such as dwarf chinkapin oak (Quercus prinoides), wild goose plum (Prunus hortulana), northern gooseberry (Ribes oxyacanthoides), and ninebark (Physocarpus opulifolicus). Stream channelization and subsequent clearing of floodplain forests for cropland has proved very detrimental for rock elm (Ulmus thomasii), coreopsis beggar-ticks (Bidens polylepis), and fragrant indigo bush (Amorpha nana).

Although the use of native grasslands for hay is often considered good utilization and a form of protection for these areas, it is not without its drawbacks. Annual haying at the same period, year after year prevents reproduction of many species, leading to the quick elimination of many annuals and the demise of perennials over longer periods. Spider milkweed (Asclepias viridis) and compact prairie-clover (Dalea cylindriceps) are threatened by this type of improper management. From the east end to the west end of the state, one of the most widespread and pervasive threats is the mismanagement of native vegetation by overgrazing. Overgrazing affects all plant communities from eastern deciduous forest to western coniferous forests, from tallgrass prairie to shortgrass prairie. In the eastern woodlands and forests, serviceberry (Amelanchier arborea) and slender muhly (Muhlenbergia tenuiflora) are threatened. In the coniferous woodlands of the west, leopard lily (Fritillaria atropurpurea) and Anemone multifida can be heavily impacted by overgrazing. Round-head prairie-clover (Dalea multiflora) and sessile-leaved tickclover (Desmodium sessilifolium) are both species of the tallgrass prairie that are preferred by livestock and are quickly eliminated from pastures. Little breadroot scurf-pea (Psoralea hypogaea) is subject to heavy grazing pressure in western prairies.

In the past 10 to 20 years the development pressures on wetlands has greatly accelerated. These pressures come not only from the direct loss of wetland due to draining and filling but also from loss of functional values from grazing and farming through the basin and from the degradation of water quality due to siltation and chemical run-off. This type of activity has affected wetlands of the Rainwater Basin as well as marshes and wetlands of the Sandhills. American pillwort (Pilularia americana), blackfoot quillwort (Isoetes melanopoda), longbarb arrowhead (Sagittaria longiloba), panicled sedge (Carex diandra), and Hall's bulrush (Scirpus hallii) are but a few of the many wetland species at risk.

The burgeoning use of pesticides and herbicides in particular, poses one of the most extensive and eminent threats to rare plants. Very often herbicide use is not targeted to a small

specific site or species occurrence but is indiscriminate and widespread, being applied to extremely large areas with devastating effects on whole plant communities. Under these conditions species can be lost from large regions in a very short length of time. Dozens of species are threatened. Wild senna (Cassia marilandica), plains flax (Linum puberulum), flexible milkvetch (Astragalus flexuosus), western aster (Machaeranthera grindelioides), cinquefoil (Potentilla plattensis), sky-line goldenweed (Haplopappus amerioides), and round-leaf bladder-pod (Lesquerella ovalifolia) are but a few of the potential victims. Specialized activities such as rock quarrying threaten green dragon (Arisaema dracontium), false pennyroyal (Trichostema brachiatum), and the only recorded populations of snow trillium (Trillium nivale) and powdery cloakfern (Notholaena dealbata) in the state.

Regions of High Rare Plant Occurrences

The southeast. Two regions of the state have high concentrations of rare plant occurrences. The southeast region consists of the following tier of counties that border the Missouri River: Washington, Douglas, Sarpy, Cass, Otoe, Nemaha, and Richardson. Twenty-five percent of the plant EO's in the NENHP database are from this region. Intensive collection efforts by botanists in this area is partially responsible for its high number of EOs, but the main factors are a combination of geographic climatic and edaphic influences. The areas rich loess soils and high rainfall allows many eastern and southern species to reach the most western and northern limits of their range here. In addition to those species mentioned previously, rare plants occurring in this region include; white baneberry (Actea alba), early buttercup (Ranunculus fasicularis), sycamore (Platanus occidentalis), spring beauty (Claytonia virginica), roundfruit St. Johns'-wort (Hypericum sphaerocarpum), rustling wild petunia (Ruellia strepens), Indian pipe (Monotropa uniflora), and raccoon grape (Ampelopsis cordata), to mention a few.

The northwest. The second region of the state to have a high concentration of rare plant occurrences is the northwest corner of the Panhandle, an area encompassed by Dawes, Sheridan, and Sioux counties. This area is characterized by shortgrass and mixedgrass prairie, badlands, and western coniferous and deciduous forests. Twenty-two percent of the records for plant element occurrences are from this region. Again this high percentage is weighted by the amount of collecting that has occurred in the region, but as with the other region this is a small factor. Climatic factors contributing to the high number of rare plants are a short growing season, high altitude, and low rainfall. These in conjunction with edaphic factors of well drained, clayey and sandy-loam soils allow northern and western species to extend their ranges east and south to their limits. Besides species mentioned in other categories, additional rare

plants occurring in the region include; fairybells (Disporum trachycarpum), ground juniper (Juniper communis), Ranunculus glabberimus, spring birch (Betula occidentalis), mountain maple (Acer glabrum), one-sided wintergreen (Pyrola secunda), Fremont's goosefoot (Chenopodium fremontii), and stonecrop (Sedum lanceolatum). Numerous other plant elements occur in this region.

The Niobrara River Valley. One of the most significant plant assemblages in Nebraska and the Great Plains occurs in the central Niobrara River Valley. Here, the juncture of complex phytogeographical and geological conditions dating as far back as the late Pleistocene have resulted in a confluence of plants, animals, and communities of great richness and biogeographic significance. At this intersection many species reach the farthest extension and limits of their ranges. This enabled species whose primary distributions were separated by extreme distances and habitat requirements to hybridize, these hybrids occur at very few other locations nation wide. With changes in climatic conditions, the protective physiogeography of the valley has maintained a consistent environment resulting in a refugia where many species now exist as disjuncts and relicts, far removed from their present day normal ranges. Six major ecotypes integrate within the Niobrara River Valley, they include: eastern tallgrass prairie, northern mixed prairie and sandhills prairie, western coniferous forest, eastern deciduous forest, and northern boreal (paper birch springbranch) forest.

Over 575 species of vascular plants are found in the river valley, of these, thirty species are on the plant element tracking list. One of the rarest elements for Nebraska is the hybrid Populus grandidentata X P. tremuloides which is found only along a very short stretch of the river bluff near Smith Falls. This is the only known location for this element in the Great Plains Region. One of the parental species, P. tremuloides, is native to northwestern Nebraska while the closest extant population of the other parental species, P. grandidentata, is over 300 miles east of the Niobrara River Valley. Prairie moonwort (Botrychium campestre), which has only recently been described, is of equal rarity in Nebraska. The single location in the Niobrara River Valley is the only state occurrence and is far south and west of the species main range. Elements such as creeping juniper (Juniper horizontalis), giant pinedrops (Pterospora andromedea), northern green orchid (Habenaria hyperborea), and marsh arrow-grass (Triglochin palustre) reach the south and east limits of their ranges in the valley. The western range extensions stop here for spinulose wood fern (Dryopteris spinulosa), frostweed (Helianthemum bicknellii), many-seed seedbox (Ludwigia polycarpa), and Loesel's twayblade (Lisparis loeselii). Northern adder's-tongue (Ophioglossum vulgatum), paper birch (Betula papyrifera), wild sarsaparilla (Aralia nudicaulis), and Canada hawkweed (Hieracium canadense) reach the southern edge of their distributions in the valley.

Special Plant Categories

Federally endangered and threatened species. Currently there is only one federally endangered plant species, blowout penstemon (*Penstemon haydenii*), occurring in Nebraska. It is Nebraska's only endemic species and is known from eight locations. Blowout penstemon is an early colonizer of sand dune blowouts. Historically, blowouts were a common and very abundant feature of the Sandhills. Changes in grazing patterns under current range management techniques have resulted in a massive decline in blowouts which in turn has led to the endangerment of blowout penstemon. All known populations are monitored for changes and field surveys are conducted in an effort to locate new populations. Populations at three of the previously known monitored sites are in good condition while populations at the other three monitored locations appear to be declining. Two of the populations were just discovered in 1988. Populations at both of these sites are low. Six of the sites receive full protection on managed areas while two sites occur on private property and are not protected.

Federally proposed and candidate species. Five species of plants occurring in Nebraska are currently proposed or are candidates for federal listing. The western prairie fringed orchid (*Platanthera praeclara*) and prairie white-fringed orchid (*Platanthera leucophaea*) are both proposed for federal listing as threatened species. *P. praeclara* is known from five extant populations and fifteen occurrences that apparently no longer exist. *P. leucophaea* is known from only one historical record. Both of these species are native to the tallgrass prairie community and their populations have been greatly reduced by the loss of habitat and the negative impact of management practices and herbicide use. *Gaura neomexicana* subsp. *coloradensis* is a C1 candidate species for federal listing. This is a subspecies endemic to the southwest corner of Nebraska's panhandle, northeast Colorado, and southeast Wyoming. It is native to shortgrass prairies and is extant at only one known site for Nebraska. *Rorippa calycina* is a C2 species. This yellow cress is a regional endemic occurring in moist sandy soils of riverbanks and floodplains. Nebraska's record is from the extreme western end of the panhandle. Prairie talinum (*Talinum rugospermum*) also is a C2 species. This species is found in dry sandy prairies and is disjunct or at the extreme western edge of its range extension in Nebraska. Three extant populations are known from the central portion of the state.

Extirpation and extinction. Many of the old records and specimens collected prior to 1940 have very little or no data associated with them. While this does lessen their usefulness, it does not negate their value. These specimens provide information on the period of flowering or time of seed production, they give an indication of change in community composition from historical

to present, and provide valuable data on species distribution and possible sites to search for extant element occurrences. In some cases these historical specimens are the only record for a species occurrence in the state. While there are undoubtably species in Nebraska that have been extirpated or have become extinct, no element on the tracking list is ranked as such. It is necessary to verify these historical occurrences as it is possible for a population that has not been collected for nearly a 100 years to remain extant at the recorded location. For example, Short's rock cress (Arabis shortii) was collected from a Wilderness Park site south of Lincoln in 1893. Another specimen was not collected from this location until 1987; 96 years later. Bearberry (Arctostaphlos uva-ursi), shining ladies'-tresses (Spiranthes lucida), and hoary fleabane (Erigeron canus) are indicative of species known only from historical records.

State species of special concern. A large number of species of plants on the element tracking list are categorized as species of special concern by the NENHP. These are species that are considered worthy of special attention due to a variety of factors which include very few occurrences in the state with very low abundance, global rarity, and threat from commercial exploitation and collection. Many species of special concern have already been mentioned in previous sections. Wolf's spikerush (Eleocharis wolfii), Poa fendleriana, Rubus ostryifolius, and Triodanis holzingeri are species with few occurrences and low abundance. White ladys'-slipper (Cypripedium candidum) is of special concern for two reasons. Not only is it one of Nebraska's rarest plants, known from only 2 sites, but it is also threatened by wildflower collectors, as are many of the native orchids. Yet other species are of special concern based on threat due to commercial exploitation by herbal enthusiasts as in the case of ginseng (Panax quinquefolius) or as a pharmaceutical drug source as in the case of pale coneflower (Echinacea pallida).

Species of undetermined status. Many of the rankings for elements on the tracking list have been ascribed, based solely on information from the number of recorded occurrences. These rankings are in need of confirmation by thorough field surveys. Other species have yet to be ranked and are in need of additional data.

Special Animals

The Nebraska Natural Heritage Program manages information on 179 special animal species: 25 mammals, 70 birds, 18 reptiles, 3 amphibians, 29 fish, and 35 invertebrates (Appendix B). This list was compiled with contributions from numerous individuals, particularly biologists in Nebraska's academic institutions and the Nebraska Game and Parks Commission. Special animal species are those whose populations in Nebraska are endangered, threatened, rare, severely depressed from former levels, peripheral, or of unknown status. Many taxa are borderline cases,

and in such cases the special animal list is inclusive rather than exclusive. From a conservation viewpoint, it is safer to learn that an animal is abundant after working for its protection than to learn that it is extinct after ignoring it. Species were ranked according to criteria described earlier.

Mammals

At least 7 species of mammals have been extirpated from Nebraska during the past 150 years, primarily due to habitat loss, hunting, and poisoning including the following:

Gray Wolf (*Canis lupus*)
Black Bear (*Ursus americanus*)
Grizzly Bear (*Ursus arctos*)
Wolverine (*Gulo gulo*)
*Bison (*Bison bison*)
Mountain Sheep (*Ovis canadensis*)
*Elk (*Cervus elaphus*)

Two of these seven species, marked with an asterisk, have been reintroduced on public and private reservations (Jones, 1964).

Highest priority (ranked) mammals include a shrew, 3 bats, 4 rodents, and 2 carnivores.

Merriam's shrew (*Sorex merriami*) is known from only one specimen collected near Rushville in 1965 (McDaniel, 1967). Merriam's shrews are most often taken in pitfall traps (Jones et al, 1983) a time consuming and laborious trapping method. Owls are their only known predator making owl pellets a potential source of information (Jones et al, 1983). A survey of owl pellets in the northwest corner of the state may help to pinpoint areas to be trapped for this shrew.

Of the 14 species of bats occurring in Nebraska (Jones, 1964) 7 are on the special animal list and 3 (*Myotis thysanodes pahasapensis*, *Pipistrellus subflavus*, and *Plecotus townsendii*) are ranked S1. Caves, rock ledges, and wooded areas are favored retreats for many kinds of bats. Scarcity of these features (Jones, 1964) along with a lack of research, accounts for the high number of bats on the list. Intensive searches of known caves and woodlands are required to determine summer roosting areas for bats in Nebraska.

Two Scuirids which historically occurred in Nebraska are the eastern chipmunk (*Tamias striatus*) and the Wyoming ground squirrel (*Spermophilus elegans*). The eastern chipmunk once occurred as a locally common resident in the wooded bluffs of the Missouri River in southeast Nebraska. The last report of an eastern chipmunk was recorded in the 1950's (Jones, 1964). The Wyoming ground squirrel occupied areas with well-drained upland

slopes covered by dry grassland or shrub-steppe, especially sagebrush in Kimball and Banner counties (Jones et al, 1983), and was last sighted in the early 1900's (Jones, 1964). A search must be conducted for both of these species before adding them to the extirpated list.

A peripheral species, the southern flying squirrel (Glaucomys volans), occupies deciduous forests in the southeast corner of the state (Jones, 1964 and Jones et al, 1983). At one time this species was probably more widespread but due to loss of habitat has declined (Jones, 1964). In 1985 the Nebraska Game and Parks Commission placed nest boxes in 4 sites historically occupied by flying squirrels. These boxes have yielded less than 100 squirrels in only 3 of the sites with the majority observed in Indian Cave State Park (F. Andelt, personal communication). Additional habitat to be surveyed has been found in extreme southeastern Richardson County.

Currently a candidate for federal listing, the Nebraska bog lemming (Synaptomys cooperi relictus) is an isolated subspecies endemic to Nebraska and is found only in a small area along Rock Creek in Dundy County (Jones, 1964). S. c. glossii the most closely related subspecies occurs approximately 200 miles to the east. The Nebraska bog lemming was first collected and described in 1952 (Jones, 1958) and last collected in 1964 (J.R. Choate, personal communication). The description of S. c. relictus as a new subspecies was based on cranial measurements and should be verified utilizing newer more accurate biochemical techniques. This endemic subspecies requires an intensive search to determine its existence, population size, and to provide specimens to verify its subspecies status.

The black-footed ferret (Mustela nigripes) is Nebraska's rarest mammal (Jones, 1964) and is listed endangered on both state and federal lists. Formerly ranging over the western three-fourths of Nebraska (Jones, 1964) it has since declined, and is possibly extirpated, due to the destruction of prairie-dog colonies through farming and pest control (Jones et al, 1983). The last preserved specimen was collected in 1949 (Jones, 1964). No black-footed ferrets are known to exist in the state, although unconfirmed reports persist (R. Lock, personal communication).

Historically, the swift fox (Vulpes velox) was fairly common in central and western Nebraska (Jones, 1964). At the turn of the century the swift fox was nearly driven to extinction by trapping and the use of poison baits to control coyotes (Jones et al, 1983). Since the early 1950's, the swift fox has been making a recovery (Jones et al, 1983) with the majority of recent sightings occurring in the northwest corner of the state (F. Andelt, personal communication).

Birds

The largest number of species on the special animal list are birds. This is due to the large avifauna found in Nebraska. Of the 435 species of birds that breed in the U.S. south of Canada, 406 species have been reported and 201 are known to breed in Nebraska (Johnsgard 1979, 1980). Five species of birds have been extirpated from Nebraska.

American Swallow-tailed Kite (Elanoides forficatus)
Ruffed Grouse (Bonasa umbellus)
Lesser Prairie Chicken (Tympanuchus pallidicinctus)
*Passenger Pigeon (Ectopistes migratorius)
*Carolina Parakeet (Conuropsis carolinensis)

Two of these five species, marked with an asterisk are now extinct (N.O.U., 1988).

Many bird species have declined due to hunting or loss of habitat. The highest priority species (ranked) discussed below are either declining, peripheral, or lack information on abundance and distribution.

The rarest bird in Nebraska is the endangered eskimo curlew (Numenuis borealis). The eskimo curlew, once believed to be extinct due to hunting, historically migrated through Nebraska in huge flocks during the spring. There has been only one recent sighting for Nebraska in 1987 on Mormon Island. Due to this recent sighting the NENHP has upgraded the eskimo curlew from SX to S1.

The mountain plover (Charadrius montanus), a state threatened species, was considered common in western Nebraska at the turn of the century (Bruner et al, 1904). There are only two recent breeding records, both for Kimball County. Decline of this species is attributed to loss of shortgrass prairie habitat. Remaining nesting habitat in Kimball County should be surveyed.

Two federally and state endangered, non-resident, high priority species are the whooping crane (Grus americana) and the bald eagle (Haliaeetus leucocephalus). Overnight roosts used by the whooping crane during migration and critical wintering habitat used by bald eagles are being recorded. These species are monitored by the U.S. Fish and Wildlife Service and the Nebraska Game and Parks Commission.

Two other listed species are being tracked, the endangered interior least tern (Sterna antillarum athalassos) and the threatened piping plover (Charadrius melodus). These species nest in colonies, often together, on the Platte, Niobrara, upper Missouri, Elkhorn, and Loup rivers. Populations have declined due to loss of sandbar habitat. These two species are closely

monitored by the Nebraska Game and Parks Commission.

Three hawks which were historically common breeders in the state have declined drastically since the turn of the century, the sharp-shinned hawk (Accipiter striatus), cooper's hawk (A. cooperi), and red-shouldered hawk (Buteo regalis). The sharp-shinned hawk was considered a common breeder in Sioux County (Bruner et al, 1904). Preferring to nest in dense mixed woodlands (Johnsgard, 1980), there are only 3 recent nesting records. Cooper's hawk was common in mature hardwood forests (Johnsgard, 1980). There are five recent nesting records from Frontier and Red Willow counties. Red-shouldered hawks were common along the Missouri River Bluffs (Bruner et al, 1904). There are no recent nesting records for this hawk in Nebraska.

Some species on the list have distributions that are limited by habitat and were never widespread. The merlin (Falco columbarius) nests in dense coniferous forests and canyons in the pine ridge (Rosche, 1982). There are 14 recent nesting records for Sioux and Dawes counties. The sage grouse (Centrocercus urophasianus) and the sage thrasher (Oreoscoptes montanus) are restricted to grasslands with abundant sagebrush in the extreme northwest corner of Nebraska.

Several species which are believed to be declining due to loss of wetland and deciduous forest habitat include the king rail (Rallus elegans), black-necked stilt (Himantopus mexicanus), pileated woodpecker (Dryocopus pileatus), and the Louisiana waterthrush (Seiurus motacilla). Although occurrence information has been accumulated for these species, the data has not been processed into the NENHP map or computer files at present.

The Nebraska Breeding Bird Atlas, conducted over the past 5 years by the Nebraska Ornithologist's Union, will be completed in 1989. The atlas project is expected to add substantially to our knowledge of breeding bird distributions in the state. Additional "peripheral" species may be found to be nesting in Nebraska, and the status of rare and declining species should be further clarified.

Reptiles and Amphibians

Sixty species of herptiles (reptiles/amphibians) are known to occur in Nebraska (Lynch, 1985). Of these 50% are on the special animal list. This high percentage is partly due to the fact that 50 species are peripheral. In addition, several species of reptiles have become much rarer or experienced distributional restrictions over the past 20 to 30 years (Lynch, 1985).

The two highest priority (ranked) amphibians, the smallmouth salamander (Ambystoma texanum) and the American toad (Bufo americanus), are peripheral and restricted to southeastern

Nebraska. The smallmouth salamander has been collected in Richardson and Douglas counties. The American toad was collected in 1982 in Saunders County, previous records were misidentified. The American toad has been found to hybridize with the rocky mountain toad (B. woodhousii), a common toad encountered throughout Nebraska. The status of B. americanus requires further study (Lynch, 1985).

The only turtle on the special animal list is the yellow mud turtle (Kinosternon flavescens). The yellow mud turtle occurs as a disjunct population in the Sandhills and along the Republican River drainage (Lynch, 1985 and Iverson et al, 1984). The Sandhills population is locally common, but it is not widely distributed, with the majority of its known population occurring on two National Wildlife Refuges. This species is declining in Nebraska due to loss of wetlands in the Sandhills (Iverson et al, 1984) and was recently listed as a candidate species by the U.S. Fish and Wildlife Service.

Two lizards, the five-lined skink (Eumeces fasciatus) and sagebrush lizard (Sceloporus graciosus), are known from very small areas in the state. The five-lined skink is known to occur only in Richardson County in a few square miles of wooded terrain along the Missouri River, southeast of Rulo (Lynch, 1985). The sagebrush lizard was first collected in 1978 and again in 1986 in Morrill County near Broadwater. In Wyoming the sagebrush lizard is associated with sagebrush communities with rocky outcroppings (Baxter and Stone, 1985). Sagebrush communities, occurring in southwest Nebraska should be searched for this lizard.

The rarest snake in Nebraska is the redbelly snake (Storeria occipitomaculata). Historically, this snake was recorded only once in the state, from a vague locality along the Missouri River in the 1800's (Lynch, 1985). In 1967 the redbelly snake was again collected in Buffalo County and in 1987 in Dawson County. These recent collections raise many questions concerning the status of the redbelly snake in Nebraska.

Three of the four pit vipers occurring in Nebraska are on the special animal list including the copperhead snake (Agkistrodon contortrix), timber rattlesnake (Crotalus horridus), and massasauga (Sistrurus catenatus). All three are limited to extreme southeastern Nebraska and have suffered drastic decline due to habitat loss. The copperhead and timber rattlesnake are found along the Missouri River Bluffs. Once these two snakes were reported as far north as the Platte River (Lynch, 1985), but all recent records are for Gage and Richardson counties. There are unconfirmed reports of timber rattlesnakes in Nemaha County that should be verified. The massasauga, an inhabitant of tallgrass prairie, was once distributed over the eastern third of Nebraska. Due to agriculture, much of the massasauga's habitat has been altered and it now persists only in Gage and Pawnee counties.

Fish

Of all the vertebrates, habitat for this group has undergone the greatest destruction. The destruction is the result of the drastic changes Nebraska's waters have undergone in the last century. These changes include: reduced instream flows from irrigation and urban water projects; increased turbidity from siltation due to agriculture; pollution from agricultural and urban developments; and modification of streams due to channelization and dams, particularly on the Missouri River, resulting in the destruction of backwater and shallow water habitats often used as spawning grounds.

Additionally very little research has been conducted on nongame fish species distributions, population sizes, and habitat requirements. When surveys have been conducted, voucher specimens often were not collected, making it impossible to verify records. Of the EO's recorded for fish, 30 percent are pre-1980 and require field verification. Occurrence information on several species of fish has been accumulated but has not been processed into the NENHP map or computer files. Species for which information has not been computerized will not be discussed here. Of the fish species on the special animal list the following four may be extirpated from the State.

Hornyhead Chub (Nocomis biguttatus)
Highfin Carpsucker (Carpiodes velifer)
Mountain Sucker (Catostomus platyrhynchus)
Blackside Darter (Percina maculata)

A lapse of 92 years between collections of the lake chub (Couesius plumbeus) in Nebraska gives hope that these four species could still be found, for this reason they have been given a rank of SH.

Six fish species are on the state threatened list.

Lake Sturgeon (Acipenser fulvescens)
Pallid Sturgeon (Scaphirhynchus albus)
Blacknose Shiner (Notropis heterolepis)
Northern Redbelly Dace (Phoxinus eos)
Finescale Dace (Phoxinus neogaeus)
Pearl Dace (Semotilus margarita)

Of these state threatened species two, the lake sturgeon (A. fulvescens) and the pallid sturgeon (S. albus), are federal candidates as are four additional species the paddlefish (Polyodon spathula), sturgeon chub (Hybopsis gelida), sicklefin chub (H. meeki), and blue sucker (Cycleptus elongatus). Twenty-nine fish are on the NENHP special animal list of these thirteen are ranked S1 or SH (critically imperilled with 1-5 EO's or historical). Of the species for which EO's have been recorded

into the NENHP database the blacknose shiner (N. heterolepis), lake chub (C. plumbeus), topeka shiner (Notropis topeka), lake sturgeon (A. fulvescens), chestnut lamprey (Icthyomyzon castaneus), silver lamprey (I. unicuspis), and silverband shiner (Notropis shumardi) have the fewest recent records.

The blacknose shiner (N. heterolepis) has been collected from eleven streams in Nebraska. Eight of these collections were made prior to 1940. Since 1980 the blacknose shiner has been reported once each at Holt Creek, Fremont Slough, and the Niobrara River. The Fremont Slough record is questionable due to its location and type of habitat. This shiner prefers cool, weedy pools of small prairie streams, and cannot tolerate turbid streams such as Fremont Slough. Turbidity due to siltation caused by agricultural practices has probably contributed to its decline (Madsen, 1985).

Nebraska's rarest fish, the lake chub (C. plumbeus), occurs as a glacial relict in north-central Nebraska (Madsen, 1985). The lake chub was collected in three streams in 1893 by Evermann and Cox and was not collected again until 1985 in the headwaters of Bone Creek (Stasiak, 1986). This species should be considered for state listing. The undetected survival of this fish for 92 years gives hope that it may still occur elsewhere.

Another very rare fish in Nebraska's waters is the topeka shiner (N. topeka). Prior to the 20th century, this fish was considered common in the central part of the state having been collected from six streams. Since 1940 it has been collected only once from the Missouri River in 1973.

The lake sturgeon (A. fulvescens) has only been collected four times in Nebraska from 1940-1983 once each in the lower Elkhorn and lower Platte rivers and twice in the Missouri River. Prior to 1900 the lake sturgeon was common and economically important as a commercial fish (Pflieger, 1975). Over-exploitation may have contributed to its rapid decline, however destruction of feeding and spawning grounds (Nebraska Game & Parks Commission, 1972), due to channelization of the Missouri River was the main contributing factor. Possible spawning and feeding grounds should be identified and protected.

Two species of lampreys have been reported from the Missouri River the chestnut lamprey (I. castaneus) and the silver lamprey (I. unicuspis). There are few records for either species, with one report of the chestnut lamprey from 1985 and two reports of the silver lamprey one undated but prior to 1937 and the other from 1981.

Another rare species of the Missouri River is the silverband shiner (N. shumardi). This fish prefers large turbid rivers (Madsen, 1985) and has been collected twice in 1892 and 1972. Due to its size this species maybe overlooked.

Invertebrates

Although the number of invertebrates in existence far outnumber the vertebrates there are fewer invertebrates on the special animal list. This is mainly due to the lack of information available on invertebrates in Nebraska. The invertebrate list was assembled from recommendations from biologists, naturalists, and several publications.

Coleoptera. There are seven beetles on the special animal list with the American burying beetle (*Nicrophorus americanus*) having the highest priority. This beetle was recently proposed for federal endangered species listing. A member of the carrion beetle family this species has almost vanished from its entire range with only two extant populations known. Its reason for decline has not been identified. It has been recorded from three locations in Nebraska: the Lincoln area (1921), Bessey National Forest (1957, 1969), and the Milburn area (1970). The U.S. Fish and Wildlife Service and U.S. Forest Service have funded an American burying beetle survey in Nebraska for 1989 to be conducted by Mary Jameson (University of Nebraska-Lincoln, PhD candidate).

The unicorn beetle (*Xyloryctes jamaicensis*) is the state's largest beetle. It was first described by Nebraska entomologists in 1979 and is found only in an isolated area along the Niobrara River and in the southeastern corner of the state (Ratcliffe, 1988).

The remaining coleoptera on the state special animal list are tiger beetles. The rarest of the tiger beetles occurring in Nebraska is *Cicindela nevadica lincolniana*. This subspecies is endemic to the salt marshes of Lancaster County. Draining and filling of the salt basins has severely reduced populations (Carter, unpublished).

Hemiptera. The only member of this order on the special animal list is the creeping water bug (*Ambrysus mormon*). The creeping water bug is a predaceous species which has been collected in only one location, Fairfield Creek in 1980 (Lamp and Pruess, unpublished).

Lepidoptera. Although butterflies are one of the most widely collected of all invertebrate groups in Nebraska, designation of rare species is a difficult task. Resident status of some species is not well established. Scattered records may actually reflect periodic range expansions from neighboring states or displaced individuals that do not breed in Nebraska. Some species are inconspicuous and seldom collected, even though they might be rather common.

Dr. Kurt Johnson of the American Museum of Natural History, New York, Mr. Steve Spomer with the University of Nebraska-Lincoln, and Mr. Richard Rosche of Chadron have contributed greatly in the preparation of the butterfly list. With their help the NENHP has targeted 21 species of butterflies as deserving special attention. Some of these will probably be shown to be secure, given more complete studies. A number of candidates not included, however, might eventually be added to the list.

Enough information is available to identify immediate conservation needs. Highest priority butterflies occur in 3 general habitats:

1) Grasslands. A few species are prairie obligates such as the ottoe skipper (*Hesperia ottoe*). Its range spans the entire tallgrass prairie biome. The ottoe skipper has declined across its entire range due to loss of habitat to agriculture (Opler and Krizek, 1984). Nebraska records are from 14 counties with the majority of these documented prior to 1952 (Johnson, 1972 and Rosche, 1986). The meadow fritillary (*Boloria bellona*) has been doing very well elsewhere adapting to man-made habitats, such as hayfields, and is expanding its range in the eastern U.S. (Opler, 1984). However, there are only three historical records from eastern Nebraska and 1 recent record from Sheridan County (Rosche, 1986). A federal candidate, the regal fritillary (*Speyeria idalia*) inhabits tallgrass prairies. Having declined drastically in the majority of its range, this species is doing very well in Nebraska (Opler, 1984). Presence of this species renders Nebraska's prairie remnants significant even from a national level.

2) Wetlands. Nebraska's rarest butterfly is the black dash (*Euphyes conspicua*). This is a peripheral species found only in the eastern part of the state from Douglas and Stanton counties (Rosche, 1986) and has not been recorded for several years. The dion skipper (*E. dion*), also an eastern species, is known from only 3 counties (Rosche, 1986). The broad-winged skipper (*Poanes viator*) is a highly localized species preferring pristine freshwater marshes. This disjunct population is well out of its normal eastern U.S. range with only one historical record from Douglas County and recent records from Sheridan, Cherry, and Grant counties (R.C. Rosche, personal communication).

3) Forests and woodlands. Most species in this group are characteristic of woodland edges or openings. Edward's hairstreak (*Satyrium edwardsii*), originally recorded in four counties, has not been seen in Nebraska since 1968 (R.C. Rosche, personal communication). This species inhabits oak thickets in rocky areas (Opler, 1984). The small apollo (*Parnassius phoebus*) was considered common in the canyons of Sioux County in the early 1900's. After diligent searching by naturalists the small apollo has only been sighted twice, once each in 1964 and 1980. A

limiting factor for the small apollo may be that its abundant food plant, Sedum lanceolatum, often dries up in the mid-summer heat (Rosche personal communication). The cliff swallowtail (Papilio indra) is a western species reaching its eastern most limits in Sioux and Banner counties. A common species of the early 1900's, overzealous collecting has caused its decline (R.C. Rosche, personal communication).

Mussels. Little information is available on mussels in Nebraska, the majority of data coming from Aughey (1877), Hoke (1983), and Guggler (unpublished) (Appendix C). Because mussels are long lived, stay in one place, and are filter feeders, they are good indicators of water purity and contamination history. As filter feeders mussels accumulate heavy metals and other contaminants in their tissues and shells. By examining the health of mussels individual annual rings the chronology of pollution or contamination of a body of water can be reconstructed.

Six species of mussels are on the special animal list. This list was compiled from the previously listed references, TNC high globally ranked species which may occur in Nebraska, and Jorgensen and Sharp, 1971. Three of these species are only known historically from the state. The endangered Higgins eye (Lampsilis higginsi) was reported twice from the state, once with no specimen from the Nemaha River in 1877 and the other a specimen in the National Museum of Natural History collected from the Elkhorn River in 1891. The spectacle case (Cumberlandia monodonta) a federal candidate and the fat pocketbook (Potamilus capax) were both reported, without specimens, in 1877 by Samuel Aughey. The remaining 3 species on the special animal list have been collected more recently. The flat floater (Anodonta suborbiculata) and scaleshell (Leptodea leptodon) have been collected from the Missouri River. The scaleshell is currently a federal candidate. After notification of the U.S. Fish and Wildlife Service by the NENHP of a recent Missouri River record of the scaleshell, Nebraska has been added to its historical range. The pond mussel (Ligumia subrostrata) can be found in streams in five counties.

Mr. Ellet Hoke (St. Louis, MO) has been conducting mussel surveys in Nebraska over the past 10 years. The NENHP hopes to obtain information from Mr. Hoke to help clarify the present status of mussels in Nebraska.

SUMMARY

Sandhills prairie, tallgrass prairie, fens, freshwater wetlands, saline wetlands, coniferous and eastern deciduous forests, and numerous streams and rivers - Nebraska harbors a wide range of natural features. Southern, northern, eastern, and western species mingle at the edge of their ranges and two major migratory flyways cross the state. Over one hundred years of development of our resources have altered the character of the landscape. Scattered in the fragments of our once vast and undisturbed wilderness are relatively undisturbed natural communities, some preserving rare and endangered plant and animal species. But unless we conscientiously catalogue the occurrence of these natural features, they may be unwittingly destroyed. Once destroyed, Nebraska's natural areas cannot be fully restored, and their resource potential, their utility for education and research, and their recreational, aesthetic, and cultural values are forever lost to future generations.

To meet this need, the Nebraska Natural Heritage Program was established in 1987 as a cooperative effort of The Nature Conservancy and the Nebraska Game and Parks Commission. The goal of the Program is to develop a continuously updated database that contains the location and status of the natural features of Nebraska's landscape, including not only features considered to be endangered, threatened, or of unique significance, but also the best examples of more common natural features.

This report completes the 21-month pilot period (September 21, 1987 - June 31, 1989) of the Nebraska Natural Heritage Program. During this period staff scientists have been collecting, condensing, and recording information about hundreds of natural communities, and rare plant and animal species. As a result of this inventory Nebraska has for the first time a single comprehensive repository of information about Nebraska's natural diversity.

Yet, because of Nebraska's size and ecological diversity, this inventory effort has only begun to adequately survey the natural communities, and rare and endangered plant and animal species scattered over the landscape. Moreover, because of the constantly changing, dynamic nature of the communities and species being inventoried the data must be continually refined and updated to remain current and become increasingly accurate.

Accomplishments

Although much work still lies ahead, much has been accomplished during the initial 21 months of the Nebraska Natural Heritage Program. Some of the achievements are detailed below:

Scientific Accomplishments

1) Systematic searches were made of major in-state and out-of-state museums and herbaria, of the zoological and botanical literature, and of state and federal agency resources and files for community, plant, and animal data.

2) Developed a systematic classification of the natural communities of Nebraska.

3) Developed natural community "element occurrence ranking criteria" for Nebraska.

4) Compiled comprehensive lists of rare Nebraska vascular plants, vertebrates, and invertebrates to help focus inventory and protection efforts.

5) Assigned priority rankings, based on standardized criteria, for all natural community types and plant and animal element species listed by the NENHP.

6) Compiled a list of all species of vertebrates occurring in Nebraska and completed global Vertebrate Characterization Abstract information for each.

7) Transcribed and mapped over 2100 element occurrences of which approximately 2050 have been computerized for rapid and efficient retrieval of information.

8) Computerized approximately 1100 Source Abstracts containing sources of information for the Program.

9) Compiled and entered locational and ownership information on 204 managed areas for state, federal, and private conservation areas.

10) Identified through a systematic infrared photo analysis and aerial surveys over 200 potential remnant prairie and forest tracts in Pawnee County.

Conservation Planning

1) Developed a Natural Diversity Scorecard for Nebraska and two site packages (protection plans) for two natural areas in Nebraska, in cooperation with the Midwest Regional Office of The Nature Conservancy. The Scorecard contains recommendations for seven acquisition sites and twenty-one registry sites.

2) Assembled in one central location, data on known occurrences (past and present) of endangered, threatened, and rare plant and animal species in the

state. This information is mapped and computerized to permit ready access by government and private decision makers.

3) Information on occurrences of natural diversity have been provided upon request to state and federal agencies, private consulting firms, and interested individuals who have demonstrated a valid need for the data.

4) Provided recommendations of candidate species for federal listing to the U.S. Fish and Wildlife Service, Grand Island Office.

5) In cooperation with the Rocky Mountain Heritage Task Force of The Nature Conservancy the botanist has begun compiling a list of rare plants that occur on U.S. Forest Service lands in (District 2) Nebraska.

Public Involvement

1) Numerous biologists and knowledgeable individuals throughout Nebraska, the Midwest, and elsewhere were contacted to obtain information on element occurrences.

2) Presented informational programs to numerous groups including the University of Nebraska-Lincoln ecology seminar, the University of Nebraska at Omaha biology seminar, Audubon Society Chapters, the Nebraska Chapter of the Wildlife Society, and other interested groups.

3) In cooperation with the Nebraska Game and Parks Commission a slide show detailing the Heritage Program was produced.

4) Contracted with two individuals for herbaria data collection.

5) Staff botanist served on the Lincoln-Lancaster County Ecological Advisory Committee and the planning board for the Eleventh North American Prairie Conference.

6) Supervised two work-study students from the University of Nebraska-Lincoln.

RECOMMENDATIONS

During the two years the NENHP has been in operation, it has proven to be very effective and successful. But despite the accomplishments of the Heritage staff to date, much remains to be done. It is simply impossible for a three person staff to completely inventory the natural diversity of a state the size of Nebraska in just two years.

The database is now fully operable and available for data requests. In the future, the staff will be better able to comment on the status of natural diversity in Nebraska, particularly for environmental impact assessments, only if the database is kept up-to-date and accurate.

Additional inventory work is urgently needed in many areas. Only a small percentage of the EO's in the NENHP's database have been field verified in recent years. Table 3 lists the number of element occurrences per decade, 1900 to the present. Approximately fifty percent of the EO's are historical (pre-1980) and require field verification. Of the 649 elements being tracked by the NENHP, 71 percent of the current animal (post-1980) EO's are represented by 8 bird species (Table 4). These birds are high research priority species for the NG&PC and the U.S. Fish & Wildlife Service. If the EO's for these 8 species are subtracted from the total number of current EO's in Table 3, only 489 EO's (33%), representing 641 elements are post-1980. From this it is evident that field verification of historical EO's and locating new EO's is necessary to update and increase the accuracy of the NENHP's database and will occupy a considerable portion of the Program's staff time.

A breakdown of element occurrences (EOs) recorded in the NENHP database by county (Figure 7) illustrates a skewed distribution. Counties with high numbers of EOs are those that contain ecologically significant areas and/or areas that have been extensively surveyed by researchers. Cherry County has the largest number of EOs, 177. It is the largest county in the state, relatively undisturbed, has a diversity of habitats, and contains two National Wildlife Refuges and TNC's Niobrara Valley Preserve. No EOs have been recorded for Boone and Wayne counties. Seven counties (8%) have more than 50 EOs, 41 (44%) have from 11-49 EOs, and 45 (48%) counties have from 0-10 EOs. The paucity of EOs for the majority of the counties, 92% have <50 EO's, reflects inadequate field research rather than an absence of biological diversity in these areas. Nebraska contains several biologically significant areas that have been relatively ignored by researchers, including the upper Elkhorn River Valley, sandsage prairies of Southwest Nebraska, Wildcat Hills, and Rose Hills in the southeast corner of the state. Field research in unsurveyed areas will undoubtedly add many new EOs to the NENHP's database and to our biological understanding of the state.

Table 3. Number of Element Occurrences (EO's) per Decade. Figures are based on totals as of May 15, 1989.

Decade	Plant EO's	Animal EO's	Community EO's	Total EO's
Pre-1900	144	39	0	183
1900-09	20	0	0	20
1910-19	55	2	0	57
1920-29	11	3	0	14
1930-39	24	51	0	75
1940-49	43	55	0	98
1950-59	25	12	0	37
1960-69	62	28	0	90
1970-79	220	190	0	410
1980-89	219	788*	47	1054**
Total	823	1168	47	2038

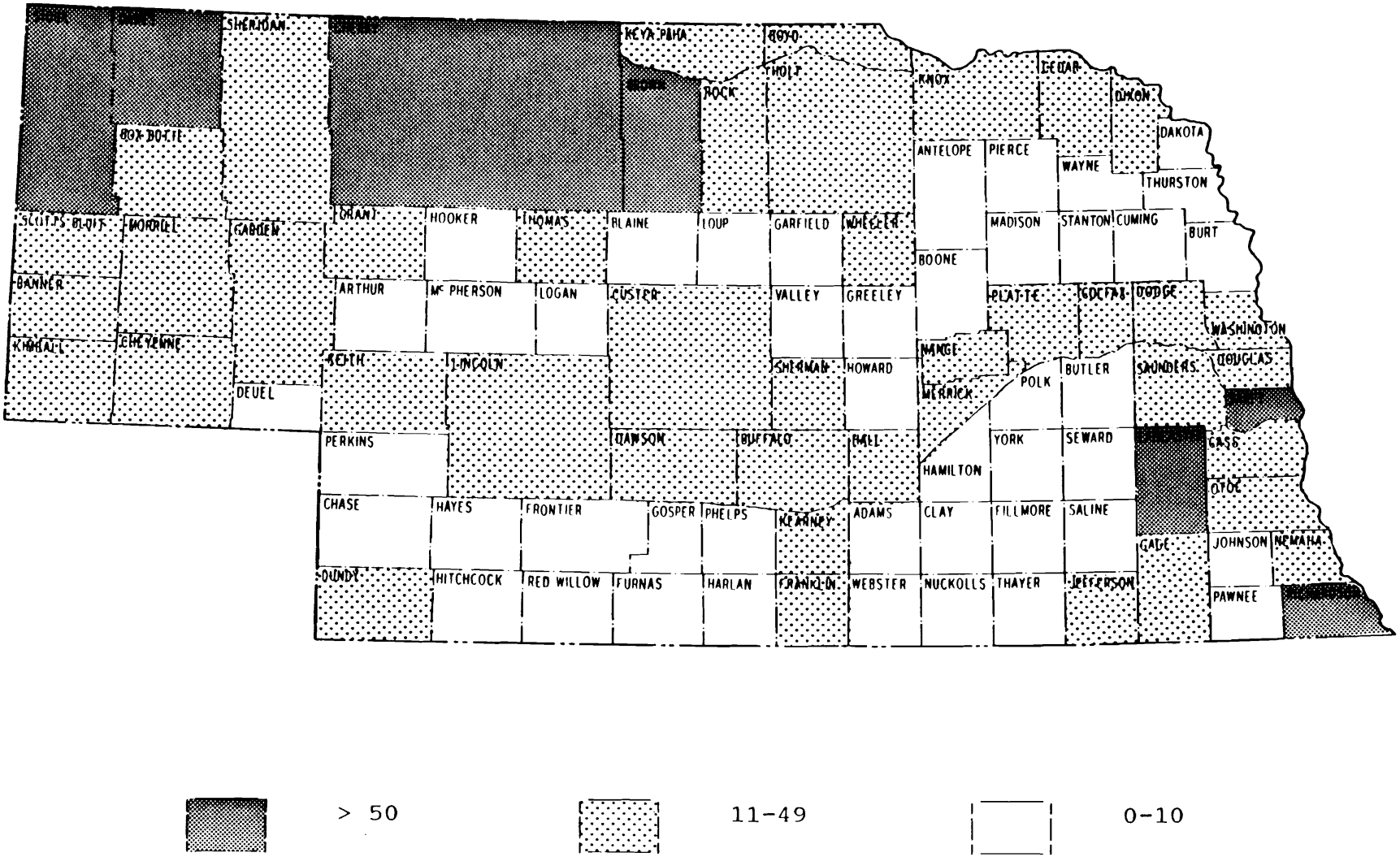
* 565 EO's are represented by 8 species of birds.
** Current (≥1980) EO's represent approximately. 50% of the total EO's in the NENHP database.

Table 4. Species of Birds Representing the Majority of Current (≥1980) EO's.

Species	Current (>1980) EO's
Bald Eagle	22
Trumpeter Swan	24
Peregrine Falcon	32
Ferruginous Hawk	44
Whooping Crane	56
Golden Eagle	64
Piping Plover	145
Least Tern	178
Total	565*

* This represents 71% of the total current (≥ 1980) animal EO's and 53% of the total current EO's.

Figure 7. Number of Element Occurrences Recorded per County.



The current status and inventory needs are summarized below for each of the element classes.

Natural Communities

In general, exemplary, relatively undisturbed natural communities are rare in Nebraska compared to their presettlement distribution. Agriculture, overgrazing, and urbanization are responsible, in large part, for this reduction. Among the natural community types none are thought to be extirpated, with the exception of tallgrass savanna, from the state. Several are limited to a few known occurrences (e.g. fens and eastern saline marshes). On the positive side, a few types (e.g. sandhills prairie and western floodplain woodland) appear to be relatively secure.

Even though significant accomplishments have been made in the identification and prioritization of communities since the initiation of the NENHP, there is still much work to do. Data should continue to be collected on all Natural Community types considering that the status of communities regarded as secure may change as new information is accumulated. Even if all sites were identified, natural and human-induced changes would require continuous monitoring of vegetation and critical populations. Protected populations also need to be reevaluated regularly to diagnose problems and to develop effective ecological remedies. Today, even the first step in the land protection process, identification and documentation of critical natural areas, is still in its early stages.

Priorities for future NENHP community studies are listed below:

1) Conduct a systematic inventory (color infrared photo analysis and field survey) for eastern saline marshes in Lancaster County. Such a study will begin in July, 1989, with funding provided by the Environmental Protection Agency.

2) Complete the Pawnee County Natural Areas Inventory which was initiated in 1988. If the county natural areas inventory proves an effective method of identifying natural community occurrences in eastern Nebraska it should be expanded to other counties that have high potential for containing natural areas.

3) Conduct field surveys of potential fens and Sandhill fens for sites identified from county soil maps.

4) Incorporate stream and river data from the Nebraska Department of Environmental Control and the Nebraska Game and Parks Commission into the data base.

5) Incorporate marsh and lake data from Nebraska Game and Parks Commission studies, U.S. Army Corps of Engineers studies, the National Wetlands Inventory, and other studies into the data base.

6) Inventory for natural community occurrences for all other community types using aerial photography analysis and field surveys. Communities that should receive high priority for inventory include western saline marsh, sandsage prairie, wet prairie, wet-mesic prairie, tallgrass prairie, tallgrass savanna, and southeastern upland forest.

Special Plants

The special plant section of this report has presented the methodology used in compiling the rare plant database. It has illustrated the factors influencing plant species rarity and species distribution and also the procedure followed in data acquisition and species ranking. As has been indicated, the database has been compiled using available data from existing research. However, this data is weighted both in terms of the age and the areas of concentration of the collections. It is evident that information for large areas of the state and for some species is not current, is incomplete, and in some cases is non-existent. The database is thorough and accurate in regards to the available information known on rare plants but it does not accurately profile the current status of all plant communities for the entire state. For this reason the existing database should not be viewed as an end product but as a foundation on which to build. In order for the NENHP rare plant database to reach and maintain its full potential and usefulness, the database must be kept current and accurate through the addition of data on extant species occurrences. This requires ongoing field research to confirm and monitor known occurrences and to identify new populations. The following recommendations are areas of activity and involvement that will ensure the quality and usefulness of the database and facilitate the ultimate goal of the NENHP - the protection of Nebraska's rare elements.

1) Conduct field research to confirm historical records, determine current species status, and locate new element occurrences.

2) Complete the transcription, mapping, and computerization of existing records.

3) Complete the search of herbaria, the transcription of specimen data, and the computerization of records.

4) Continue contacts with out-of-state researchers, non-professional collectors, and lay people for the acquisition of new data.

5) Monitor existing populations of endangered, threatened, and rare plant species.

6) Work cooperatively with botanical researchers to direct their collecting and research to rare plant species.

7) Create a State Endangered and Threatened Plant List (with legal status) through the involvement of scientific authorities and with evidence of hard scientific data.

8) Contact and cooperate with private landowners and public land managers to facilitate protection and management for high priority species occurring on their property.

9) Update the element tracking list to include new vascular plant species and expand the list to include non-vascular plants (i.e. mosses and lichens).

Special Animals

The animal population in Nebraska has changed drastically in the past 100 years. Both the abundance and diversity of species have declined. At least 12 vertebrate species are known to be extirpated from the state: 7 mammals and 5 birds. An additional 3 mammals, 4 fish, and an unknown number of invertebrate species may also be extirpated. It is nearly impossible to determine the extent of invertebrate species decline, since so little documentation of these species has occurred. Besides the large number of species extirpated from Nebraska, an alarming number of the vertebrate species, over 25%, are listed as special animals by the Heritage Program. These species are endangered, threatened, rare, peripheral, or of special concern in Nebraska.

The loss and decline of species can be attributed to two major causes: 1) habitat loss and degradation, and 2) direct disturbance and exploitation. Over one hundred years of development of our lands have altered the once abundant habitat for prairie, woodland, riverine, and wetland species. Direct exploitation, such as overharvest, caused others to decline long before habitat was destroyed.

This loss of species and habitat has slowed somewhat in the past 50-80 years. Legal protection of migratory birds and regulated harvesting of game species was a major conservation achievement in the early 1900's. More recent conservation efforts have concentrated on waterfowl and game species habitat protection. Nongame species, unless federally or state listed, are only beginning to receive conservation and protection efforts. Even so, some inadvertent protection of special animals has occurred on public managed lands such as National Wildlife Refuges and Forest Service lands.

Continued preservation of those species not included in managed areas is a high priority. However, this is often times very difficult to accomplish. Inadequate knowledge of species habitat requirements and population status hampers progress. Little is known about many of the Heritage species.

For these reasons, it is imperative that efforts be continued by the Nebraska Natural Heritage Program to reverify many species on the list, and to study those that have not been searched for in many years. The following is a list of specific recommendations for further animal inventory work by the NENHP.

1) Compile secondary records for species not yet represented in the NENHP data base.

2) Complete the transcription and computerization of records already obtained from secondary sources.

3) Conduct field investigations to reverify historical element occurrences and to obtain new element occurrences.

4) To determine the status of Merriam's shrew (*Sorex merriami*) contact Len McDaniel, Valentine National Wildlife Refuge Manager, to discuss habitat and trapping methods. Collect owl pellets in the Rushville vicinity for shrew remains and determine trapping sites.

5) Continue research on the status of Nebraska bats through netting surveys and by searching for summer roosts. This will involve cooperation with Dr. Freeman at the University of Nebraska State Museum and Dr. Geluso at the University of Nebraska at Omaha.

6) Conduct field investigations to determine the status of the eastern chipmunk (*Tamias striatus*) and the Wyoming ground squirrel (*Spermophilus elegans*).

7) Search additional habitat in southeastern Nebraska for the southern flying squirrel (*Glaucomys volans*). This work should be done in cooperation with Frank Andelt of the NG&PC.

8) Conduct field investigations to determine the status of the Nebraska bog lemming (*Synaptomys cooperi relictus*). If a viable population is found collect specimens for biochemical determination of subspecies status.

9) Obtain records from the Nebraska Ornithologist's Union breeding bird atlas and solicit help to obtain additional nesting records in the future.

10) Determine the breeding status of the mountain plover Charadrius montanus) by searching the remaining nesting habitat in Kimball County.

11) Investigate nesting sites for uncommon wetland and forest birds.

12) Conduct intensive field investigations for new records of secretive species of herptiles such as the smallmouth salamander (Ambystoma texanum), five-lined skink (Eumeces fasciatus), sagebrush lizard (Sceloporus graciosus), and the redbelly snake (Storeria occipitomaculata).

13) Monitor known populations and determine new locations for the three declining pit vipers the copperhead snake (Agkistrodon contortrix), timber rattlesnake (Crotalus horridus), and the massasauga (Sistrurus catenatus).

14) Collect field samples of fish from small tributary streams, fens, and other sites that have not been visited during recent investigations. This will require the cooperation of the NG&PC Fisheries Division and possibly the DEC and state NRDs.

15) Determine the status of historical fish the hornyhead chub (Nocomis biguttatus), highfin carpsucker (Carpiodes velifer), mountain sucker (Catostomus platyrhynchus), blackside darter (Percina maculata), and the recently rediscovered lake chub (Couesius plumbeus).

16) Identify critical spawning habitats and specific stretches of streams, rivers, and shorelines which support populations of Nebraska's rare and endangered species.

17) Obtain information on the status of the American burying beetle (Nicrophorus americanus) from the investigation to be conducted by Mary Jameson.

18) Document existing records of rare butterflies, beetles, and mussels.

19) Search for rare butterflies in other community types by identifying localities where larval food plants are known to occur. This will involve cooperation with the NENHP Botanist and Community Ecologist, and several Lepidopterists.

20) With the help of knowledgeable biologists, create a reference collection of Nebraska's mussels for use by future researchers.

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Appendix A. List of NENHP Plant Elements. Alphabetized by family with global ranks, state ranks, federal status, and state status. Ranking codes are given in the text. LE = federally endangered, LT = federally threatened, C1-C2 = federal candidate species, 3C = former federal candidate species, SEN = state endangered, STH = state threatened, SSP = state special concern species, SNC = state in need of conservation species.

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
ACANTHACEAE					
RUELLIA STREPENS	RUSTLING WILD-PETUNIA	G4G5	S1		
ACERACEAE					
ACER GLABRUM	MOUNTAIN MAPLE	G4G5	S1		
ADIANTACEAE					
CHEILANTHES FEEI	FEE LIPFERN	G5	S2		
NOTHOLAENA DEALBATA	POWDERY CLOAKFERN	G4G5	SH		SSP
PELLAEA ATROPURPUREA	PURPLE-STEM CLIFF-BRAKE	G5	S2		
ALISMATACEAE					
SAGITTARIA LONGILOBA		G?	S1		
SAGITTARIA RIGIDA	SESSILE-FRUITED ARROWHEAD	G5	S2		
AMARANTHACEAE					
TIDESTROMIA LANUGINOSA		G5			
ANACARDIACEAE					
RHUS COPALLINA	WINGED SUMAC	G5	S1		
ANNONACEAE					
ASIMINA TRILOBA	PAWPAW	G5	S2		SSP
APIACEAE					
ERYNGIUM YUCCIFOLIUM		G5	S1		
LOMATIUM NUTTALLII	NUTTALL DESERT-PARSLEY	G?	S1		SSP
THASPIUM TRIFOLIATUM	PURPLE MEADOW-PARSNIP	G5	S1		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
ARACEAE					
ARISAEMA DRACONTIUM	GREEN DRAGON	G5	S1		
ARALIACEAE					
ARALIA NUDICAULIS	WILD SARSAPARILLA	G5	S3		
ARALIA RACEMOSA	AMERICAN SPIKENARD	G5	S2		
PANAX QUINQUEFOLIUS	AMERICAN GINSENG	G4	S1	3C	SSP
ARISTOLOCHIACEAE					
ASARUM CANADENSE		G5	S1		
ASCLEPIADACEAE					
ASCLEPIAS AMPLEXICAULIS	CLASPING MILKWEED	G5	S1		
ASCLEPIAS ENGELMANNIANA	ENGLEMANN MILKWEED	G?	S2		
ASCLEPIAS VIRIDIS	SPIDER MILKWEED	G4G5	S2		
ASPLENIACEAE					
ASPLENIUM PLATYNEURON		G5	S1		
ATHYRIUM FILIX-FEMINA	SUBARCTIC LADY-FERN	G5	S1		
CYSTOPTERIS BULBIFERA	BULBLET FERN	G5	S?		SSP
DRYOPTERIS CRISTATA	CRESTED SHIELD-FERN	G5	S1		
DRYOPTERIS SPINULOSA		G5	S2		
ASTERACEAE					
AGOSERIS GLAUCA	PALE FALSE-DANDELION	G4G5	S1		
AMBROSIA TOMENTOSA		G?	S1		
ANTENNARIA DIMORPHA	TWO-FORM PUSSYTOES	G5	S1		
ARTEMISIA CANA	HOARY SAGEBRUSH	G4?	S2		
ASTER BRACHYACTIS	RAYLESS ALKALI ASTER	G3G5	S1		
ASTER FENDLERI	FENDLER'S ASTER	G?	S1		SSP
ASTER JUNCIFORMIS		G3G5	S2		
ASTER LATERIFLORUS		G5			
ASTER PUNICEUS	SWAMP ASTER	G5	S?		
ASTER SUBULATUS	ANNUAL SALTMARSH ASTER	G5	S?		
ASTER SUBULATUS VAR LIGULATUS		G5TU	S1		
BIDENS POLYLEPIS	AWNLESS BEGGAR-TICKS	G5	S1		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
BRICKELLIA GRANDIFLORA	TASSEL FLOWER	G5	S2		
CACALIA ATRIPLICIFOLIA	PALE INDIAN-PLANTAIN	G4G5	S3		
CHRYSOTHAMNUS PARRYI SSP HOWARDII		G5T?	S1		
CIRSIUM PULCHERRIMUM		G?			
CREPIS ACUMINATA		G5	S1		
CREPIS OCCIDENTALIS	GRAY HAWKSBEARD	G?NE	S2		
ECHINACEA PALLIDA		G4G5			
ERIGERON CAESPITOSUS		G5			
ERIGERON CANUS	HOARY FLEABANE	G4	S2		
ERIGERON DIVERGENS	SPREADING FLEABANE	G5	S?		
ERIGERON FLAGELLARIS		G4	S1		
ERIGERON GLABELLUS	SMOOTH FLEABANE	G4	S1		
ERIGERON OCHROLEUCUS		G5			
ERIGERON SUBTRINERVIS	THREE-NERVE FLEABANE	G5	S1		
ERIGERON VETENSIS		G4			
EUPATORIUM SEROTINUM		G5	S2		
EUTHAMIA OCCIDENTALIS	WESTERN FRAGRANT-GOLDEN-ROD	G?	S?		
EVAX PROLIFERA	BIG-HEAD EVAX	G?	S?		
HAPLOPAPPUS ANNUUS		G?			
HAPLOPAPPUS ARMERIOIDES	SKYLINE GOLDEN-WEED	G3G5	S2		
HAPLOPAPPUS CILIATUS		G?			
HELENIUM AMARUM	FIVE-LEAF SNEEZEWEED	G5	S?		
HELIANTHUS HIRSUTUS	STIFF-HAIR SUNFLOWER	G5	S?		
HELIANTHUS MOLLIS	ASHY SUNFLOWER	G4G5	S?		
HIERACIUM CANADENSE	CANADA HAWKWEED	G5	S?		
HIERACIUM LONGIPILUM	HAIRY HAWKWEED	G4G5	S?		
HIERACIUM UMBELLATUM	UMBELLATE HAWKWEED	G?NE	S?		
HYMENOPAPPUS SCABIOSAEUS VAR CORYMBOSUS		G?	S1		
HYMENOXYS SCAPOSA		G4G5	S3		
KRIGIA CAESPITOSA		G?			
LEUCELENE ERICOIDES	ROSE-HEATH	G?	S?		
LIATRIS MUCRONATA		G?	S?		
MACHAERANTHERA GRINDELIOIDES	WESTERN ASTER	G3	S2		
PALAFOXIA SPHACELATA	OTHAKE	G?	S1		
PARTHENIUM HISPIDUM		G?	S?		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
PICRADENIOPSIS WOODHOUSEI	WOODHOUSE'S FALSE-BAHIA	G?	S?		
PRENANTHES RACEMOSA SSP MULTIFLORA		G?	S?		
PYRRHOPAPPUS CAROLINIANUS	CAROLINA FALSE-DANDELION	G5	S?		
RATIBIDA TAGETES		G?			
RUDBECKIA SUBTOMENTOSA	SWEET CONEFLOWER	G5	S?		
SENECIO GLABELLUS	GRASSLEAF RAGWORT	G5	S1		
SENECIO SPARTIOIDES		G?			
SOLIDAGO FLEXICAULIS	BROAD-LEAVED GOLDENROD	G5	S2		
SOLIDAGO PETIOLARIS	DOWNY GOLDENROD	G3G5	S2		
SOLIDAGO ULMIFOLIA	ELM-LEAF GOLDENROD	G5	S2		
STEPHANOMERIA RUNCINATA	DESERT SKELETONPLANT	G?	S?		
TOWNSENDIA HOOKERI	HOOKER TOWNSEND	G5	S?		
VERBESINA ENCELIOIDES SSP EXAURICULATA		G?T?	S1		
VERBESINA VIRGINICA	WHITE CROWNBEARD	G4G5	S?		
VERNONIA MISSURICA		G4G5			
BERBERIDACEAE					
BERBERIS REPENS	CREPPING OREGON-GRAPE	G5	S?		
CAULOPHYLLUM THALICTROIDES	BLUE COHOSH	G5	S2		
PODOPHYLLUM PELTATUM	MAY APPLE	G5	S3		
BETULACEAE					
BETULA OCCIDENTALIS	SPRING BIRCH	G4G5	S1		
BETULA PAPYRIFERA	PAPER BIRCH	G5	S1		
BORAGINACEAE					
CRYPTANTHA CANA		G3	S3		
HACKELIA FLORIBUNDA	DAVIS MOUNTAIN STICKSEED	G5?	S2		
HELIOTROPIUM CURASSAVICUM		G5	S2		
LAPPULA CENCHRUSOIDES		G?	S1		
BRASSICACEAE					
ARABIS CANADENSIS		G5	S3		
ARABIS DIVARICARPA		G5	S1		
ARABIS DRUMMONDII	DRUMMOND ROCKCRESS	G5	S1		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
ARABIS SHORTII	SHORT'S ROCK-CRESS	G5	S2		
ARABIS VIRGINICA		G5	S1		
CARDAMINE CONCATENATA	CUTLEAF TOOTHWORT	G5	S2		
CARDAMINE PENSYLVANICA		G5	S1		
DRABA CUNEIFOLIA		G5	S1		
LESQUERELLA ARENOSA VAR ARENOSA		G5T?	S1		
LESQUERELLA ARENOSA VAR ARGILLOSA		G5T2	S2		
LESQUERELLA GRACILIS SSP NUTTALLII		G?	SH		
LESQUERELLA MONTANA		G?	S1		
LESQUERELLA OVALIFOLIA	ROUND-LEAF BLADDER-POD	G?	S?		SSP
RORIPPA CALYCINA		G3		C2	
RORIPPA CURVIPES		G?			
RORIPPA TENERRIMA		G?	S1		
STANLEYA PINNATA VAR PINNATA		G4G5	S1		
THELYPODIUM INTEGRIFOLIUM		G?	S1		
CACTACEAE					
CORYPHANTHA MISSOURIENSIS	MISSOURI CORYCACTUS	G5	S2		
ECHINOCEREUS VIRIDIFLORUS	GREEN-FLOWERED HEDGEHOG-CACTUS	G4	S2		
CALLITRICHACEAE					
CALLITRICHE HERMAPHRODITICA		G5	S1		
CALLITRICHE VERNA		G5	S1		
CAMPANULACEAE					
LOBELIA CARDINALIS	CARDINAL FLOWER	G5	S2		
LOBELIA INFLATA	INDIAN-TOBACCO	G5	S?		
TRIODANIS HOLZINGERI		G3G5	S1		
TRIODANIS PERFOLIATA VAR BIFLORA		G5T?			
CAPRIFOLIACEAE					
LONICERA DIOICA VAR GLAUCESCENS		G5TU	S2		
LONICERA PROLIFERA		G5?			
TRIOSTEUM AURANTIACUM	COFFEE TINKER'S-WEED	G5	S1		
VIBURNUM LENTAGO		G5	S2		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
CARYOPHYLLACEAE					
ARENARIA LATERIFLORA		G5	S2		
ARENARIA STRICTA SSP TEXANA		G5TU	S?		
LOEFLINGIA SQUARROSA	SPREADING LOEFLINGIA	G?	S1		SSP
PARONYCHIA CANADENSIS		G5	S2		
SILENE MENZIESII		G?	S2		
SILENE NIVEA		G?	SH		
STELLARIA LONGIFOLIA		G5	S3		
CHENOPODIACEAE					
ATRIPLEX CANESCENS		G5	S2		
ATRIPLEX DIOICA		G?			
ATRIPLEX NUTTALLII		G?	S1		
CHENOPODIUM FREMONTII		G?	S1		
CHENOPODIUM MISSOURIENSE		G?			
CHENOPODIUM SUBGLABRUM		G?	S1		
SALICORNIA RUBRA	WESTERN GLASSWORT	G4	S1		
SUCKLEYA SUCKLEYANA		G?	S1		
CISTACEAE					
HELIANTHEMUM BICKNELLII		G5			
LECHEA STRICTA	UPRIGHT PINWEED	G?	S1		
LECHEA TENUIFOLIA	NARROWLEAF PINWEED	G5	S?		
CLUSIACEAE					
HYPERICUM MUTILUM		G5			
HYPERICUM PUNCTATUM	COMMON ST. JOHN'S-WORT	G5	S1		
HYPERICUM PYRAMIDATUM	GREAT ST. JOHN'S-WORT	G4	S2		
HYPERICUM SPHAEROCARPUM		G?	S1		
TRIADENUM FRASERI		G?	S2		
CONVOLVULACEAE					
IPOMOEA PANDURATA	BIG-ROOT MORNING-GLORY	G5	S1		
CRASSULACEAE					
SEDUM LANCEOLATUM		G5	S1		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
CUCURBITACEAE					
CYCLANTHERA DISSECTA		G?	S1		
CUPRESSACEAE					
JUNIPERUS COMMUNIS	GROUND JUNIPER	G5	S3		
JUNIPERUS HORIZONTALIS	CREEPING JUNIPER	G5	S2		
CYPERACEAE					
CAREX ANNECTENS	A SEDGE	G5	S1		
CAREX BUSHII	BUSH'S SEDGE	G4	S1		
CAREX BUXBAUMII	BROWN BOG SEDGE	G5	S2		
CAREX CONJUNCTA	SOFT FOX SEDGE	G4G5	S2		
CAREX CRINITA		G3G5	S1		
CAREX CRUS-CORVI	RAVENFOOT SEDGE	G3G5	S1		
CAREX DIANDRA		G5	S2		
CAREX FESTUCACEA	FESCUE SEDGE	G5	S1		
CAREX FOENEA	DRY-SPIKE SEDGE	G5?	S1		
CAREX FRANKII	FRANK SEDGE	G5	S1		
CAREX GRANULARIS VAR GRANULARIS	A SEDGE	G5T5	S1		
CAREX HAYDENII	CLOUD SEDGE	G5	S1		
CAREX HITCHCOCKIANA		G5	S2		
CAREX HYALINOLEPIS		G4G5	S2		
CAREX JAMESII	NEBRASKA SEDGE	G5	S1		
CAREX LEAVENWORTHII	LEAVENWORTH SEDGE	G?	S1		
CAREX LIMOSA	MUD SEDGE	G5	S1		
CAREX LUPULINA		G5	S1		
CAREX MUHLENBERGII VAR ENERVIS	A SEDGE	G5T5	S2		
CAREX PECKII		G4G5	S3		
CAREX ROSSII	SHORT SEDGE	G4G5	S1		
CAREX SAXIMONTANA	ROCKY MOUNTAIN SEDGE	G3G5	S3		
CAREX SQUARROSA	SQUARROSE SEDGE	G4G5	S1		
CAREX TEXENSIS		G?	S1		
CAREX XERANTICA		G5	S1		
ELEOCHARIS ATROPURPUREA		G4G5	S1		
ELEOCHARIS PAUCIFLORA	FEWFLOWER SPIKERUSH	G5Q	S1		
ELEOCHARIS ROSTELLATA		G5	S2		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
ELEOCHARIS VERRUCOSA		G3G5Q	S2		
ELEOCHARIS WOLFII		G3G5	S2		
ERIOPHORUM GRACILE	SLENDER COTTON-GRASS	G5	S1		
ERIOPHORUM POLYSTACHYON		G5TU	S1		
FIMBRISTYLIS AUTUMNALIS	SLENDER FIMBRY	G5	S1		
SCIRPUS HALLII	HALL BULRUSH	G2?Q	S1		
SCIRPUS HETEROCHAETUS	SLENDER BULLRUSH	G5	S1		
SCIRPUS NEVADENSIS	NEVADA BULLRUSH	G4	S2		
SCIRPUS SMITHII	SMITH BULLRUSH	G5?	S1		
SCIRPUS TORREYI	TORREY BULLRUSH	G5?	S1		
DIOSCOREACEAE					
DIOSCOREA VILLOSA		G5	S1		
ELATINACEAE					
BERGIA TEXANA	TEXAS BERGIA	G5	S1		
EQUISETACEAE					
EQUISETUM FLUVIATILE	WATER HORSETAIL	G5	S2		
ERICACEAE					
ARCTOSTAPHYLOS UVA-URSI	BEARBERRY	G5	SH		
MONOTROPA HYPOPITHYS	AMERICAN PINESAP	G5	S1		
MONOTROPA UNIFLORA	INDIAN-PIPE	G5	S2		
PTEROSPORA ANDROMEDEA	GIANT PINEDROPS	G5	S3		
PYROLA ELLIPTICA	ELIPTICAL-LEAF WINTERGREEN	G5	S?		
PYROLA SECUNDA	ONE-SIDE WINTERGREEN	G5	S?		
PYROLA VIRENS	GREEN PYROLA	G?	S1		
EUPHORBIACEAE					
CROTON CAPITATUS VAR CAPITATUS		G5T?	S2		
CROTON GLANDULOSUS VAR SEPTENTRIONALIS		G5T?	S2		
FABACEAE					
AMORPHA NANA	FRAGRANT INDIGOBUSH	G5	S2		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
ASTRAGALUS AGRESTIS		G?	S1		
ASTRAGALUS FLEXUOSUS	FLEXIBLE MILK-VETCH	G3G5	S1		
ASTRAGALUS SHORTIANUS	A MILK-VETCH	G?	S1		
BAPTISIA AUSTRALIS	WILD FALSE INDIGO	G5?	S?		
CAESALPINIA JAMESII	JAMES' CAESALPINIA	G?	S1		
CASSIA MARILANDICA		G5	S2		
DALEA CYLINDRICEPS	COMPACT PRAIRIE-CLOVER	G5	S?		SSP
DALEA MULTIFLORA	ROUND-HEAD PRAIRIE-CLOVER	G3G5	S1		
DESMODIUM SESSILIFOLIUM		G5			
LATHYRUS OCHROLEUCUS		G4G5	S2		
LESPEDEZA VIOLACEA	VIOLET BUSH-CLOVER	G5	S1		
LUPINUS ARGENTEUS VAR PARVIFLORUS		G?	S1		
OXYTROPIS MULTICEPS		G?	S2		
PHASEOLUS POLYSTACHYUS	WILD KIDNEY BEAN	G4	SRF		
PSORALEA HYPOGAEA	LITTLE BREADROOT SCURF-PEA	G3G4	S2		SSP
PSORALEA LINEARIFOLIA	NARROWLEAF SCURF-PEA	G?	S1		SSP
TRIFOLIUM REFLEXUM		G3G5	S1		
VICIA CRACCA		G?NE	S1		
FAGACEAE					
QUERCUS ALBA	WHITE OAK	G5	S1		
QUERCUS MARILANDICA	BLACKJACK OAK	G5	S1		
QUERCUS PRINOIDES	DWARF CHINKAPIN OAK	G5	S2		
QUERCUS SHUMARDII		G5	S1		
GERANIACEAE					
GERANIUM VISCOSISSIMUM	STICKY GERANIUM	G?	S?		
GROSSULARIACEAE					
RIBES HIRTELLUM		G5			
RIBES OXYACANTHOIDES		G?	S2		
RIBES SETOSUM		G?	S1		
HALORAGACEAE					
MYRIOPHYLLUM VERTICILLATUM		G5	S1		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
HIPPOCASTANACEAE					
AESCULUS GLABRA VAR ARGUTA		G5T4?Q	S2		
HIPPURIDACEAE					
HIPPURIS VULGARIS	COMMON MARE'S-TAIL	G5	SH		
HYDROCHARITACEAE					
VALLISNERIA AMERICANA		G5	S1		
HYDROPHYLLACEAE					
PHACELIA HASTATA VAR LEUCOPHYLLA		G5T5	S2		
IRIDACEAE					
IRIS MISSOURIENSIS	WESTERN BLUE IRIS	G5	S2		
IRIS VERSICOLOR	BLUEFLAG	G5	S?		
ISOETACEAE					
ISOETES MELANOPODA	BLACKFOOT QUILLWORT	G5	S?		
JUGLANDACEAE					
CARYA TOMENTOSA	MOCKERNUT HICKORY	G5	S1		
JUNCACEAE					
JUNCUS CANADENSIS	CANADA RUSH	G5	S?		
JUNCUS EFFUSUS		G5			
JUNCUS SCIRPOIDES	SCIRPUS-LIKE RUSH	G5	S2		
LAMIACEAE					
AGASTACHE FOENICULUM	BLUE GIANT HYSSOP	G4G5	S2		
AGASTACHE SCROPHULARIIFOLIA	PURPLE GIANT HYSSOP	G4	S1		
BLEPHILIA HIRSUTA	HAIRY WOODMINT	G4?	S1		
DRACOCEPHALUM PARVIFLORUM	AMERICAN DRAGONHEAD	G5	S2		
HEDEOMA PULEGIOIDES		G5	S2		
PHYSOSTEGIA PARVIFLORA	PURPLE DRAGON-HEAD	G4G5	SH		
PYCNANTHEMUM PILOSUM	HAIRY MOUNTAINMINT	G5Q	S1		
PYCNANTHEMUM TENUIFOLIUM	SLENDER MOUNTAIN-MINT	G5	S1		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
SCUTELLARIA BRITTONII		G?	S2		
TRICHOSTEMA BRACHIATUM		G4G5	S2		
LEMNACEAE					
LEMNA VALDIVIANA		G5			
LILIACEAE					
ALLIUM CERNUUM		G5	S1		
ALLIUM STELLATUM		G5	S1		
ALLIUM TRICOCCUM		G5	S1		
CALOCHORTUS GUNNISONII		G5	S1		
CALOCHORTUS NUTTALLII		G5	S2		
DISPORUM TRACHYCARPUM		G?	S1		
ERYTHRONIUM MESOCHOREUM	MIDLAND FAWNLILY	G?	S?		SSP
FRITILLARIA ATROPURPUREA		G?	S2		
TRILLIUM NIVALE	SNOW TRILLIUM	G4	S?		SSP
ZIGADENUS ELEGANS		G5	S1		
LINACEAE					
LINUM PUBERULUM	PLAINS FLAX	G?	S?		
LINUM RIGIDUM SSP BERLANDIERI		G?	S?		
LOASACEAE					
MENTZELIA ALBICAULIS		G5	S1		
MENTZELIA OLIGOSPERMA	FEW-FLOWER STICK-LEAF	G?	S1		
LYTHRACEAE					
LYTHRUM CALIFORNICUM		G?			
MARSILEACEAE					
PILULARIA AMERICANA	AMERICAN PILLWORT	G5	S1		
MENYANTHACEAE					
MENYANTHES TRIFOLIATA		G5	S1		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
NYCTAGINACEAE					
MIRABILIS ALBIDA	PALE UMBRELLA-WORT	G5	S2		
MIRABILIS GLABRA		G5			
TRIPTEROCALYX MICRANTHUS					
NYMPHAEACEAE					
NUPHAR LUTEUM	AMERICAN LOTUS	G5	S2		
NYMPHAEA ODORATA		G5	S2		
NYMPHAEA TUBEROSA		G5	S2		
ONAGRACEAE					
GAURA NEOMEXICANA SSP COLORADENSIS		G5T2	S1	C1	
LUDWIGIA ALTERNIFOLIA VAR PUBESCENS		G5T?	S?		
LUDWIGIA POLYCARPA		G4	S2		
OENOTHERA CANESCENS	SPOTTED EVENING-PRIMROSE	G?	S1		
OENOTHERA FREMONTII	FREMONT EVENING-PRIMROSE	G?	S?		
OPHIOGLOSSACEAE					
BOTRYCHIUM DISSECTUM		G5			
BOTRYCHIUM CAMPESTRE	MOONWORT	G?	S1		
OPHIOGLOSSUM VULGATUM	ADDER'S-TONGUE	G5	S1		SSP
ORCHIDACEAE					
APLECTRUM HYEMALE	PUTTYROOT	G5	S?		SSP
CORALLORHIZA MACULATA		G5	S2		
CORALLORHIZA ODONTORHIZA	AUTUMN CORAL-ROOT	G5	S1		SSP
CORALLORHIZA STRIATA	STRIPED CORAL-ROOT	G5	S1		SSP
CORALLORHIZA WISTERIANA		G5	S1		
CYPRIPEDIUM CALCEOLUS	SMALL YELLOW LADY'S-SLIPPER	G5NE	S1		SSP
CYPRIPEDIUM CANDIDUM	SMALL WHITE LADY'S-SLIPPER	G3	S1	3C	SSP
GALEARIS SPECTABILIS	SHOWY ORCHID	G5	S2		
HABENARIA HYPERBOREA	NORTHERN GREEN ORCHID	G5	S2		
HABENARIA VIRIDIS VAR BRACTEATA	FROG ORCHID	G5	S1		
LIPARIS LOESELII	LOESEL'S TWAYBLADE	G5	S2		SSP
PLATANTHERA LEUCOPHAEA	PRAIRIE WHITE-FRINGED ORCHID	G2	SH	C2	SSP
PLATANTHERA PRAECLARA	WESTERN PRAIRIE FRINGED ORCHID	G2	S1	C2	SSP

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
SPIRANTHES LACERA		G5	S1		
SPIRANTHES LUCIDA	SHINING LADIES'-TRESSES	G5	S1		SSP
SPIRANTHES ROMANZOFFIANA		G5	S1		
TRIPHORA TRIANTHOPHORA	NODDING POGONIA	G4	S1		SSP
OROBANCHACEAE					
OROBANCHE UNIFLORA	NAKED BROOMRAPE	G5	S1		
PAPAVERACEAE					
CORYDALIS AUREA		G5	S2		
CORYDALIS CRYSTALLINA		G?			
CORYDALIS FLAVULA		G5	S1		
SANGUINARIA CANADENSIS	BLOODROOT	G5	S2		
PINACEAE					
PINUS FLEXILIS	LIMBER PINE	G5	S?		
PLANTAGINACEAE					
PLANTAGO ELONGATA		G4	S2		
PLATANACEAE					
PLATANUS OCCIDENTALIS	SYCAMORE	G5	S?		
POACEAE					
AGROPYRON SPICATUM	BLUE-BUNCH WHEATGRASS	G?	S2		
ALOPECURUS GENICULATUS		G5			
ARISTIDA PURPURASCENS		G5	S2		
BRACHYELYTRUM ERECTUM	BEARDED SHORT-HUSK	G5	S2		
BROMUS PORTERI	PORTER'S CHESS	G?	S1		
DICHANTHELIUM LATIFOLIUM		G5	S1		
ELYMUS CINEREUS		G?	S1		
ERAGROSTIS CAPILLARIS		G5?	S1		
ERAGROSTIS PILOSA VAR PERPLEXA		G?T?NE	S1		
ERAGROSTIS REPTANS		G5	S2		
FESTUCA PARADOXA	CLUSTER FESCUE	G5	S1		
GLYCERIA BOREALIS	SMALL FLOATING MANNA-GRASS	G5	SH		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
LEUCOPA KINGII	SPIKE-FESCUE	G5	S1		
MELICA NITENS	THREE-FLOWER MELIC GRASS	G5	S?		
MUHLENBERGIA FILIFORMIS		G5	S2		
MUHLENBERGIA GLOMERATA	MARSH MUHLY	G5	S?		
MUHLENBERGIA RICHARDSONIS		G4			
MUHLENBERGIA SOBOLIFERA	CLIFF MUHLY	G5	S2		
MUHLENBERGIA TENUIFLORA	SLENDER MUHLY	G5	S1		
ORYZOPSIS RACEMOSA	BLACK-FRUIT MOUNTAIN-RICEGRASS	G5	S1		
POA FENDLERIANA	A BLUEGRASS	G3G5	S2		
POA INTERIOR	INLAND BLUEGRASS	G5	S?		
POA NEVADENSIS VAR JUNCIFOLIA		G5T?			
POA SANDBERGII		G?			
SCOLOCHLOA FESTUCACEA		G5			
SPOROBOLUS TEXANUS	TEXAS DROPSEED	G5	S1		
ZIZANIA AQUATICA	INDIAN WILD RICE	G5	S2		
POLEMONIACEAE					
IPOMOPSIS CONGESTA	BALL-HEAD STANDING-CYPRESS	G5	S?		
IPOMOPSIS SPICATA		G3G5	S2		
LEPTODACTYLON CAESPITOSUM		G3G4			
LEPTODACTYLON PUNGENS	GRANITE PRICKLY-PHLOX	G5	S?		
MICROSTERIS GRACILIS		G5	S1		
NAVARRETIA INTERTEXTA VAR PROPINQUA		G?			
POLEMONIUM REPTANS		G5?			
POLYGALACEAE					
POLYGALA SENEGA	SENECA SNAKEROOT	G4G5	S?		
POLYGONACEAE					
ERIOGONUM GORDONII	A WILD-BUCKWHEAT	G?	S1		
ERIOGONUM PAUCIFLORUM VAR GNAPHALODES	A WILD-BUCKWHEAT	G5TU	S3		
ERIOGONUM PAUCIFLORUM VAR NEBRASKENSE	HYBRID	HYB	S1		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
PORTULACACEAE					
CLAYTONIA VIRGINICA	NARROW-LEAVED SPRING BEAUTY	G5	S1		
TALINUM CALYCINUM	LARGE-FLOWER FAME-FLOWER	G?	S3		
TALINUM RUGOSPERMUM		G3G4	S1	C2	
POTAMOGETONACEAE					
POTAMOGETON ALPINUS	NORTHERN PONDWEED	G5	S1		
POTAMOGETON FRIESII		G4	S3		
POTAMOGETON PRAELONGUS		G5	S2		
POTAMOGETON STRICTIFOLIUS		G5	S3		
PRIMULACEAE					
DODECATHEON MEADIA	SHOOTINGSTAR	G5	S1		
DODECATHEON PULCHELLUM SSP PAUCIFLORUM	DARK-THROAT SHOOTING-STAR	G?	S1		
GLAUX MARITIMA	SEA MILKWORT	G5	S1		
LYSIMACHIA HYBRIDA	LANCE-LEAF LOOSESTRIFE	G5	S3	3C	
RANUNCULACEAE					
ACTAEA ALBA		G5	S1		
ACTAEA RUBRA		G5	S2		
ANEMONE MULTIFIDA		G5	S1		
ANEMONE QUINQUEFOLIA		G5	S1		
CALTHA PALUSTRIS	MARSH MARIGOLD	G5	S1		
CLEMATIS FREMONTII	FREMONT'S VIRGIN'S-BOWER	G2G3	S1		SSP
CLEMATIS HIRSUTISSIMA	CLUSTERED LEATHER-FLOWER	G?	S1		
CLEMATIS PITCHERI	PITCHER LEATHER-FLOWER	G?	S1		
DELPHINIUM NUTTALLIANUM		G?	S2		
POTENTILLA ANSERINA	SILVERWEED	G5	S1		
POTENTILLA HIPPIANA		G?	S2		
POTENTILLA PLATTENSIS		G?	S1		
PRUNUS ANGUSTIFOLIA		G5	S2		
PRUNUS HORTULANA		G3G5	S1		
ROSA ACICULARIS SSP SAYI		G5TU	S1		
RUBUS ALLEGHENIENSIS		G5	S2		
RUBUS FLAGELLARIS		G5	S1		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
RUBUS OSTRYIFOLIUS	A BRAMBLE	G3G5	S1		
RUBUS PENSILVANICUS	PENNSYLVANIA BLACKBERRY	G5	S1		
RUBUS PUBESCENS	CATHERINETTES BERRY	G5?	SH		
SALICACEAE					
POPULUS ACUMINATA	HYBRID	GU	S2		SSP
POPULUS ANGUSTIFOLIA	NARROWLEAF COTTONWOOD	G5	S1?		
SALIX BEBBIANA		G5	S2		
SAXIFRAGACEAE					
HEUCHERA HIRSUTICAULIS		G?	S?		
LITHOPHRAGMA PARVIFLORUM		G3G5	S1		
SCHEUCHZERIACEAE					
TRIGLOCHIN PALUSTRE	MARSH ARROW-GRASS	G5	S2		
RANUNCULUS FASCICULARIS		G5	S1		
RANUNCULUS GLABERRIMUS		G5	S1		
RANUNCULUS GMELINII		G5	S1		
RANUNCULUS HISPIDUS	HISPID BUTTERCUP	G5	S1		
RANUNCULUS INAMOENUS	GRACEFUL BUTTERCUP	G?	S1		
RANUNCULUS MICRANTHUS	ROCK CROWFOOT	G5?	S1		
RANUNCULUS RECURVATUS		G5	S1		
RANUNCULUS RHOMBOIDEUS		G?	S2		
THALICTRUM VENULOSUM	VEINY MEADOWRUE	G4G5	S1		
ROSACEAE					
AGRIMONIA PUBESCENS		G5	S2		
AMELANCHIER ARBOREA	DOWNY SERVICEBERRY	G5	S3		
PHYSOCARPUS OPULIFOLIUS		G5	S3		
SCROPHULARIACEAE					
AGALINIS SKINNERIANA		G3G4	S1		
BESSEYA WYOMINGENSIS	WYOMING CORAL-DROPS	G?	S2		
DASISTOMA MACROPHYLLA		G?	S1		
GRATIOLA NEGLECTA		G5	S2		
LIMOSELLA AQUATICA	NORTHERN MUDWORT	G?	S1		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
MIMULUS ALATUS		G5	S2		
ORTHOCARPUS LUTEUS	YELLOW OWL'S-CLOVER	G?	S2		
PEDICULARIS CANADENSIS	EARLY WOOD LOUSEWORT	G5	S2		
PEDICULARIS LANCEOLATA	SWAMP LOUSEWORT	G5	S2		
PENSTEMON COBAEA	COBAEA BEARDTONGUE	G4	S2		
PENSTEMON DIGITALIS		G5	S1		
PENSTEMON HAYDENII	BLOWOUT PENSTEMON	G1	S1	LE	SEN
PENSTEMON TUBIFLORUS	TUBE PENSTEMON	G4	S2		
VERONICASTRUM VIRGINICUM	CULVER'S-ROOT	G5	S1		
SELAGINELLACEAE					
SELAGINELLA DENSA	DENSE SPIKE-MOSS	G5	S1		
SOLANACEAE					
PHYSALIS VISCOSA VAR CINERASCENS		G4G5TU			
SPARGANIACEAE					
SPARGANIUM CHLOROCARPUM	GREENFRUIT BUR-REED	G5	S?		
STAPHYLEACEAE					
STAPHYLEA TRIFOLIA	AMERICAN BLADDERNUT	G5	S3		
TYPHACEAE					
TYPHA DOMINGENSIS	SOUTHERN CATTAIL	G4G5	S3		
ULMACEAE					
ULMUS THOMASII	ROCK ELM	G5	S1		SSP
VIOLACEAE					
VIOLA LANCEOLATA		G5	S1		
VIOLA NEPHROPHYLLA	NORTHERN BOG VIOLET	G5	S2		
VIOLA PEDATA		G5	S1		

FAMILY/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
VITACEAE					
AMPELOPSIS CORDATA	PEPPERVINE	G5?	S2		
VITIS AESTIVALIS		G5	S1		
VITIS CINEREA	PIGEON GRAPE	G4G5	S2		

Appendix B. List of NENHP Animal Elements. Includes global ranks, state ranks, federal status, and state status. Ranking codes are given in the text. LE = federally endangered, LT = federally threatened, C1-C2 = federal candidate species, 3C = former federal candidate species, SEN = state endangered, STH = state threatened, SSP = state special concern species, SNC = state in need of conservation species.

ORDER/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
	MAMMALS				
CARNIVORA					
FELIS CONCOLOR	MOUNTAIN LION	G4	S1		
MUSTELA NIGRIPES	BLACK-FOOTED FERRET	G1	SH	LE	SEN
SPILOGALE PUTORIUS	SPOTTED SKUNK	G5	S3		SNC
VULPES VELOX	SWIFT FOX	G4	S2	C2	SEN
CHIROPTERA					
MYOTIS SEPTENTRIONALIS	NORTHERN MYOTIS	G5	S3		
MYOTIS THYSANODES PAHASAPENSIS	FRINGE-TAILED BAT	G5T2	S1		
MYOTIS VOLANS	LONG-LEGGED BAT	G5	S2		
NYCTICEIUS HUMERALIS	EVENING BAT	G5	S3		
PIPISTRELLUS SUBFLAVUS	EASTERN PIPISTRELLE	G5	S1		
PLECOTUS TOWNSENDII	TOWNSEND'S BIG-EARED BAT	G5	S1		
TADARIDA BRASILIENSIS	BRAZILIAN FREE-TAILED BAT	G4	SN		
INSECTIVORA					
SOREX MERRIAMI	MERRIAM'S SHREW	G5	S1		
RODENTIA					
GLAUCOMYS VOLANS	SOUTHERN FLYING SQUIRREL	G5	S1		STH
MICROTUS PENNSYLVANICUS FINITUS	MEADOW VOLE	G5T?	S1		
MICROTUS PINETORUM	WOODLAND VOLE	G5	S3		
NEOTOMA CINEREA	BUSHY-TAILED WOODRAT	G5	S3		
NEOTOMA FLORIDANA BAILEYI	BAILEY'S EASTERN WOODRAT	G5T?	S2		
PEROGNATHUS FASCIATUS	OLIVE-BACKED POCKET MOUSE	G5	S3		
PEROGNATHUS FLAVUS	SILKY POCKET MOUSE	G5	S4		
SPERMOPHILUS ELEGANS	WYOMING GROUND SQUIRREL	GU	SH		

ORDER/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
SYNAPTOMYS COOPERI RELICTUS	SOUTHERN BOG LEMMING	G5T?	S1	C2	
TAMIAS MINIMUS	LEAST CHIPMUNK	G5	S3		SSP
TAMIAS STRIATUS	EASTERN CHIPMUNK	G5	SH		SSP
THOMOMYS TALPOIDES CHEYENNENSIS	NORTHERN POCKET GOPHER	G5T?	S1		
THOMOMYS TALPOIDES PIERREICOLUS	NORTHERN POCKET GOPHER	G5T?	S2		
	BIRDS				
ANSERIFORMES					
AYTHYA VALISINERIA	CANVASBACK	G5	S3		
CYGNUS BUCCINATOR	TRUMPETER SWAN	G4	S2		
APODIFORMES					
AERONAUTES SAXATALIS	WHITE-THROATED SWIFT	G5	S4		
CAPRIMULGIFORMES					
CAPRIMULGUS CAROLINENSIS	CHUCK-WILL'S-WIDOW	G5	S1		
CAPRIMULGUS VOCIFERUS	WHIP-POOR-WILL	G5	S2		
PHALAENOPTILUS NUTTALLII	COMMON POORWILL	G5	S2		
CHARADRIIFORMES					
CHARADRIUS MELODUS	PIPING PLOVER	G2	S2	LT	STH
CHARADRIUS MONTANUS	MOUNTAIN PLOVER	G3	S1	C2	STH
CHLIDONIAS NIGER	BLACK TERN	G4	S3		
GALLINAGO GALLINAGO	COMMON SNIPE	G5	S2		
HIMANTOPUS MEXICANUS	BLACK-NECKED STILT	G5	S1		
NUMENIUS AMERICANUS	LONG-BILLED CURLEW	G5	S3	C2	
NUMENIUS BOREALIS	ESKIMO CURLEW	G1	S1	LE	SEN
STERNA ANTILLARUM ATHALASSOS	INTERIOR LEAST TERN	G4T2	S2	LE	SEN
STERNA FORSTERI	FORSTER'S TERN	G5	S3		SSP
CICONIIFORMES					
ARDEA HERODIAS	GREAT BLUE HERON	G5	S4		SSP
BOTAURUS LENTIGINOSUS	AMERICAN BITTERN	G4	S3		
IXOBRYCHUS EXILIS	LEAST BITTERN	G5	S2		
NYCTICORAX NYCTICORAX	BLACK-CROWNED NIGHT-HERON	G5	S2		

ORDER/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
PLEGADIS CHIHI	WHITE-FACED IBIS	G5	S1	C2	
FALCONIFORMES					
ACCIPITER COOPERII	COOPER'S HAWK	G4	S1		SSP
ACCIPITER STRIATUS	SHARP-SHINNED HAWK	G5	S1		SSP
AQUILA CHRYSAETOS	GOLDEN EAGLE	G4	S3		SSP
BUTEO LINEATUS	RED-SHOULDERED HAWK	G5	S1		SSP
BUTEO REGALIS	FERRUGINOUS HAWK	G4	S2	C2	SSP
BUTEO SWAINSONI	SWAINSON'S HAWK	G4	S3	C2	
CIRCUS CYANEUS	NORTHERN HARRIER	G5	S3		
ELANOIDES FORFICATUS	SWALLOW-TAILED KITE	G5	SX	C2	
FALCO COLUMBARIUS	MERLIN	G4	S1		SSP
FALCO PEREGRINUS	PEREGRINE FALCON	G3	S3	LE	SEN
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	G3	S1	LE	SEN
GALLIFORMES					
BONASA UMBELLUS	RUFFED GROUSE	G5	S1		
CENTROCERCUS UROPHASIANUS	SAGE GROUSE	G5	S1		
TYMPANUCHUS PALLIDICINCTUS	LESSER PRAIRIE CHICKEN	G3	SX		
GRUIFORMES					
GRUS AMERICANA	WHOOPING CRANE	G1	S1	LE	SEN
LATERALLUS JAMAICENSIS	BLACK RAIL	G5	S1		
RALLUS ELEGANS	KING RAIL	G4Q	S1		
PASSERIFORMES					
CALCARIUS MCCOWNII	MCCOWN'S LONGSPUR	G4?	S3		
CALCARIUS ORNATUS	CHESTNUT-COLLARED LONGSPUR	G5	S2		
CERTHIA AMERICANA	BROWN CREEPER	G5	S3		
CISTOTHORUS PLATENSIS	SEDGE WREN	G5	S2		
CONTOPUS SORDIDULUS	WESTERN WOOD-PEWEE	G5	S4		
DENDROICA CERULEA	CERULEAN WARBLER	G5	S2		
EMPIDONAX DIFFICILIS	WESTERN FLYCATCHER	G5	S1		
EUPHAGUS CYANOCEPHALUS	BREWER'S BLACKBIRD	G5	S4		
LOXIA CURVIROSTRA	RED CROSSBILL	G5	S4		
MELOSPIZA GEORGIANA	SWAMP SPARROW	G5	S3		

ORDER/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
MYADESTES TOWNSENDI	TOWNSEND'S SOLITAIRE	G5	S2		
OPORORNIS FORMOSUS	KENTUCKY WARBLER	G5	S3		
OREOSCOPTES MONTANUS	SAGE THRASHER	G5	S1		
PASSERCULUS SANDWICHENSIS	SAVANNAH SPARROW	G5	S3		
PASSERINA AMOENA	LAZULI BUNTING	G5	S4		
PIRANGA LUDOVICIANA	WESTERN TANAGER	G5	S4		
PIRANGA RUBRA	SUMMER TANAGER	G5	S4		
POLIOPTILA CAERULEA	BLUE-GRAY GNATCATCHER	G5	S3		
PROTONOTARIA CITREA	PROTHONOTARY WARBLER	G5	S2		
SEIURUS MOTACILLA	LOUISIANA WATERTHRUSH	G5	S1		
SITTA PYGMAEA	PYGMY NUTHATCH	G5	S3		
TACHYCINETA THALASSINA	VIOLET-GREEN SWALLOW	G5	S3		
THRYOTHORUS LUDOVICIANUS	CAROLINA WREN	G5	S2		
VIREO BELLII	BELL'S VIREO	G5	S4		
VIREO FLAVIFRONS	YELLOW-THROATED VIREO	G5	S2		
VIREO GRISEUS	WHITE-EYED VIREO	G5	S2		
VIREO SOLITARIUS	SOLITARY VIREO	G5	S2		
PICIFORMES					
DRYOCOPUS PILEATUS	PILEATED WOODPECKER	G5	S1		
MELANERPES LEWIS	LEWIS' WOODPECKER	G4	S2		
PODICIPEDIFORMES					
AECHMOPHORUS OCCIDENTALIS	WESTERN GREBE	G5	S3		SSP
PODICEPS NIGRICOLLIS	EARED GREBE	G5	S4		
STRIGIFORMES					
ASIO FLAMMEUS	SHORT-EARED OWL	G5	S2		
STRIX VARIA	BARRED OWL	G5	S2		SSP
	AMPHIBIANS				
CAUDATA					
AMBYSTOMA TEXANUM	SMALLMOUTH SALAMANDER	G5	S1		

ORDER/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
SALIENTIA					
BUFO AMERICANUS	AMERICAN TOAD	G5	S1		
GASTROPHRYNE OLIVACEA	GREAT PLAINS NARROWMOUTH TOAD	G5	S2		
	REPTILES				
SQUAMATA					
AGKISTRODON CONTORTRIX	COPPERHEAD	G5	S1		
ARIZONA ELEGANS	GLOSSY SNAKE	G5	S2		
CARPHOPHIS AMOENUS	WORM SNAKE	G5	S2		
CROTALUS HORRIDUS	TIMBER RATTLESNAKE	G5	S1		
EUMECES FASCIATUS	FIVE-LINED SKINK	G5	S1		
LAMPROPELTIS CALLIGASTER	PRAIRIE KINGSNAKE	G5	S3		
LAMPROPELTIS GETULUS	COMMON KINGSNAKE	G5	S2		
MASTICOPHIS FLAGELLUM	COACHWHIP	G5	S3		
OPHEODRYS VERNALIS	SMOOTH GREEN SNAKE	G5	S1		
OPHISAURUS ATTENUATUS	SLENDER GLASS LIZARD	G5	S1		
PHRYNOSOMA DOUGLASSII	SHORT-HORNED LIZARD	G5	S3		SNC
REGINA GRAHAMII	GRAHAM'S CRAYFISH SNAKE	G5	S2		
SCELOPORUS GRACIOSUS	SAGEBRUSH LIZARD	G5	S1		
SISTRURUS CATENATUS	MASSASAUGA	G3G4	S1		
STORERIA OCCIPITOMACULATA	REDBELLY SNAKE	G5	S1		
TANTILLA NIGRICEPS	PLAINS BLACKHEAD SNAKE	G5	S1		
THAMNOPHIS PROXIMUS	WESTERN RIBBON SNAKE	G5	S2		
TESTUDINES					
KINOSTERNON FLAVESCENS	YELLOW MUD TURTLE	G5	S3	C2	
	FISH				
ACIPENSERIFORMES					
ACIPENSER FULVESCENS	LAKE STURGEON	G3	S1	C2	STH
POLYODON SPATHULA	PADDLEFISH	G4	S2	3C	
SCAPHIRHYNCHUS ALBUS	PALLID STURGEON	G1	S1	C2	STH

ORDER/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
ATHERINIFORMES					
FUNDULUS SCIADICUS	PLAINS TOPMINNOW	G4	S3/S4		
CYPRINIFORMES					
CARPIODES VELIFER	HIGHFIN CARPSUCKER	G5	SH		
CATOSTOMUS PLATYRHYNCHUS	MOUNTAIN SUCKER	G5	S1		
COUESIUS PLUMBEUS	LAKE CHUB	G5	S1		
CYCLEPTUS ELONGATUS	BLUE SUCKER	G4	S3	C2	
HYBOPSIS GELIDA	STURGEON CHUB	G3	S1	C2	SSP
HYBOPSIS MEEKI	SICKLEFIN CHUB	G4	S2	C2	SSP
ICTIOBUS NIGER	BLACK BUFFALO	G5	S2/S3		
NOCOMIS BIGUTTATUS	HORNYHEAD CHUB	G5	SH		
NOTROPIS CORNUTUS	COMMON SHINER	G5	S2		
NOTROPIS HETEROLEPIS	BLACKNOSE SHINER	G5	S1		STH
NOTROPIS SHUMARDI	SILVERBAND SHINER	G5	SU		
NOTROPIS TOPEKA	TOPEKA SHINER	G4	S1		
PHOXINUS EOS	NORTHERN REDBELLY DACE	G5	S3		STH
PHOXINUS NEOGAEUS	FINESCALE DACE	G5	S2		STH
PIMEPHALES NOTATUS	BLUNTNOSE MINNOW	G5	S3		SSP
RHINICHTHYS ATRATULUS	BLACKNOSE DACE	G5	S2		SSP
SEMOTILUS MARGARITA	PEARL DACE	G5	S3		STH
GASTEROSTEIFORMES					
CULAEA INCONSTANS	BROOK STICKLEBACK	G5	S3		STH
PERCIFORMES					
ETHEOSTOMA EXILE	IOWA DARTER	G5	S4		
ETHEOSTOMA NIGRUM	JOHHNY DARTER	G5	S3		SSP
ETHEOSTOMA SPECTABILE	ORANGETHROAT DARTER	G5	S3		
PERCINA MACULATA	BLACKSIDE DARTER	G5	SH		
PERCOPSIFORMES					
PERCOPSIS OMISCOMAYCUS	TROUT-PERCH	G5	S1		

ORDER/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
PETROMYZONTIFORMES					
ICHTHYOMYZON CASTANEUS	CHESTNUT LAMPREY	G5	S1		
ICHTHYOMYZON UNICUSPIS	SILVER LAMPREY	G5	S1		
	INSECTS				
COLEOPTERA					
AMBLYCHILA CYLINDRIFORMIS	A TIGER BEETLE	G?	S2		
CICINDELA NEBRASKANA	A TIGER BEETLE	G?	S1		
CICINDELA NEVADICA LINCOLNIANA	A TIGER BEETLE	G?	S1		
CICINDELA PULCHRA	A TIGER BEETLE		S1		
CICINDELA TOGATA	A TIGER BEETLE		S1		
NICROPHORUS AMERICANUS	AMERICAN BURYING BEETLE	G1	S1	C2	
XYLORYCTES JAMAICENSIS	UNICORN BEETLE				
HEMIPTERA					
AMBRYSUS MORMON	CREEPING WATER BUG	G?	S2		
LEPIDOPTERA					
BOLORIA BELLONA	MEADOW FRITILLARY	G5	SH		
CERCYONIS MEADII	RED-EYED WOOD NYMPH	G5	S1/S2		
CERCYONIS OETUS	DARK WOOD NYMPH	G5	S1		
CHLOSYNE ACASTUS	PEARLY CHECKERSPOT	G?	S1		
EUPHILOTES ENOPTES	DOTTED BLUE	G5	S1		
EUPHILOTES RITA	DESERT BUCKWHEAT BLUE	G4	S1		
EUPHYES CONSPICUUS BUCHOLZI	BLACK DASH				S1
EUPHYES DION	DION SKIPPER	G4	S2		
HESPERIA OTTOE	OTTOE SKIPPER	G3?	S3		
HESPERIA VIRIDUS	GREEN SKIPPER	G?	S1		
ICARICIA SHASTA	SHASTA BLUE	G5	S2		
MEGATHYMUS COLORADENSIS	YUCCA SKIPPER	G?	S1		
PAPILIO INDRA	SHORT-TAILED BLACK SWALLOWTAIL	G5	S2		
PARNASSIUS PHOEBUS	PHOEBUS PARNASSIAN	G5	S1		
PHYCOIDES BATESII	TAWNY CRESCENT	G4	S2		
POANES VIATOR VIATOR	BROAD-WINGED SKIPPER	G5T4	S2		
POLADRYAS ARACHNE	BEARDTONGUE CHECKERSPOT	G5	S1/S2		

ORDER/ SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	NE STATUS
PYRGUS SCRIPTURA	SMALL CHECKERED SKIPPER	G?	SH		
SATYRIUM EDWARDSII	EDWARDS HAIRSTREAK	G4	SH		
SPEYERIA IDALIA	REGAL FRITILLARY	G3	S3	C2	
SPEYERIA MORMONIA	MORMON FRITILLARY				
	MUSSELS				
BIVALVIA					
ANODONTA SUBORBICULATA	FLAT FLOATER	G4	S1		
CUMBERLANDIA MONODONTA	SPECTACLE CASE	G2G3	S1	C2	
LAMPSILIS HIGGINSI	HIGGINS EYE	G1	S1	LE	
LEPTODEA LEPTODON	SCALESHELL	G1G2	S1		
LIGUMIA SUBROSTRATA	PONDMUSSEL	G2G3	S1		
POTAMILUS CAPAX	FAT POCKETBOOK	G1	S1		

Appendix C. Mussels Expected in Nebraska. Based on notes from Dr. Guggler's files (UNL), specimens catalogued in the OSUM Bivalve Collection, the NENHP element records, and Hoke (1983).

Scientific Name	Common Name
Actinonaias ligamentina	Mucket
Alasmidonta viridus	Slipershell
Ameblema plicata	Three Ridge
Anodonta grandis	Giant floater
Anodonta imbecillis	Paper pondshell
Anodonta suborbiculata	Flat floater
Anodontoides ferussacianus	Cylindrical papershell
Arcidens confragosus	Rock-pocketbook
Cumberlandia monodonta	Spectaclecase
Cyclonaias tuberculata	Purple wartyback
Cyprogenia aberti	Western fanshell
Ellipsaria lineolata	Butterfly
Elliptio crassidens	Elephant-ear
Epioblasma triquetra	Snuffbox
Fusconaia ebena	Ebonyshell
Fusconaia flava	Wabash pigtoe
Lampsilis cardium	Plain pocketbook
Lampsilis higginsi	Higgins eye
Lampsilis ovata	Pocketbook
Lampsilis radiata	Easter lampmussel
Lampsilis teres	Yellow sandshell
Lasmigona complanata	White heelsplitter
Lasmigona compressa	Creek heelsplitter
Lasmigona costata	Fluted-shell
Leptodea fragilis	Fragile papershell
Leptodea leptodon	Scaleshell
Ligumia nasuta	Eastern pondmussel
Ligumia recta	Black sandshell
Ligumia subrostrata	Pondmussel
Margaritifera margaritifera	Eastern pearlshell
Megalonaias nervosa	Washboard
Obliquaria reflexa	Threehorn wartyback
Obovaria olivaria	Hickorynut
Plethobasus cyphyus	Sheepnose
Pleurobema clava	Clubshell
Pleurobema cordatum	Ohio pigtoe
Potamilus alatus	Pink heelsplitter
Potamilus capax	Fat pocketbook
Potamilus ohiensis	Pink papershell
Potamilus purpuratus	Bleufer
Ptychobranchus fasciolaris	Kidneyshell
Quadrula cylindriea	Rabbitsfoot
Quadrula metanevra	Monkeyface
Quadrula nodulata	Wartyback
Quadrula pustulosa	Pimpleback

Scientific Name	Common Name
Strophitus undulatus	Squawfoot
Toxolasma parvus	Lilliput
Tritogonia verrucosa	Pistolgrip
Truncilla donaciformis	Fawnsfoot
Truncilla truncata	Deertoe
Uniomerus tetralasmus	Pondhorn
Venustaconcha ellipsiformis	Ellipse

Appendix D. Characterization of the Natural Communities of Nebraska. Explanations of element codes are given in the Nebraska Operations Manual. Regional Crosswalk Classes were developed by the Midwest Regional Office, The Nature Conservancy to group similar community classes used by natural heritage programs in ten Midwest states. Global and State ranks are explained in the text of this document. Minimum size is the minimum size of a stand necessary to qualify it as a natural community occurrence.

TERRESTRIAL SYSTEM

The Terrestrial System includes community types that are often termed "upland". A community type is placed in the Terrestrial System if it has all of the following characteristics: (1) vegetative cover that is never (not even periodically) predominately hydrophytic, (2) soil that is not predominately hydric, and (3) a surface that is not flooded or saturated at any time during the year (Chapman 1988). Not all well-drained habitats are in the Terrestrial System: deep underground community types are in the Subterranean System, and upland communities created and maintained by human activities are in the Cultural System. The Terrestrial System extends laterally to the edge of wetland, deepwater, and cultural habitats. It extends downward to the lower limit of normal soil horizons and surface biological activity, including the maximum depth of plant roots and burrowing, or surface animals (Chapman 1988).

GRASSLANDS

Grasslands are dominated by herbaceous species (mainly grasses) which have 30-100 % cover; trees and shrubs together have <30 % cover, and trees by themselves have <5 % cover. (Chapman 1988).

TALLGRASS PRAIRIE

Element Code: ETG000TG00
Regional Crosswalk Class: TALLGRASS PRAIRIE, GLACIATED LOWER MIDWEST TYPE; TALLGRASS PRAIRIE, GLACIATED NORTHERN GREAT PLAINS TYPE
Rank: G2G3/S2
Overview: This community type occurs on uplands ranging from gently sloping bottomlands to steep slopes throughout the Eastern Lowlands Region. It also occurs westward in suitable lowland habitats such as stream and river valleys.
Soils: The mainly silty and loamy soils are shallow to deep, moderately well drained to well drained and formed in a variety

of parent materials including loess, glacial till, alluvium, colluvium, and weathered rock.
Vegetation: Dominants are mid and tall grasses. Forbs and shrubs are abundant. Species diversity is very high.
Dominant Plants: Big bluestem (Andropogon gerardii), little bluestem (A. scoparius), Indian grass (Sorghastrum nutans), porcupine grass (Stipa spartea), prairie dropseed (Sporobolus heterolepis), and sideoats grama (Bouteloua curtipendula).
Characteristic Plants: Switchgrass (Panicum virgatum), lead plant (Amorpha canescens), compass plant (Silphium laciniatum), cup plant (S. perfoliatum), New Jersey tea (Ceanothus herbaceous var. pubescens), purple coneflower (Echinacea angustifolia), purple prairie clover (Dalea purpurea), white prairie clover (D. candida), flowering spurge (Euphorbia corolatta), stiff goldenrod (Solidago rigida), bush clover (Lespedeza capitata), pitcher's sage (Salvia pitcheri), silver-leaf scurf pea (Psoralea argophylla), white wild indigo (Baptisia lactea), and stiff sunflower (Helianthus rigidus).
Natural Processes: Fires were frequent and prevented shrub and tree invasion.
Similar Communities: WET-MESIC PRAIRIE, NORTHERN MIXEDGRASS PRAIRIE, LOESS MIXEDGRASS PRAIRIE
Minimum Size: 5 ac

WET-MESIC PRAIRIE

Element Code: ETG000WM00
Regional Crosswalk Class: TALLGRASS PRAIRIE, GLACIATED LOWER MIDWEST TYPE; TALLGRASS PRAIRIE, GLACIATED NORTHERN GREAT PLAINS TYPE
Rank: G2G3/S2
Overview: This community type occurs near headwaters of streams, on depressions of terraces, and on floodplains of larger streams and rivers mainly within the Eastern Lowland Region, but it also occurs westward on suitable habitat.
Soils: The deep sandy loam soils are somewhat poorly drained and formed in alluvium, glacial till, and loess.
Vegetation: Tall grasses are dominant. Low growing forbs are abundant. The community is a mixture of Tallgrass Prairie and Wet Prairie species. Species diversity is moderately high.
Dominant Plants: Big bluestem (Andropogon gerardii) is the most ubiquitous dominant. Other dominants include prairie cordgrass (Spartina pectinata), switchgrass (Panicum virgatum), and Indian grass (Sorghastrum nutans).
Characteristic Plants: Canada wildrye (Elymus canadensis), prairie phlox (Phlox pilosa), blazing stars (Liatris pycnostachya and L. lancifolia), Canada goldenrod (Solidago canadensis), purple meadow rue (Thalictrum dasycarpum), rosinweed (Silphium integrifolium), golden alexander (Zizia aurea), sawtoothed sunflower (Helianthus grosseserratus), horsetails (Equisetum spp.), prairie violet (Viola pedatifida), slender wheatgrass

(Agropyron caninum subsp. majus), and porcupine grass (Stipa spartea).
Natural Processes: This community type is intermediate between a terrestrial and palustrine system, the water table is often near the surface with occasional standing water in winter or spring and after heavy rains. Fires were frequent.
Similar Communities: TALLGRASS PRAIRIE, SANDHILLS WET-MESIC PRAIRIE, WET PRAIRIE
Minimum Size: 5 ac

SANDHILLS WET-MESIC PRAIRIE

Element Code: ETG000SW00
Regional Crosswalk Class: MOIST PRAIRIE, UNGLACIATED NORTHERN GREAT PLAINS TYPE
Rank: G3?/S3
Overview: This community type occurs in interdunal sandhill valleys, on terraces and floodplains of streams and rivers, and on flats where drainage systems are poorly developed within the Sandhills Region. It is most abundant in the broad valleys of the Northern Sandhills, along the Elkhorn River in Antelope and Holt counties in the eastern Sandhills, and in Box Butte and Grant counties in the western Sandhills.
Soils: The silty loam to sandy soils contain considerable humus, are somewhat poorly drained and formed in eolian sand and alluvium.
Vegetation: Tall grasses dominate, although shrubs may be abundant in areas and occasionally form a chaparral type vegetation. This community type contains a mixture of Tallgrass Prairie, Wet Prairie, and Sandhills Prairie species. Species diversity is moderate.
Dominant Plants: Big bluestem (Andropogon gerardii), little bluestem (A. scoparius), prairie cordgrass (Spartina pectinata), switchgrass (Panicum virgatum), Indian grass (Sorghastrum nutans), western wheatgrass (Agropyron smithii), and sandbar willow (Salix exigua).
Characteristic Plants: Reedgrass (Calamagrostis stricta), field mint (Mentha arvensis), fringed loosestrife (Lysimachia ciliata), tufted loosestrife (L. thyrsifolia), grooved flax (Linum sulcatum), lead plant (Amorpha canescens), and prairie coneflower (Ratibida columnifera).
Natural Processes: This community type is intermediate between a terrestrial and a palustrine system, the water table is near the surface (0.3 to 2 M) and there may be occasional standing water in winter or spring or after heavy rains. Fires were frequent.
Similar Communities: WET-MESIC PRAIRIE, WET PRAIRIE, WET MEADOW
Minimum Size: 5 ac

NORTHERN MIXEDGRASS PRAIRIE

Element Code: ETG000NM00
Regional Crosswalk Class: MIXEDGRASS PRAIRIE, NORTHERN GREAT PLAINS TYPE
Rank: G4/S4
Overview: This community type occurs over an extensive area in the north-central portion of the Sandhills Region and extends eastward into the northern portion of the Central Lowlands Region on clay soils. The type occupies a variety of sites including nearly level sand plains and gently undulating sandhills near the Niobrara River, stream terraces and upland slopes, and sandstone and shale tablelands north of the Niobrara River.
Soils: The clay to sandy loam soils are shallow to deep, poorly drained to well drained, and derived from a variety of parent materials including sandstone, shale, siltstone, loess, colluvium, alluvium, and eolian sand.
Vegetation: Mid grasses dominate. There is no real layered structure to the vegetation as may occur in other mixedgrass types. Forbs are fairly abundant. The characteristic species are a mixture of Sandhills Prairie and Tallgrass Prairie species. Species diversity is moderately high.
Dominant Plants: Needle and thread (Stipa comata), porcupine grass (S. spartea), purple three-awn (Aristida purpurea var. purpurea), forked tipped three-awn (A. basiramea), little bluestem (Andropogon scoparius), and plains muhly (Muhlenbergia cuspidata).
Characteristic Plants: Sideoats grama (Bouteloua curtipendula), blue grama (B. gracilis), hairy grama (B. hirsuta), prairie sandreed (Calamovilfa longifolia), western wheatgrass (Agropyron smithii), buffalo grass (Buchloe dactyloides), Junegrass (Koeleria pyramidata), big bluestem (Andropogon gerardii), New Jersey tea (Ceanothus americanus and C. herbaceous var. pubescens), soapweed (Yucca glauca), lead plant (Amorpha canescens), prairie wild rose (Rosa arkansana), sand cherry (Prunus besseyi), plains sunflower (Helianthus petiolaris), fourpoint evening rose (Oenothera rhombipetela), and western sagewort (Artemisia campestris).
Natural Processes: Fires were common. Bison grazing may have had a significant influence on community composition and structure.
Similar Communities: TALLGRASS PRAIRIE, SANDHILLS PRAIRIE, LOESS MIXEDGRASS PRAIRIE, NORTHWESTERN MIXEDGRASS PRAIRIE, SHORTGRASS PRAIRIE
Minimum Size: 5 ac

NORTHWESTERN MIXEDGRASS PRAIRIE

Element Code: ETG000NW00
Regional Crosswalk Class: MIXEDGRASS PRAIRIE, NORTHERN GREAT PLAINS TYPE
Rank: G4/S3

Overview: This community type occupies the rolling hills and broad swale-like drainage ways of the Pierre Hills in the northwestern corner of the Foothills Region, but it may also occur in other portions of the Foothills Region where shale outcrops are near the surface.
Soils: The clayey soils range from shallow to deep (shale bedrock at 4 to 40 inches), are well drained to excessively well drained and formed in shale of the Chadron and Pierre Formations.
Vegetation: Short and mid grasses dominate. Forbs are common. Species diversity is moderate.
Dominant Plants: Needle and thread (Stipa comata), western wheatgrass (Agropyron smithii), threadleaf sedge (Carex filifolia), blue grama (Bouteloua gracilis), and buffalo grass (Buchloe dactyloides).
Characteristic Plants: Green needlegrass (Stipa viridula), sideoats grama (Bouteloua curtipendula), hairy grama (B. hirsuta), woolly locoweed (Astragalus adsurgens), standing milkvetch (A. adsurgens var. robustior), platte lupine (Lupinus plattensis), purple locoweed (Oxytropis lambertii), silver-leaf scurf pea (Psoralea argophylla), wild alfalfa (P. tenuiflora), prairie turnip (P. esculenta), western wallflower (Erysimum asperum), white beardtonque (Penstemon albidus), cinquefoil (Potentilla hippiana), prairie buck bean (Thermopsis rhombifolia), and groundsel (Senecio douglasii var. longilobus).
Natural Processes: Fires were common. Bison grazing may have had a significant influence on species composition and structure.
Similar Communities: SHORTGRASS PRAIRIE, NORTHERN MIXEDGRASS PRAIRIE
Minimum Size: 5 ac

LOESS MIXEDGRASS PRAIRIE

Element Code: ETG000LM00
Regional Crosswalk Class: MIXEDGRASS PRAIRIE, SOUTHERN GREAT PLAINS TYPE
Rank: G4/S3
Overview: This community type occurs on level to steep upland sites over extensive areas of the Loess Hills and Plains Region.
Soils: The silty soils are deep, moderately well drained to well drained and formed in loess.
Vegetation: Hilltops and upper slopes are dominated by short grasses. Mid slopes are dominated by a layered mixture of mid and short grasses. Lower slopes and terraces, bottoms, and east- and north-facing slopes are dominated by mid and tall grasses. The vegetation is a mixture of Shortgrass Prairie and Tallgrass Prairie species. Species diversity is moderately high.
Dominant Plants: Big bluestem (Andropogon gerardii), little bluestem (A. scoparius), sideoats grama (Bouteloua curtipendula), blue grama (B. gracilis).
Characteristic Plants: Junegrass (Koeleria pyramidata), tall dropseed (Sporobolus asper), plains muhly (Muhlenbergia

cuspidata), western wheatgrass (Agropyron smithii), purple three-awn (Aristida purpurea var. purpurea), buffalo grass (Buchloe dactyloides), scarlet mallow (Sphaeralcea coccinea), skeleton weed (Lygodesmia juncea), prairie coneflower (Ratibida columnifera), lead plant (Amorpha canescens), soapweed (Yucca glauca), locoweed (Oxytropis lambertii), evening primrose (Calylophus serrulata), snake root (Liatris punctata), purple coneflower (Echinacea angustifolia), and purple poppy mallow (Callirhoe digitatea).
Natural Processes: Fires were common. Bison grazing may have had a significant influence on community composition and structure.
Similar Communities: TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, NORTHERN MIXEDGRASS PRAIRIE, SANDHILLS PRAIRIE
Minimum Size: 5 ac

SANDHILLS PRAIRIE

Element Code: ETG000SH00
Regional Crosswalk Class: DRY SAND PRAIRIE, GLACIATED NORTHERN GREAT PLAINS TYPE
Rank: G3?/S5
Overview: This community type occupies extensive areas within the Sandhills Region but also occurs on sand deposits outside the sandhills. It occurs on gently undulating to steep, irregular sandhills composed of eolian sand, within interdunal dry sand valleys (where the water table is at a depth greater than 1 m), and along flats bordering rivers.
Soils: The loamy fine sand to sand soils are somewhat excessively drained to excessively well drained and formed in eolian sand.
Vegetation: Mid and tall grasses dominate. Prior to settlement the vegetation was heavily dominated by the bunchgrass little bluestem (Andropogon scoparius). Since settlement sod-forming grasses have become more prominent due to changes in land management. The vegetation is composed of a mixture of Tallgrass Prairie, Shortgrass Prairie, and Mixedgrass Prairie species. Species diversity is moderate.
Dominant Plants: Little bluestem (A. scoparius), sand bluestem (A. hallii), prairie sandreed (Calamovilfa longifolia), and needle and thread (Stipa comata).
Characteristic Plants: Switchgrass (Panicum virgatum), Junegrass (Koeleria pyramidata), blue grama (Bouteloua gracilis), hairy grama (B. hirsuta), dropseeds (Sporobolus asper and S. cryptanthus), sand lovegrass (Eragrostis trichodes), sand muhly (Muhlenbergia pungens), umbrella sedge (Cyperus schweinitzii), sand cherry (Prunus pumila var. besseyi), soapweed (Yucca glauca), lemon scurf pea (Psoralea lanceolata), annual eriogonum (Eriogonum annuum), golden aster (Chrysopsis villosa), green milkweed (Asclepias viridiflora), hymenopappus (Hymenpappus filifolius), spiderwort (Tradescantia occidentalis), silky prairie clover (Dalea villosa), New Jersey tea (Ceanothus herbaceous var. pubescens), and lead plant (Amorpha canescens).

Seral Communities: Blowouts are a seral phase of the Sandhills Prairie community type. They consist of rounded or irregular conical depressions of varying depth and diameter formed by wind removing sand and vegetation from the upper slopes and crests of sand hills and ridges. Sand removal may continue for several years. Once it ceases, a grass-dominated, multi-seral community occupies the blowout. Often the first plant to invade blowouts is blowout grass (Redfieldia flexuosa). Other common invaders include , prairie sandreed (Calamovilfa longifolia) and sand bluestem (Andropogon hallii). Blowouts eventually succeed to Sandhills Prairie.
Natural Processes: Blowouts were once widespread. Fires were common. Bison grazing may have had a significant influence on community composition and structure.
Similar Communities: NORTHERN MIXEDGRASS PRAIRIE, LOESS MIXEDGRASS PRAIRIE, SHORTGRASS PRAIRIE, SANDSAGE PRAIRIE
Minimum Size: 10 ac

SANDSAGE PRAIRIE

Element Code: ETG000SA00
Regional Crosswalk Class: DRY SAND PRAIRIE, SOUTHERN GREAT PLAINS TYPE
Rank: GU/S2
Overview: This community type occurs primarily on low undulating sandhills in Chase, Dundy, Hayes, Lincoln, and Perkins counties in the southwestern portion of the Sandhills Region. It also occurs on the level mesa between the North Platte River lowlands and the tablelands in Cheyenne, Deuel, and Scottsbluff counties within the Foothills Region.
Soils: The loamy fine sand to sand soils are somewhat excessively drained to excessively drained and formed in eolian sand.
Vegetation: This community has an evenly spaced shrub layer (up to 1 m tall) with mid and tall grasses dominating the spaces between shrubs. The majority of the species in the type are characteristic of Sandhills Prairie. Species diversity is moderate.
Dominant Plants: Sand sagebrush (Artemisia filifolia), little bluestem (Andropogon scoparius), sand bluestem (A. hallii), and prairie sandreed (Calamovilfa longifolia).
Characteristic Plants: Pasture sagebrush (Artemisia frigida), needle and thread (Stipa comata), blue grama (Bouteloua gracilis), sideoats grama (B. curtipendula), lemon scurf-pea (Psoralea lanceolata), golden aster (Chrysopsis villosa), plains sunflower (Helianthus petiolaris), hoary vetchling (Lathyrus polymorphus), and the sedge (Carex eleocharis).
Natural Processes: Fires were common. Bison grazing may have had a significant influence on species composition and structure.
Similar Communities: SANDHILLS PRAIRIE
Minimum Size: 10 ac

SHORTGRASS PRAIRIE

Element Code: ETG000SG00
Regional Crosswalk Class: SHORTGRASS PRAIRIE, SOUTHERN GREAT PLAINS TYPE; SHORTGRASS PRAIRIE, NORTHERN GREAT PLAINS TYPE
Rank: GU/S3
Overview: This community type occupies a variety of sites including plains, rolling hills, ridges, and tablelands within the Foothills Region, but it also extends eastward in suitable xeric habitats.
Soils: The clayey to sandy soils range from shallow to deep, are moderately well to excessively drained, and are derived from a variety of parent materials including sandstone, siltstone, shale, limestone, loess, and alluvium.
Vegetation: Short grasses dominate along with lesser amounts of mid grasses. The extensive dominance of short grasses may be the result of overgrazing by cattle. Forbs are not abundant. Species diversity is low to moderate.
Dominant Plants: Blue grama (Bouteloua gracilis), buffalo grass (Buchloe dactyloides), western wheatgrass (Agropyron smithii), and needle and thread (Stipa comata).
Characteristic Plants: Sideoats grama (B. curtipendula), threadleaf sedge (Carex filifolia), Junegrass (Koeleria pyramidata), sand dropseed (Sporobolus cryptandrus), little bluestem (Andropogon scoparius), peppergrass (Lepidium densiflorum), Patagonian plantain (Plantago patagonica), wild begonia (Rumex venosus), cactus (Opuntia spp.), purple locoweed (Astragalus lambertii), red false mallow (Sphaeralcea coccinea), western wallflower (Erysimum asperum), curly-top gumweed (Grindelia squarrosa), snakeweed (Gutierrezia sarothrae), platte lupine (Lupinus plattensis), silver-leaf scurf pea (Psoralea argophylla), erigeron (Erigeron pumilus), cutleaf ironplant (Haplopappus spinulosus), and false boneset (Kuhnia eupatoriodes).
Natural Processes: Fires were occasional. Bison grazing may have had a significant influence on community composition and structure.
Similar Communities: NORTHWESTERN MIXEDGRASS PRAIRIE, LOESS MIXEDGRASS PRAIRIE, NORTHERN MIXEDGRASS PRAIRIE
Minimum Size: 10 ac

EASTERN SALINE PRAIRIE

Element Code: ETG000ES00
Regional Crosswalk Class: SALINE MOIST MEADOW, NORTHERN GREAT PLAINS TYPE; SALINE MOIST MEADOW, SOUTHERN GREAT PLAINS TYPE; and possibly SALINE WET MEADOW NORTHERN GREAT PLAINS TYPE; SALINE WET MEADOW SOUTHERN GREAT PLAINS TYPE
Rank: G3?/S2
Overview: This community type occurs on nearly level bottomlands and upland depressions where soils have a moderate to very strong

saline character within the Eastern Lowlands Region and Loess Hills and Plains Region.
Soils: The loamy soils are somewhat poorly drained to poorly drained and derived from alluvium, glacial till, or loess.
Vegetation: Salt tolerant mid and short grasses dominate. Species diversity is low.
Dominant Plants: Inland saltgrass (Distichlis stricta), plains bluegrass (Poa arida), slender wheatgrass (Agropyron caninum), and switchgrass (Panicum virgatum).
Characteristic Plants: Common sunflower (Helianthus annuus), kochia (Kochia scoparia), foxtail barley (Hordeum jubatum), marsh elder (Iva annua), and common ragweed (Ambrosia artemisiifolia).
Natural Processes: Fires were common. Bottomland sites have a seasonally high water table (spring) that usually fluctuates from near the surface to 6 to 8 feet below the surface. Lower portions of the community are occasionally flooded for short periods.
Similar Communities: WESTERN SALINE/ALKALINE PRAIRIE. This community is sometimes associated with EASTERN SALINE MARSHES, the marsh occupies the lower more saline portions of basins with the prairie on higher less saline portions of the basin.
Minimum Size: 5 ac

WESTERN SALINE-ALKALINE PRAIRIE

Element Code: ETG000WS00
Regional Crosswalk Class: ALKALINE HARDPAN MIXEDGRASS PRAIRIE, NORTHERN GREAT PLAINS TYPE
Rank: G3?/S3
Overview: This community type occurs on nearly level bottomlands, nearly level to very gently sloping stream terraces, foot slopes, within wind-formed shallow depressions, and on uplands (overlying shale of the Chadron Formation) in the Foothill Region where the soil is moderately to very strongly saline-alkaline. In the Sandhill Region it occurs on bottomlands in interdunal valleys where the soil is moderately to strongly saline/alkaline. This community is most abundant along the North Platte River Valley and in the 'closed basin area' of the western Sandhills Region.
Soils: The silty clay to sand soils are deep, moderately well drained to poorly drained and formed in loess, eolian sand and alluvium. They are moderately to very strongly saline-alkaline. Upland sites formed in loess have silty loam topsoil and a impermeable or slowly permeable subsoil layer, and are seasonally wet becoming dry in summer and autumn. Upland sites overlying the Chadron Formation have shallow, moderately well drained, silty clay or clay soils formed in shale. Sites within the sandhill valleys have loamy sand and sand soils which are poorly drained to moderately well drained and formed in eolian sand.
Vegetation: The vegetation consists of salt tolerant species. Short and mid grasses dominate. Sedges, forbs and shrubs are also prominent. Species diversity is low.
Dominant Plants: Alkali sacaton (Sporobolus airoides), inland

saltgrass (Distichlis stricta), and western wheatgrass (Agropyron smithii).
Characteristic Plants: Blue grama (Bouteloua gracilis), buffalo grass (Buchloe dactyloides), foxtail barley (Hordeum jubatum), prairie sandreed (Calamovilfa longifolia), switchgrass (Panicum virgatum), saltbush (Atriplex spp.), sea blite (Suaeda depressa), and bearded sprangletop (Leptochloa fascicularis).
Natural Processes: Fires were occasional. Bottomland sites have a seasonally high water table (spring) that usually fluctuates from near the surface to 6 to 8 feet below the surface. Lower portions of the community are occasionally flooded for short periods.
Similar Communities: This community type is often associated with western saline marshes and sandhills alkaline marshes; the marshes occupying the lower more saline portions of basins and the prairie the higher less saline portions of basins. EASTERN SALINE PRAIRIE.
Minimum Size: 5 ac

SAVANNAS

Savannas are grasslands with scattered or clumped trees with 5-30 % cover. The trees are >5 m tall, have low spreading branches, and mostly do not have interlaced crowns. Nearly always only one layer of woody plants is prominent, and a graminoid layer is always present (Chapman 1988). The open nature of savannas is maintained by periodic fires except on edaphically extreme sites.

TALLGRASS SAVANNA

Element Code: ETV000TG00
Regional Crosswalk Class: RICH SAVANNA, MIDWEST TYPE
Rank: G1/S1
Overview: This community type is thought to have occurred on gently sloping to steep upland sites within 20 miles of the Missouri River and possibly along other rivers in Eastern Lowlands Region. No known intact remnants of this community type presently exits. Occurrences have been destroyed through overgrazing, plowing, and tree cutting. Tallgrass Savanna may have been most abundant in southeastern Nebraska where growing conditions are more suitable to trees.
Soils: The silty or loamy soils range from shallow to deep are moderately well drained to well drained and formed in loess and glacial till.
Vegetation: The overstory is dominated by fire-resistant trees, predominantly bur oak (Quercus macrocarpa). The trees have low branches and spreading crowns. The understory vegetation is composed predominantly of Tallgrass Prairie species, though Bur Oak Woodland species may have occurred where trees were concentrated. Species diversity is high.
Dominant Plants: Bur oak (Quercus macrocarpa) is the dominant

overstory tree. Understory dominants are the same as those listed for the Tallgrass Prairie community type.
Characteristic Plants: The characteristic species are the same as those listed for the Tallgrass Prairie community type and possibly the Bur Oak Woodland Community.
Natural Processes: Fires were frequent and responsible for maintaining the open nature of the community. Bison grazing may have had a significant influence on community composition and structure.
Similar Communities: BUR OAK WOODLAND, TALLGRASS PRAIRIE.
Minimum Size: 10 ac

FLOODPLAIN SAVANNA

Element Code: ETV000FS00
Regional Crosswalk Class: RICH SAVANNA, MIDWEST TYPE
Rank: G1/S1
Overview: This community type occurs on floodplains and terraces of streams and rivers mainly within the Eastern Lowlands Region, but also may have occurred westward.
Soils: The deep, sandy loam to sandy soils are somewhat poorly drained and formed in alluvium.
Vegetation: The overstory consists of medium to tall trees. The groundlayer consists of mid and tall grasses, and forbs; and is typical of Wet-Mesic Prairie.
Dominant Plants: The dominant overstory trees are cottonwood (Populus deltoides), green ash (Fraxinus pennsylvanica), box elder (Acer negundo), and bur oak (Quercus macrocarpa). Groundlayer dominants include big bluestem (Andropogon gerardii), prairie cordgrass (Spartina pectinata), switchgrass (Panicum virgatum), and Indian grass (Sorghastrum nutans).
Characteristic Plants: Black willow (Salix nigra), Canada wildrye (Elymus canadensis), slender wheatgrass (Agropyron caninum subsp. majus), porcupine grass (Stipa spartea), prairie phlox (Phlox pilosa), blazing stars (Liatris pycnostachya and L. lancifolia), Canada goldenrod (Solidago canadensis), purple meadow rue (Thalictrum dasycarpum), rosinweed (Silphium integrifolium), golden alexander (Zizia aurea), sawtoothed sunflower (Helianthus grosseserratus), horsetails (Equisetum spp.), and prairie violet (Viola pedatifida).
Natural Processes: Fires were frequent and maintained the open nature of the community. This community type is intermediate between a terrestrial and palustrine system, the water table is near the surface with occasional standing water in winter or spring on lower sites.
Similar Communities: WET-MESIC PRAIRIE, TALLGRASS SAVANNA
Minimum Size: 10 ac

CONIFEROUS SAVANNA

Element Code: ETV000CS00
Regional Crosswalk Class: DRY WOODLAND, UNGLACIATED NORTHERN GREAT PLAINS TYPE
Rank: GU/S4
Overview: This community type occurs primarily on xeric bluffs, ridges, escarpments, and uplands bordering these sites. It is most abundant on the Pine Ridge and Wildcat Hills escarpments within the Foothills Region. It also extends eastward along stream and river valleys, mainly the Niobrara River, to roughly the center of the State.
Soils: The loamy, sandy, and rocky soils are shallow to deep, well drained, and formed mainly from sandstone, but also colluvium, eolian sand, and loess.
Vegetation: The vegetation is a mosaic of scattered to clumped, fire-resistant, coniferous trees with a mixedgrass prairie groundlayer. On sites bordering sandhills the understory consists predominantly of Sandhills Prairie species. Ponderosa pine (Pinus ponderosa) is usually the dominant tree species, individuals are 15-20 m tall with spreading branches and short trunks. The trees never become dense enough to exclude the prairie understory, except directly under the trees where pine needles may have complete ground coverage. Shrubs are common. Species diversity is moderate.
Dominant Plants: Ponderosa pine (Pinus ponderosa) is the primary overstory dominant. Limber pine (P. flexilis) is an overstory dominant in a small area of Kimball county. Rocky Mountain juniper (Juniperus scopulorum) and red cedar (J. virginiana) are also occasional overstory dominants. Needle and thread (Stipa comata) and threadleaf sedge (Carex filifolia) are groundlayer dominants.
Characteristic Plants: Little bluestem (Andropogon scoparius), western wheatgrass (Agropyron smithii), sideoats grama (Bouteloua curtipendula), hairy grama (B. hirsuta), blue grama (B. gracilis), Junegrass (Koeleria pyramidata), green needlegrass (Stipa viridula), prairie sandreed (Calamovilfa longifolia), snowberry (Symphoricarpos occidentalis), fragrant sumac (Rhus aromatica var. trilobata), poison ivy (Toxicodendron rydbergii), soapweed (Yucca glauca), mountain mahogany (Cercocarpus montanus), sego lily (Calochortus nuttallii), scarlet gaura (Gaura coccinea), plains milkweed (Asclepias pumila), and lemon scurf-pea (Psoralea lanceolata).
Natural Processes: Fires were frequent and responsible for maintaining the open nature of the community. Bison grazing may have had a significant influence on community composition and structure.
Similar Communities: NORTHWESTERN MIXED GRASS PRAIRIE, NORTHERN MIXEDGRASS PRAIRIE, WESTERN CONIFEROUS FOREST
Minimum Size: 20 ac

WOODLANDS

Woodlands are composed of open stands of trees with 30-80 % cover. The tree canopy is often discontinuous (often clumped). Trees are >5m tall, the lower canopy branches are widely spreading, are visibly longer than in forest trees, and may originate half-way up the stem. Nearly always only one layer of woody plants is prominent; a graminoid layer need not be present. Without fire, except on edaphically extreme sites, woodlands will convert to forests in a few decades (Curtis, 1959).

BUR OAK WOODLAND

Element Code: ETW0000W00
Regional Crosswalk Class: WELL DRAINED WOODLAND/SAVANNA, MIDWEST TYPE; WELL DRAINED WOODLAND, UNGLACIATED NORTHERN GREAT PLAINS TYPE; WELL DRAINED RICH WOODLAND, GLACIATED NORTHERN GREAT PLAINS TYPE
Rank: G1,GU,G3/S2
Overview: This community type occupies moderately steep to steep bluffs of rivers and streams, ravines and canyons slopes, and adjacent uplands. Its distribution is nearly statewide.
Soils: The shallow to deep soils are moderately well drained to well drained and formed in loess, glacial till, limestone, sandstone, shale, and colluvium.
Vegetation: The overstory is dominated by short to moderately tall fire-resistant, deciduous trees. The understory consists of a mixture of woodland and grassland species. Shrubs may be abundant. Species diversity is moderate.
Dominant Plants: Bur oak (Quercus macrocarpa) is usually the dominant overstory tree. With the cessation of fire other species may become prominent in the overstory, including green ash (Fraxinus pennsylvanica), red cedar (Juniperus virginiana), black walnut (Juglans nigra), hackberry (Celtis occidentalis), and elms (Ulmus spp.).
Characteristic Plants: Poison ivy (Toxicodendron rydbergii), western snowberry (Symphoricarpos occidentalis), prickly ash (Xanthoxylum americanum), woodbine (Parthenocissus vitacea), little bluestem (Andropogon scoparius), and sideoats grama (Bouteloua curtipendula).
Natural Processes: Fires were frequent.
Similar Communities: SPRING BRANCH CANYON WOODLAND, NORTHEASTERN UPLAND FOREST.
Minimum Size: 10 ac

NORTHERN SPRINGBRANCH CANYON WOODLAND

Element Code: ETW000NS00
Regional Crosswalk Class: WELL DRAINED RICH WOODLAND, GLACIATED NORTHERN GREAT PLAINS TYPE

Rank: G3/S2
Overview: This community type occupies steep springbranch canyons (and adjacent river bluffs) along a roughly 30 mile stretch of the Niobrara River in western Brown and Keya Paha, and eastern Cherry counties.
Soils: The deep loamy soils range from poorly drained to well drained and are formed in eolian sand, alluvium and Rosebud siltstone. Soils near seeps may be highly saturated with water and have a dense layer of humus and leaf mold.
Vegetation: This community type as an overstory is dominated by a mixture of coniferous and deciduous trees. Near the base of springbranch canyons and river bluffs the trees are moderately tall with a dense canopy and take on more of a forest aspect. Near the top of canyons and the river bluff the trees are shorter with a more open canopy and have a woodland aspect. A shrub layer is relatively sparse except near edges and where the canopy is more open. The herbaceous layer is fairly well developed. A dense moss and fungi layer occurs along streams and seeps. At the bluff tops the community grades into Northern Mixedgrass Prairie or Sandhills Prairie. This community is composed of a mixture of western montane, eastern deciduous forest and northern boreal forest species. Species diversity is high.
Dominant Plants: Dominant trees include basswood (Tilia americana), green ash (Fraxinus pennsylvanica), bur oak (Quercus macrocarpa), paper birch (Betula papyrifera), red cedar (Juniperus virginiana), ponderosa pine (Pinus ponderosa), and hop horn-beam (Ostrya virginiana). Virginia wild rye (Elymus virginicus) is a dominant understory species.
Characteristic Plants: Black walnut (Juglans nigra), hazelnut (Corylus americana), prickly ash (Zanthoxylum americanum), western snowberry (Symphoricarpos occidentalis), hairy wild rye (Elymus villosus), wild sarsaparilla (Aralia nudicaulis), harebell (Campanula rotundifolia), alumroot (Heuchera richardsonii), tall white violet (Viola canadensis var. rugulosa), lopseed (Phryma leptostachya), spotted touch-me-not (Impatiens biflora), sedges (Carex spp.), and mosses and fungi.
Natural Processes: Fires were common. Spring seeps are abundant within many of the ravines and are responsible for the cool, mesic nature of the canyons.
Similar Communities: NORTHEASTERN UPLAND FOREST, BUR OAK WOODLAND
Minimum Size: 5 ac

NORTHWESTERN CANYON BOTTOM WOODLAND

Element Code: ETW000NC00
Regional Crosswalk Class: WELL DRAINED RICH WOODLAND, UNGLACIATED NORTHERN GREAT PLAINS TYPE
Rank: G3\S2
Overview: This community type occupies deep mesic ravines and canyon bottoms within the Pine Ridge escarpment and Hat Creek Basin in the northwestern corner of the Foothill Region.

Soils: The soils are generally deep, moderately well drained to well drained and formed in sandstone, colluvium and alluvium.
Vegetation: This community type has a dense to somewhat open deciduous overstory layer. The shrub layer and herbaceous layer are well developed. The vegetation is a mixture of primarily western montane and eastern deciduous forest species.
Dominant Plants: Dominant trees include green ash (Fraxinus pennsylvanica), American elm (Ulmus americanus), and boxelder (Acer negundo). Dominant shrubs include choke cherry (Prunus virginiana) and gooseberry (Ribes oxyacanthoides).
Characteristic Plants: Hackberry (Celtis occidentalis), quacking aspen (Populus tremuloides), cottonwood (P. deltoides), hop hornbeam (Ostrya virginiana), mountain maple (Acer glabrum), mountain birch (Betula occidentalis), Saskatoon service-berry (Amelanchier alnifolia), buffalo berry (Shepherdia argentea), poison ivy (Toxicodendron rydbergii), fragrant sumac (Rhus aromatica var. trilobata), virginia creeper (Parthenocissus quinquefolia), and striped coral-root (Corallorhiza striata).
Similar Communities: WESTERN FLOODPLAIN WOODLAND
Minimum Size: 5 ac

FORESTS

Forests are dominated by trees >5 m tall with 50-100 % cover. Canopy branches of most trees are not widely spreading, are fairly short, and confined to the upper third of the stem. Nearly always two layers of woody plants are prominent (Chapman 1988).

SOUTHEASTERN UPLAND FOREST

Element Code: ETF000SE00
Regional Crosswalk Class: RICH FOREST, LOWER MIDWEST TYPE
Rank: G3\S2
Overview: This community type occupies the bluffs of streams and rivers and adjacent uplands in the southern half of the Eastern Lowlands Region. It is most abundant on the bluffs of the Missouri River (where it extends as far north as Omaha) and along the lower course of tributaries of the Missouri such as the Platte River, Nemaha Rivers, and Weeping Water Creek. In the far southeastern corner of the State it may extend as far as 25 miles west of the Missouri River on uplands, this distance gradually decreases to the north.
Soils: The clayey and loamy soils are moderately deep to deep, usually well drained and formed in loess, glacial-till, sandstone, or limestone.
Vegetation: This mesic community type has a tall deciduous overstory tree canopy. The secondary layer of small trees is poorly developed. A well developed short shrub and herbaceous layers are present. Near the more xeric top of bluffs the community takes on a more open aspect with shrubby species

becoming more abundant. Numerous eastern deciduous forest species reach their northern and western distributional limit within this type. Species diversity is high, though it decreases in the northern and western range.
Dominant Plants: Overstory tree dominants include shagbark hickory (Carya ovata), bitternut hickory (C. cordiformis), bur oak (Quercus macrocarpa), red oak (Q. rubra), black oak (Q. velutina), and basswood (Tilia americana). Dominant shrubs include coralberry (Symphoricarpos orbiculatus) and gooseberries (Ribes spp.).
Characteristic Plants: White oak (Quercus alba), green ash (Fraxinus pennsylvanica), black walnut (Juglans nigra), Kentucky coffee-tree (Gymnocladus dioica), American elm (Ulmus americana), hop-hornbeam (Ostrya virginiana), redbud (Cercis canadensis), pawpaw (Asimina triloba), bladderpod (Staphylea trifolia), rough-leaved dogwood (Cornus drummondii), wahoo (Euonymus atropurpureus), June-berry (Amelanchier alnifolia), black raspberry (Rubus occidentalis), bristly greenbrier (Smilax hispida), moonseed (Menispermum canadensis), bur cucumber (Sicyos angulatus), golden glow (Rudbeckia laciniata), nettle-leaved vervain (Verbena urticifolia), may apple (Podophyllum peltatum), Solomon's seal (Polygonatum biflorum), blue cohosh (Caulophyllum thalictroides), stinging nettle (Urtica dioica), wood nettle (Laportea canadensis), groundnut (Apios americana), blue phlox (Phlox divaricata subsp. laphamii), white snake root (Eupatorium rugosum), pale indian plantain (Cacalia atriplicifolia), showy orchis (Galearis spectabilis), Dutchman's breeches (Dicentra cucullaria), and wild columbine (Aquilegia canadensis).
Natural Processes: Occasional wind damage.
Similar Communities: NORTHEASTERN UPLAND FOREST, BUR OAK WOODLAND
Minimum Size: 15 ac

NORTHEASTERN UPLAND FOREST

Element Code: ETF000NE00
Regional Crosswalk Class: WELL DRAINED FOREST, LOWER MIDWEST TYPE
Rank: G3?/S2
Overview: This community type occupies the bluffs of streams and rivers and adjacent uplands in the northeastern portion of the Eastern Lowlands Region. It is most abundant on the bluffs of the Missouri River, where it occurs as far south as Omaha, and the lower Niobrara River.
Soils: The loamy soils are well drained and formed mainly in loess.
Vegetation: This community type has a tall deciduous overstory tree canopy. The secondary layer of small trees is not well developed. The shrub and herbaceous layers are well developed. Near the tops of the bluffs the community takes a more open aspect and shrubs become very abundant often forming dense thickets which may extend well beyond the forest edge. Species diversity is not as high as in the Southeastern Upland Forest

community type.
Dominant Plants: Dominant trees include bur oak (Quercus macrocarpa), black walnut (Juglans nigra), green ash (Fraxinus pennsylvanica), American elm (Ulmus americana), basswood (Tilia americana), and hop-hornbeam (Ostrya virginiana).
Characteristic Plants: Red oak (Q. rubra), red cedar (Juniperus virginiana), prickly ash (Xanthoxylum americanum), choke cherry (Prunus virginiana), Saskatoon service-berry (Amelanchier alnifolia), bristly greenbrier (Smilax hispida), moonseed (Menispermum canadensis), golden glow (Rudbeckia laciniata), may-apple (Podophyllum peltatum), cow parsnip (Heracleum sphondylium subsp. montanum), Solomon's seal (Polygonatum biflorum), stinging nettle (Urtica dioica), wood nettle (Laportea canadensis), blue phlox (Phlox divaricata subsp. laphamii), blue cohosh (Caulophyllum thalictroides), Dutchman's breeches (Dicentra cucullaria), and wild columbine (Aquilegia canadensis)
Natural Processes: Occasional wind damage.
Similar Communities: SOUTHEASTERN UPLAND FOREST, NORTHERN SPRINGBRANCH CANYON WOODLAND, BUR OAK WOODLAND
Minimum Size: 15 ac

WESTERN CONIFEROUS FOREST

Element Code: ETF000WC00
Regional Crosswalk Class: WELL DRAINED FOREST, UNGLACIATED NORTHERN GREAT PLAINS TYPE
Rank: G3?\S2
Overview: This community type occurs primarily within steep ravines and on east- and north-facing slopes on the Pine Ridge escarpment and within the Hat Creek Basin in the northwestern corner of the Foothills Region. Isolated stands also occur along rivers as far east as Keya Paha and Custer counties.
Soils: The rocky to sandy loam soils are shallow to deep, well drained and usually formed from limestone or sandstone.
Vegetation: This community type has a overstory canopy dominated by coniferous trees, predominantly Ponderosa Pine (Pinus ponderosa). Individual trees are up to 30 m tall with straight trunks. Due to heavy cutting since white settlement most of the trees are less than 100 years old. A shrub layer is sometimes present. The groundlayer is sparse with pine needles often having nearly complete ground coverage. The vegetation is composed mainly of western montane species. Species diversity is fairly low.
Dominant Plants: Ponderosa pine (P. ponderosa) is the primary overstory dominant. Red cedar (Juniperus virginiana) and Rocky Mountain juniper (Juniperus scopulorum) may be occasional dominants, but usually occur as scattered individuals.
Characteristic Plants: Choke cherry (Prunus virginiana), Saskatoon service-berry (Amelanchier alnifolia), wintergreen (Pyrola virens and P. secunda), pine drops (Pterospora andromedea), fragile fern (Cystopteris fragilis), little-seed

ricegrass (Oryzopsis micrantha), spikenard (Smilacina stellata), Oregon grape (Berberis repens), and green needlegrass (Stipa viridula).
Natural Processes: Surface fires were fairly frequent, canopy fires were fairly rare. Occasional wind damage.
Similar Communities: CONIFEROUS SAVANNA
Minimum Size: 15 ac

SPARSELY VEGETATED COMMUNITIES

Within sparsely vegetated communities herbaceous vascular plants have <30 % cover; nonvascular plants may be prominent; trees and shrubs together have <30 % cover; and trees by themselves have <5 % cover (Chapman 1988). Sparsely vegetated communities also have the following characteristics: 1) soil is thin or absent, and the parent material is at or near the surface. 2) the community is maintained indefinitely at an early stage of succession by the substrate or by natural disturbance.

BADLANDS

Element Code: ETC000BA00
Regional Crosswalk Class: ALKALINE POORLY CONSOLIDATED SLOPE, UNGLACIATED NORTHERN GREAT PLAINS TYPE
Rank: GU/S3
Overview: This community type occurs on areas of highly eroded, steep, irregular topography (badlands) on shale plains in the far northwestern portion of the Foothills Region.
Soils: Soils are poorly developed and highly erodible and formed in silts, clays, and shale of the Brule and Chadron Formations. On steep slopes soil is lacking. Soils on flats may be alkaline.
Vegetation: The dominant species are shrubs. Steep slopes are usually totally denude of vegetation except for a few occasional shrubs. On more favorable locations such as gentle slopes, canyon and gulch bottoms the vegetation is sparse. Species diversity is low.
Dominant Plants: None.
Characteristic Plants: Greasewood (Sarcobatus vermiculatus), winter fat (Ceratoides lanata), wire lettuce (Stephanomeria tenuifolia), minors candle (Cryptantha fendleri), wavy-leaf thistle (Cirsium undulatum), and prairie sandreed (Calamovilfa longifolia).
Natural Processes: Erosion is prominent.
Similar Communities: None
Minimum Size: 5 ac

DRY CLIFF/ROCK SLOPE

Element Code: ETC000DC00
Regional Crosswalk Class: DRY CLIFF, NORTHERN GREAT PLAINS TYPE; ALKALINE DRY CLIFF NORTHERN GREAT PLAINS TYPE
Rank: GU/S4
Overview: This community includes extremely steep to vertical exposures (>70 degree slope) of bedrock along bluffs, escarpments, and buttes; and the extremely rocky hillsides (<70 degree slope) below these rock outcrops. It is best developed on west- and south-facing aspects and unshaded sites. The bedrock consists mainly of sandstone and limestone, but also shale and chalk. This community type is most abundant in the Foothills Region, but also occurs eastward.
Soils: The substrate is 75-100 % stone. Soils are generally absent except for very shallow soils on ledges, shelves and at the base of overhangs. They are rapidly drained.
Vegetation: The vegetation is generally sparse and is dominated by xerophytic species. Steep rock faces are often completely devoid of vegetation except for lichens which may cover a large percentage of the rock surface. Trees may occur on suitable habitat among the rocks, but when present they are scattered, stunted, and gnarled. Small shrubs and forbs may be abundant on the rocky slopes. Species diversity is fairly low. In the Foothills Region this community type harbors many western and southwestern species. Many of these species do not occur outside the Foothill Region. Xerophytic species characteristic of adjacent community types also occur within this type.
Dominant Plants: Lichens.
Characteristic Plants: Trees characteristic of this community type are ponderosa pine (Pinus ponderosa), Rocky Mountain juniper (Juniperus scopulorum), red cedar (Juniperus virginiana), and bur oak (Quercus macrocarpa). Plants characteristic of the rock slopes include milk vetches (Astragalus spp.), Hood's phlox (Phlox hoodii), phlox (P. bryoides), ball head (Ipomopsis congesta), scorpionweed (Phacelia hastata var. leucophylla), sandwort (Arenaria hookeri), nodding wild buckwheat (Eriogonum cernuum), yellow buckwheat (Eriogonum flavum), stonecrop (Sedum lanceolatum), bladderpod (Lesquerella alpina), Easter daisy (Townsendia exscapa), prickly pear cactus (Opuntia spp.), the umbell (Musineon tenuifolium), and blue grama (Bouteloua gracilis).
Natural Processes: Erosion is prominent.
Similar Communities: NORTHWESTERN MIXEDGRASS PRAIRIE, NORTHERN MIXEDGRASS, WESTERN SHORTGRASS PRAIRIE
Minimum Size: The cliffs must have a height >4 m.

WET CLIFF

Element Code: ETC000WC00
Regional Crosswalk Class: MOIST CLIFF, LOWER MIDWEST TYPE; ALKALINE MOIST CLIFF, LOWER MIDWEST TYPE
Rank: GU/S3
Overview: This community includes extremely steep to vertical exposures (>70 degree slope) of bedrock along stream and river bluffs, canyons, and dissected hills. It is best developed on east- and north-facing aspects and well shaded sites. The cliffs are composed mainly of limestone and sandstone, but also shale and siltstone. This community type is most abundant in the Eastern Lowland Region, but also occurs in the other regions.
Soils: Soils are generally absent except for very shallow soil on ledges, shelves, or at the base of overhangs. They are usually rapidly drained, but may be kept moist for significant periods of time because of seepage or dense shading.
Vegetation: Vegetation is generally sparse. Steep rock faces are often completely devoid of vegetation except for mosses, lichens, and liverworts which may cover a large percentage of the rock surface often forming thick mats. Trees may occur on suitable habitat among the rocks, but when present they are scattered, stunted, and gnarled. Herbaceous vegetation is sparse usually consisting of ferns. Species diversity is moderately low.
Dominant Plants: Lichens and mosses.
Characteristic Plants: Maidenhair fern (Adiantum pedatum), purple stemmed cliff-brake (Pellaea atropurpurea), blunt-lobed woodsia (Woodsia obtusa), common bladder fern (Cystopteris fragilis), horsetails (Equisetum spp.), mosses, lichens, and liverworts.
Natural Processes: Erosion is prominent.
Similar Communities: None
Minimum Size: The cliffs must have a height >4 m.

PALUSTRINE SYSTEM

The Palustrine System includes wetlands dominated by trees, shrubs, emergent herbs, emergent mosses or lichens (Chapman 1988). Wetlands are defined to have the following diagnostic characteristics: 1) the prevalent vegetation consists of hydrophytic macrophytes; 2) soils are classified as hydric or show evidence of low oxygen availability during the growing season; 3) the area is inundated permanently or periodically at mean depths less than 2 meters, or the soil is saturated to the surface at some time during the growing season (Environmental Laboratory 1987). The Palustrine System also includes wetlands lacking vegetation, but with all of the following three characteristics: 1) area less than 8 ha (20 ac); 2) active wave-formed or bedrock shoreline features lacking; 3) water depth in the deepest part of the basin less than 2 m at low water. The Palustrine System is bounded by upland or any of the other systems (Chapman 1980).

GRASSLANDS

WET PRAIRIE

Element Code: EPHTG0WT00
Regional Crosswalk Class: WET PRAIRIE, GLACIATED LOWER MIDWEST TYPE
Rank: G2/S1
Overview: This community type occurs on the floodplains of streams and rivers primarily in the Eastern Lowlands Region.
Soils: The deep, silty clay loam to fine sandy loam soils are poorly to very poorly drained and formed in alluvium.
Vegetation: The vegetation consists primarily of tall grasses. Herbs are not abundant. The vegetation is similar to that of Wet-Mesic Prairies, but species diversity is lower.
Dominant Plants: Tall grasses dominate, the primary one is prairie cordgrass (Spartina pectinata). Localized areas are dominated by sedges including Carex lanuginosa, C. striata, and C. vulpinoides.
Characteristic Plants: Bluejoint reedgrass (Calamagrostis canadensis), northern reedgrass (C. inexpansa), switchgrass (Panicum virgatum), Canada wildrye (Elymus canadensis), American sloughgrass (Beckmania syzigachne), rice cut-grass (Leersia oryzoides), fowl mannagrass (Glyceria striata), reed canary grass (Phalaris arundinacea), swamp milkweed (Asclepias incarnata), marsh betony (Stachys palustris subsp. pilosa), water parsnip (Sium suave), and indian hemp (Apocynum sibiricum).
Natural Processes: Fires were frequent. Spring and early summer floods were common. There is a seasonally high water table with standing water present during spring and winter or after heavy rains.
Similar Communities: WET-MESIC PRAIRIE, WET MEADOW. Wet prairies often occur as a mosaic with wet-mesic prairies.
Minimum Size: 5 ac

WET MEADOW

Element Code: EPHTF0WM00
Regional Crosswalk Class: WET MEADOW, GLACIATED NORTHERN GREAT PLAINS TYPE
Rank: G3/S4
Overview: This community type occupies nearly level sites along streams and rivers, and within wet sandhill valleys (it often occurs as a concentric zone around lakes and marshes). It is abundant in the Sandhills Region, but also occurs in the Foothills Region and in the northeast portion of the Eastern Lowlands Region.
Soils: The peat, muck, loamy sand, or sand soils are deep, poorly drained and formed in eolian sand and alluvium.
Vegetation: The vegetation consists predominantly of grasses,

sedges, and rushes. Forbs and shrubs are common. Occasional trees may occur within this community. Species diversity is moderate.
Dominant Plants: The vegetation is dominated primarily by hydric grasses, sedges, and rushes including, path rush (Juncus tenuis), knotted rush (J. nodosus), Torrey's rush (J. torreyi), bulrushes (Scirpus atrovirens and S. americanus), spikerushes (Eleocharis spp.), sedges (Carex spp.), bluejoint reedgrass (Calamagrostis canadensis), northern reedgrass (C. inexpansa), prairie cordgrass (Spartina pectinata), and reed canary grass Phalaris arundinacea). Common water hemlock (Cicuta maculata) and swamp milkweed (Asclepias incarnata) are occasional dominants. Marsh fern (Thelypteris palustris) and sensitive fern (Onoclea sensibilis) sometimes dominate this community type in the Sandhills Region. Shrubs, including meadow willow (Salix petiolaris), sandbar willow (S. exigua), and false indigo (Amorpha fruticosa) may dominate localized areas especially on peat soils bordering Sandhills Lakes where the water table is 6 to 12 inches below the surface.
Characteristic Plants: Tall mannagrass (Glyceria grandis), field mint (Mentha arvensis), winged loosestrife (Lythrum alatum), American bugleweed (Lycopus americanus), fringed loosestrife (Lysimachia ciliata), tufted loosestrife (L. thyrsiflora), marsh marigold (Caltha palustris), joe-pye weed (Eupatorium maculatum var. bruneri), spotted touch-me-not (Impatiens capensis), St. John's-wort (Triadenum fraseri), water smartweed (Polygonum amphibium var. emersum), and patience dock (Rumex patientia)
Natural Processes: Floods are common. This community type may have standing water in winter and spring and the water table is usually near the surface.
Similar Communities: WET PRAIRIE
Minimum Size: 5 ac

GROUNDWATER SEEPAGE COMMUNITIES

Groundwater seepage natural community types are distinguished from other palustrine communities in that soils or substrates are continually saturated by groundwater seepage (White and Madany 1978).

FEN

Element Code: EPHAS0FN00
Regional Crosswalk Class: RICH SHRUB/HERB FEN, MIDWEST TYPE
Rank: GU/S1
Overview: This community type occurs near the base of canyon and valley slopes, and on floodplains terraces. At present this community type is known to occur in Jefferson County in southeastern Nebraska and in northeastern Nebraska along the Missouri River. Little is known about the distribution and composition of fens in Nebraksa.

Soils: The deep soils consists of peat or muck (often mixed with sand) and are constantly saturated with moderately minerotrophic (pH 6.0-6.9) to possibly strongly minerotrophic (pH 7.0-8.4) groundwater. The peat often forms uplifted mounds.
Vegetation: The vegetation is dominated by a mixture of herbaceous species. Shrubs are occasional. Species diversity is moderate.
Dominant Plants: Sedges (Carex spp.), rushes (Juncus spp.), bulrushes (Scirpus spp.), grasses, and forbs.
Characteristic Plants: Pussy willow (Salix discolor), bulrushes (Scirpus atrovirens and S. vallidus), the sedges (Carex sterilis, C. lanuginosa and C. hystricinia), rice cutgrass (Leersia oryzoides), three-way sedge (Dulchium arundinaceum), boneset (Eupatorium perfoliatum), common water hemlock (Cicuta maculata), northern bog violet (Viola nephrophylla), American bugleweed (Lycopus americanus), sensitive fern (Onoclea sensibilis), and marsh fern (Thelypteris palustris).
Natural Processes: Fires may have been common. This community has a constant flow of groundwater that keeps the soil continually saturated.
Similar Communities: SANDHILLS FEN. This type may be divided into several types after future field work is conducted.
Minimum Size: 0.1 ac

SANDHILLS FEN

Element Code: EPSAS0SF00
Regional Crosswalk Class: RICH SCRUB FEN, NORTHERN GREAT PLAINS TYPE
Rank: G3/S1
Overview: This community type occurs on gently sloping to level valley bottoms bordering sandhill streams and possibly lakes. Presently, it is known to occur in the northern portion of Cherry county, but most likely occurs in other areas of the Sandhills.
Soils: The deep peat and mucks soils formed in eolian sand and alluvium, and are constantly saturated by moderately minerotrophic (pH 6.0-6.9) groundwater. The peat often forms uplifted mounds.
Vegetation: The vegetation is dominated by a mixture of herbaceous species. Shrubs may be abundant in areas. Species diversity is fairly high. This community type harbors glacial relict populations of several northern species.
Dominant Plants: Sedges (Carex interior, C. lacustris, C. nebraskensis, C. prarisa, and C. sartwellii), fowl mannagrass (Glyceria striata), bluejoint reedgrass (Calamagrostis canadensis). Willows (Salix spp.) are the dominant shrubs.
Characteristic Plants: Bulrushes (Scirpus spp.), spikerushes (Eleocharis compressa and E. erythropoda), northern bog violet (Viola nephrophylla), water smartweed (Polygonum amphibium), buckbean (Menyanthes trifoliata), cottongrass (Eriophorum polystachion), long-leaved stitchwort (Stellaria longifolia),

wild lily (Lilium philadelphicum), marsh fern (Thelypteris palustris), and sensitive fern (Onoclea sensibilis).
Natural Processes: Fires may have been common. This community has a constant flow of groundwater that keeps the soil saturated. Flooding from beaver dams may have been an important process for fens bordering streams.
Similar Communities: SANDHILLS WET MEADOW, FEN
Minimum Size: 0.1 ac

SPRING SEEP

Element Code: EPHAS0SE00
Regional Crosswalk Class: RICH SHRUB/HERB FEN, MIDWEST TYPE
Rank: GU/S3
Overview: This community type occupies the slopes of valleys, hills, and bluffs. It has a statewide distribution, but is most abundant in the Eastern Lowland Region and Sandhills Region.
Soils: The shallow to deep (depending on degree of slope) soils are composed of muck, sand, or gravel; formed in loess, glacial till, eolian sand, bedrock, and colluvium; and are constantly saturated by moderately minerotrophic (pH 6.0-6.9) groundwater.
Vegetation: Herbaceous species usually dominate, a tree canopy may be present.
Dominant Plants: Horsetails (Equisetum spp.), broad-leaved cattail (Typha latifolia), and cottonwood (Populus deltoides).
Characteristic Plants:
Natural Processes: Fires may have been common. This community type has a constant flow of groundwater that keeps the soil saturated. Slumping may occur on steep slopes.
Similar Communities: FEN, SANDHILLS FEN, TALLGRASS PRAIRIE
Minimum Size: 0.1 ac

MARSHES

Marshes are natural communities dominated by herbaceous plants and occur in low-lying areas and have water near or above the surface for most of the year (White and Madany 1978).

LOWLAND FRESHWATER MARSH

Element Code: EPHRI0LM00
Regional Crosswalk Type: PERMANENT MARSH, LOWER MIDWEST TYPE
Rank: GU/S3
Overview: This community type occupies swales and depressions on low floodplain terraces of rivers and streams, it may also occupy areas of slow moving water adjacent to rivers and streams. This community is most abundant on the floodplains of the larger rivers in the Eastern Lowlands Region, but also occurs in the other Regions of the State.

Soils: The peat, muck, sand or silt soils are usually deep, very poorly drained and formed in alluvium.
Vegetation: The vegetation of this type is highly variable in response to water depth and other natural forces. The vegetation includes submerged aquatics, emergent aquatics, and floating-leaved aquatics. The marsh can contain areas of open water but the majority is occupied by vegetation. Species diversity is moderate.
Dominant Plants: Large areas may be dominated by a single species. In deeper portions of the marsh where standing water is present for long periods the dominants include broad-leaved cattail (Typha latifolia), river bulrush (Scirpus fluviatilis), hardstem bulrush (Scirpus acutus), water plantain (Alisma trivale), arrowhead (Sagittaria latifolia), bur-weed (Sparganium eurycarpum), and pondweeds (Potamogeton spp.). In shallower areas where standing water is not present for long periods the dominants include smartweeds (Polygonum spp.), rice cutgrass (Leersia oryzoides), and reed canary grass (Phalaris arundinacea).
Characteristic Plants: Characteristic submerged aquatics include water milfoil (Myriophyllum spp.), horned pondweed (Zannichellia palustris), and coontail (Ceratophyllum demersum). Characteristic floating-leaved aquatics include water chinkapin (Nelumbo lutea), white waterlily (Nymphaea tuberosa). Other characteristic species include the bulrushes (Scirpus atrovirens and S. americanus), the sedge (Carex lurida), the spikerush (Eleocharis macrostachya), and buttercups (Rannunculus spp.).
Natural Processes: This community is subject to seasonal flooding by moving water which keeps the water fresh and circulates nutrients and organic debris. Standing water (sometimes moving) is present for the majority of the year. The marsh basins may become dry in mid to late summer, but the water table remains near the surface at all times.
Similar Communities: WET MEADOW, POND MARSH
Minimum Size: 5 ac

POND MARSH

Element Code: EPHRI0PM00
Regional Crosswalk: SEMI-PERMANENT MARSH, SOUTHERN GREAT PLAINS TYPE
Rank: G4/S3
Overview: This community type occupies wind-formed depressions on nearly level upland sites and depressions on terraces. It is most abundant in the Rainwater Basin located in the southern portion of the Loess Hills and Plains Region; in Keith, Lincoln, Perkins and Chase counties in the Foothills Region; and on uplands bordering the Platte River in the east-central portion of the Eastern Lowlands Region, but may also occur in other portions of the State.
Soils: The deep, silt loam and silty clay loam soils are somewhat

poorly drained to very poorly drained and have a claypan subsoil. They are formed in loess on uplands and loess or alluvium on terraces. This community type is usually associated with Scott and Fillmore soils.
Vegetation: The vegetation of this community is highly variable in response to water depth and other natural forces. The vegetation includes submerged aquatics, emergent aquatics and floating-leaved aquatics.
Dominant Plants: Large areas may be dominated by a single species. Dominants include broad-leaved cat-tail (Typha latifolia), hardstem bulrush (Scirpus acutus), river bulrush (S. fluviatilis), spikerush (Eleocharis macrostachya), reed canary grass (Phalaris arundinacea), and smartweeds (Polygonum spp.).
Characteristic Plants:
Natural Processes: This community type receives water primarily through surface runoff and has standing water present for extended periods of the year, but may become dry in mid to late summer and during droughts.
Similar Communities: LOWLAND FRESHWATER MARSH
Minimum Size: 5 ac

EASTERN SALINE MARSH

Element Code: EPHSA0ES00
Regional Crosswalk Class: SALINE MARSH, MIDWEST TYPE
Rank: GU/S1
Overview: This community type occupies swales and depressions of floodplains and terraces, and valley basins. It is restricted to Lancaster and southern Saunders counties in the Eastern Lowlands Region.
Soils: The silty clay loam soils are deep, poorly drained and formed in alluvium that is slightly to moderately affected by soluble salts. This community is usually associated with Zoe and Salmo soils.
Vegetation: The vegetation consists of salt tolerant species. Zonation of species is based on salt tolerance. The most saline portions of the marshes are often denude of vegetation and appear as salt encrusted mud flats, only scattered individuals of saltwort (Salicornia rubra) are able to inhabit this zone. Emergent hydrophytic plants are abundant in less saline areas.
Dominant Plants: Dense colonies dominated by one or two species are common. Areas with standing water are dominated by ditchgrass (Ruppia maritima var. occidentalis), prairie bulrush (Scirpus maritimus var. paludosus), and narrow-leaved cattail (Typha latifolia). Other dominants include spearscale (Atriplex patula), saltgrass (Distichlis stricta), foxtail barley (Hordeum jubatum), marsh elder (Iva annua), saltwort (Salicornia rubra), sea blite (Suaeda depressa), and prairie cordgrass (Spartina pectinata).
Characteristic Plants:
Natural Processes: Fires may have been common. This community has a seasonally high water table that may be as much has 1 m above

the surface, the marshes often become dry in mid to late summer or during drought. The marsh is fed primarily from surface runoff, though saline seeps may occur within the marsh.
Similar Communities: WESTERN SALINE MARSH. This community type is closely associated with EASTERN SALINE PRAIRIES, the marsh occupies the lower more saline portions of basins, the prairie the higher less saline portions.
Minimum Size: 5 ac

WESTERN SALINE MARSH

Element Code: EPHSA0WS00
Regional Crosswalk Class: SALINE WET MEADOW, SOUTHERN GREAT PLAINS TYPE
Rank: G3?/S1?
Overview: This community type occupies depressions on the bottomlands of rivers and streams. Its known distribution is limited to the valley of the North Platte River and its smaller tributary streams in the Foothills Region.
Soils: The loam to sandy loam soils are deep, poorly drained and formed in alluvium. The soils are slightly to strongly affected by soluble salts. During dry periods a white salt crust often appears at the soil surface.
Vegetation: The vegetation is dominated by salt tolerant species. Zonation of species reflects salt tolerance.
Dominant Plants: Where standing water is present the vegetation is dominated by the submerged aquatic ditchgrass (Ruppia maritima var. occidentalis). The most saline portions of the marshes are dominated by a sparse cover of sea blite (Suaeda depressa). Less saline portions of the marshes are dominated by Piccadeniopsis oppisitifolia, the goosefoot (Chenopodium incanum), and poverty weed (Monolepis nuttalliana).
Characteristic Plants:
Natural Processes: This community type has water at or near the surface most of the time with occasional standing water, the marshes often become dry in mid to late summer or during drought. The marsh is fed primarily from surface runoff, though saline seeps may occur within the marsh.
Similar Communities: EASTERN SALINE MARSH. This community type is closely associated with WESTERN SALINE PRAIRIES, the marsh occupies the lower more saline portions of basins, the prairies the higher less saline portions.
Minimum Size: 5 ac

SANDHILLS MARSH

Element Code: EPHRI0SM00
Regional Crosswalk Class: SEMI-PERMANENT MARSH, GLACIATED NORTHERN GREAT PLAINS TYPE; DRYING MARSH, GLACIATED NORTHERN GREAT PLAINS TYPE

Rank: G3?/S3
Overview: This community type occupies low areas in sandhill valleys and often occurs as a zone surrounding the open water of Sandhill Lakes. The distribution of this community is restricted to the Sandhills Region and is most abundant in the eastern two-thirds of the Sandhills.
Soils: The deep, peat, muck and mineral soils are poorly drained formed in eolian sand.
Vegetation: The vegetation of this community is highly variable in response to water depth and other natural forces. The vegetation includes submerged aquatics, emergent aquatics, and floating-leaved aquatics. Species diversity is high compared to Sandhills Alkaline Marshes.
Dominant Plants: Dense colonies dominated by one or two species are common. Dominant species include the bulrushes (Scirpus acutus, S. americanus and S. validus), cat-tails (Typha latifolia and T. angustifolia), plume reed (Phragmites australis), arrowheads (Sagittaria spp.), and wild rice (Zizania aquaitica). Deeper portions of the marshes may be dominated by floating-leaf aquatics including cowlily (Nuphar luteum), floatingleaf pondweed (Potamogeton natans), water smartweed (Polygonum amphibium var. stipulaceum), and the submerged aquatic sago pondweed (Potamogeton pectinatus). Shallow areas with open sandy bottoms are often dominated by chara (Chara ssp.), water nymph (Najas flexilis), and horned pondweed (Zannichellia palustris). During low water periods exposed areas may be dominated almost solely by water smartweeds (Polygonum spp.).
Characteristic Plants:
Natural Processes: This community receives water from surface runoff and from groundwater seepage. The water is fresh to slightly alkaline (<5,000 mg/l). Surface water levels often fluctuate with groundwater water levels.
Similar Communities: SANDHILLS ALKALINE MARSH
Minimum Size: 5 ac

SANDHILLS ALKALINE MARSH

Element Code: EPHRI0SA00
Regional Crosswalk Class: SEMI-PERMANENT MARSH, GLACIATED NORTHERN GREAT PLAINS TYPE; DRYING MARSH, GLACIATED NORTHERN GREAT PLAINS TYPE
Rank: G3?/S3
Overview: This community type occupies low areas in sandhill valleys and often occurs as a zone surrounding Sandhill Alkaline Lakes. The distribution of this community type is restricted to the Sandhills Region and is most abundant in the 'closed basin area' of the western Sandhills, where the surface drainage systems are poorly developed.
Soils: The deep, mainly mineral soils are poorly drained and formed in eolian sand. The soils contain potassium-sodium enriched silty clay deposits which form an impervious seal and

prevent the influx of groundwater.
Vegetation: This community type has rather sparse vegetation consisting of species that can tolerate high levels of alkalinity. Species diversity is low.
Dominant Plants: The vegetation is dominated by the bulrushes (Scirpus validus and S. americanus).
Characteristic Plants: Sago pondweed (Potamogeton pectinatus), ditchgrass (Ruppia maritima), common reed (Phragmites australis), cat-tails (Typha latifolia and T. angustifolia), and arrowgrass (Triglochin maritima).
Natural Processes: This community type receives water only through surface runoff and has very little surface water drainage. Waters are moderate to highly alkaline (>5,000 mg/1) because of leaching and evaporation.
Similar Communities: SANDHILLS MARSH
Minimum Size: 5 ac

WOODLANDS

WESTERN FLOODPLAIN WOODLAND

Element Code: EPWTF0WF00
Regional Crosswalk Class: FLOODED FOREST, UNGLACIATED NORTHERN GREAT PLAINS TYPE; FLOODED FOREST, SOUTHERN GREAT PLAINS TYPE
Rank: GU/S4
Overview: This community type occurs on floodplains of major rivers and streams in the Sandhills Region, Loess Hills and Plains Region, and the Foothills Region.
Soils: The deep soils are somewhat poorly drained to moderately well drained and formed in alluvium.
Vegetation: This community type has an overstory canopy dominated by medium to tall deciduous trees. The groundlayer is mixed herbaceous.
Dominant Plants: Along sandy rivers like the Platte and Republican, cottonwood (Populus deltoides), peach leaf willow (Salix amygdaloides), and sandbar willow (S. exigua) are the tree dominants. Along streams with heavier soils green ash (Fraxinus pennsylvanica), American elm (Ulmus americanus), hackberry (Celtis occidentalis), and red cedar (Juniperus virginiana) are also overstory dominants.
Characteristic Plants: Boxelder (Acer negundo), Virginia creeper (Parthenocissus vitacea), and poison ivy (Toxicodendron rydbergii). Also mountain mahogany (Cercocarpus montanus) and mountain birch (Betula occidentalis) in the Foothills Region.
Seral Communities: Western floodplain forest usually originate on recently deposited sandbars. The first sere to invade sandbars is dominated by sand-loving herbs, and cottonwood and willow seedlings. A mature cottonwood and willow dominated woodland then develops. Other overstory species become dominate as cottonwoods die and leave gaps in the overstory.

Natural Processes: Fires were common. The sites have a high water table for a significant period of the year and are subject to frequent spring or early summer flooding.
Similar Communities: EASTERN FLOODPLAIN FOREST, NORTHWESTERN CANYON BOTTOM WOODLAND, BUR OAK WOODLAND
Minimum Size: 10 ac

FORESTS

EASTERN FLOODPLAIN FOREST

Element Code: EPFTF0EF00
Regional Crosswalk Class: FLOODED FOREST, CENTRAL MIDWEST TYPE
Rank: G3?/S2
Overview: This community type occurs on floodplains (first and second bottoms) along major streams and rivers in the Eastern Lowland Region, primarily the Big Blue, Elkhorn, Missouri, Niobrara, Platte, and Republican rivers.
Soils: The deep soils are poorly drained to well drained and formed in recently deposited silty or clayey alluvium.
Vegetation: This community type has a fairly diverse, tall deciduous overstory canopy and a well developed herbaceous understory. Vines are common. Species diversity is moderately high.
Dominant Plants: Hackberry (Celtis occidentalis), silver maple (A. saccharinum), green ash (Fraxinus pennsylvanica), cottonwood (Populus deltoides), American elm (Ulmus americana), red elm (Ulmus rubra), and sycamore (Platanus occidentalis) are overstory dominants. Peachleaf willow (Salix amygdaloides), poison ivy (Toxicodendron rydbergii), and prickly ash (zanthoxylum americanum) are also dominants.
Characteristic Plants: Black walnut (Juglans nigra), boxelder (Acer negundo), black willow (Salix nigra), dogwood (Cornus spp.), greenbrier (Smilax hispida), and gooseberry (Ribes spp.).
Seral Communities: Eastern floodplain forests originate on recently deposited sandbars. The initial sere is dominated by sand-loving herbs, and cottonwood and willow seedlings. A mature cottonwood dominated forest then develops. Other overstory species become dominants the cottonwoods die and leave gaps in the overstory.
Natural Processes: The sites have a high water table for a significant period of the year and are subject to frequent spring and early summer flooding.
Similar Communities: WESTERN FLOODPLAIN FOREST, SOUTHEASTERN UPLAND FOREST, NORTHEASTERN UPLAND FOREST
Minimum Size: 10 ac

SPARSELY VEGETATED COMMUNITIES

SANDBAR

Element Code: ETC000SB00
Regional Crosswalk Class: ALKALINE RIVERWASH, UNGLACIATED NORTHERN GREAT PLAINS TYPE; ALKALINE RIVERWASH, GLACIATED NORTHERN GREAT PLAINS TYPE; ALKALINE RIVERWASH, SOUTHERN GREAT PLAINS TYPE
Rank: G3?/S3
Overview: Sandbars occur throughout the State in braided river and stream beds where frequent flooding constantly changes the soil substrate. Sandbars are usually short-lived due to recurring flooding. If not disturbed they will succeed to other floodplain community types.
Soils: Soils are usually poorly developed or absent and are formed in recently deposited alluvium (sand, silt or gravel). Soil drainage varies depending on texture and height above the water level.
Vegetation: Vegetation is sparse to abundant. In general, where vegetation occurs it is highly dynamic and of irregular structure because of extreme changes in the riverbed characteristics. Low mesic areas are dominated by hydric species while higher areas are dominated by drought tolerant species. Trees are generally absent except for seedlings and scattered individuals on higher sites. Shrubs may be common on higher areas. Annual grasses and herbs are abundant. Species diversity is fairly low.
Dominant Plants: None.
Characteristic Plants: Cottonwood (Populus deltoides), sandbar willow (Salix exigua), yellow willow (S. lutea), false indigo (Amorpha fruticosa), sand love grass (Eragrostis trichodes), sand dropseed (Sporobolus cryptanthus), sandgrass (Triplasis purpurea), sandbur (Cenchrus longispinus), pale smartweed (Polygonum lapathifolium), umbrella sedges (Cyperus spp.), rushes (Juncus spp.), bulrush (Scirpus americanus), arrowgrass (Triglochin maritima var. elata), cocklebur (Xanthium strumarium), the sedge (Hemicarpha micrantha).
Natural Processes: Sandbars are created by late winter or spring flooding when receding waters deposit sand and lesser amounts of silt or clay on pointbars or islands. Existing sandbars are subject to extreme fluctuation in water levels during periods of flooding and undercutting. During flooding plants are subject to abrasion and burial by sand, gravel, ice, and debris.
Similar Communities:
Minimum Size: 2 ac

LACUSTRINE SYSTEM

The Lacustrine System includes wetlands and deepwater habitats with all the following characteristics: 1) situated in a topographic depression; 2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with > than 30% areal coverage; and 3) total area exceeds 8 ha (20 acres). Similar wetland and deepwater habitats are also considered lacustrine communities if an active wave-formed or bedrock shoreline features makes up all or part of the boundary, or if the water in the deepest part of the basin exceeds 2 m (6.6 feet) at low water levels (Chapman 1988). Lacustrine Systems include permanently flooded lakes and intermittent lakes. Islands of palustrine wetland may lie within the boundaries of the Lacustrine System. The Lacustrine System is bounded by upland or by wetland dominated by trees, shrubs, emergent herbs, emergent mosses, or lichens. Where a river enters a lake, the extension of the Lacustrine shoreline forms the Riverine-Lacustrine boundary.

LAKES

Lakes are bodies of open, standing water (White and Madany 1978).

SANDHILLS ALKALINE LAKE

Element Code: EL000SL00
Regional Crosswalk Class:
Rank: G?/S4
Overview: This community type occurs in low lying depressions within sandhill valleys. Its distribution is generally limited to the 'closed basin area' in the far western portion of the Sandhills Region; primarily Garden, Morrill, and Sheridan counties, but it also occurs in other areas of the Sandhills.
Physical Description: The lakes are shallow (usually less than 3 m deep) with saucer-shaped bottoms composed of fine sandy loam underlain with potassium-sodium enriched clay deposits which form an impervious seal against the groundwater table. They are eutrophic and highly mineralized through leaching and evaporation (alkalinity is >5,000 mg/l).
Vegetation: The vegetation consists of alkaline tolerant species. Species diversity is extremely low.
Dominant Plants: Sago pondweed (Potamogeton pectinatus) and ditchgrass (Ruppia maritima) are dominant submergents.
Characteristic Plants:
Natural Processes: These lakes lie within closed basins and receive the majority of their water from surface runoff. They are intermittent and few maintain a permanent water table through a series of dry years.
Similar Communities: SANDHILLS FRESHWATER LAKE
Minimum Size: See above description of Lacustrine System.

SANDHILLS FRESHWATER LAKE

Element Code: EL0000SF00
Regional Crosswalk Class:
Rank: G?/S4
Overview: This community occurs in low lying depressions within sandhill valleys. This community type is restricted to the Sandhills Region.
Physical Description: These lakes are shallow (usually less than 3 m deep) with saucer-shaped bottoms composed of sand, silt, or muck. They are also eutrophic and slightly to moderately alkaline (alkalinity <5,000 mg/l).
Vegetation: Floating and submergent plants are common. Species diversity is high compared to Sandhills Alkaline Lakes.
Dominant Plants: Dominant floating species include duckweed (Lemna spp.), greater duckweed (Spirodela polyrhiza), common bladderwort (Utricularia vulgaris), watermeal (Wolffia columbiana). Dominant submergents include coontail (Ceratophyllum demersum), American milfoil (Myriophyllum exalbescens), water nymph (Najas spp.), pondweeds (Potamogeton spp.), and horned pondweed (Zannichellia palustris).
Characteristics Plants:
Natural Processes: The lakes have open or closed basins and receive water from surface runoff and through exchange with the groundwater table. The lake water level is usually maintained at a level equal to that of ground water table. The lakes are intermittent and few maintain a permanent water table through a series of dry years.
Similar Communities: SANDHILL ALKALINE LAKES
Minimum Size: See above description of Lacustrine System.

FLOODPLAIN LAKES

Element Code: EL000FL00
Regional Crosswalk Class:
Rank: G?/S2
Overview: This community type occupies abandoned river channels on floodplains. Its most abundant in the Eastern Lowlands Region, but also occurs in other portions of the State.
Physical Description: Floodplain lakes are shallow, horseshoe-shaped bodies of water with sloping sides. The bottom is composed of sand, silt, clay, or muck. They are eutrophic and have freshwater.
Vegetation: Floating and submergent plants are abundant. Species diversity is moderately high.
Dominant Plants:
Characteristic Plants:
Natural Processes: Historically floodplain lakes were subject to frequent late winter, spring, and early summer flooding.
Similar Communities: LOWLAND FRESHWATER MARSH
Minimum Size: See above description of Lacustrine System.

RIVERINE SYSTEM

The Riverine System include wetlands and deepwater communities contained within a channel with the exceptions of wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens (Chapman 1988). Water is usually, but not always, flowing in Riverine Systems. Riverine Systems are bounded on the landward side by upland, channel bank (including natural and man-made levees), or wetland dominated by trees, shrubs, persistent emergent herbs, emergent mosses, or lichens. In braided streams, the Riverine System is bounded by the banks forming the outer limits of the depression within which the braiding occurs. Upland islands of palustrine wetlands may occur in the channel, but they are not included in the Riverine System. The Riverine System terminates at the downstream end where the channel enters a lake. It terminates at the upstream end where tributary streams originate, or where the channel leaves a lake. Springs discharging into a channel are considered part of the riverine communities (Chapman 1988).

RIVERS

Rivers have an average base flow rate ≥ 250 cfs.

LARGE WARMWATER RIVER

Element Code: ER0000LW00
Regional Crosswalk Class:
Rank: G?/S1
Overview: The Missouri River is the only river of this type in Nebraska.
Physical Description: Water temperature commonly exceeds 25 C. These rivers are very deep, wide and have a fast to slow current. The channel is meandering, sandbars and islands are abundant. They carry a very heavy silt load and usually have a sand or silt bottom.
Base Flow Rate: ≥ 10,000 cfs.
Characteristic Fish: Blue sucker (Cycleptus elongatus), burbot (Lota lota), bowfin (Amia calva), chestnut lamprey (Ichthyomyzon castaneus), paddlefish (Polyodon spathula), shovelnose sturgeon (Scaphirhynchus platorynchus), pallid sturgeon (S. albus), goldeye (Hiodon alosoides), American eel (Anguilla rostrata), skipjack herring (Alosa chrysochloris), and blue catfish (Ictalurus furcatus).
Natural Processes: Spring and early summer floods are frequent.
Similar Communities: WARMWATER RIVER

WARMWATER RIVER

Element Code: ER0000WR00
Regional Crosswalk Class:
Rank: G?/S3
Overview: They are most frequent in the Eastern Lowlands Region of the State but also occurs in the other Regions of the State.
Physical Description: Water temperature commonly exceeds 25 C. These rivers are shallow to deep, usually wide and have a moderately fast to slow current. The channel is usually meandering and sandbars may be abundant. They carry a heavy silt load and usually have a sand or silt bottom.
Base Flow Rate: ≥ 250 cfs but ≤ 10,000 cfs.
Characteristic Fish: River Carpsucker (Carpoides carpio), quillback (C. cyprinus), sturgeon chub (Hybopsis gelida), bigmouth buffalo (Ictiobus cyprinellus), shortnose gar (Lepisosteus platostomus), skipjack herring (Alosa chrysochloris), gizzard shad (Dorosoma cepedianum), emerald shiner (Notropis atherinoides), flathead chub (Hybopsis gracilis), freshwater drum (Aplodinotus grunniens), flathead catfish (Pylodictis olivaris), and channel catfish (Ictalurus punctatus).
Natural Processes: Spring and early summer floods are frequent. Low water levels are common during dry summers.
Similar Communities: WARMWATER STREAM

COLDWATER RIVER

Element Code: ER0000CR00
Regional Crosswalk Class:
Rank: G?/S1
Overview: This community type is restricted to the Foothills Region and possibly the Sandhills Region.
Physical Description: Water temperature seldom exceeds 25 C. These rivers are shallow to deep, and narrow to fairly wide. They carry a low to moderate silt load and have a sand or gravel bottom
Base Flow Rate: ≥ 250 cfs but ≤ 10,000 cfs.
Characteristic Fish: Though not native to Nebraska, rainbow trout (Salmo gairdneri), brown trout (S. trutta) and brook trout (Salvelinus fontinalis) are now characteristic species in Nebraska's Coldwater Rivers. Native characteristic fish include the longnose dace (Rhinichthys cataractae) and longnose sucker (Catostomus catostomus).
Natural Processes: Spring and early summer floods are frequent.
Similar Communities: COLDWATER STREAMS

STREAMS

Streams have an average base flow rate ≤ 250 cfs.

WARMWATER STREAM

Element Code: ER0000WS00
Regional Crosswalk Class:
Rank: G?/S4
Overview: This community type is most abundant in the Eastern Lowlands Region but also occurs in other Regions of the State.
Base Flow Rate: ≥ 5 cfs but ≤ 250 cfs.
Physical Description: Water temperature commonly exceeds 25 C. These streams are shallow, fairly narrow and have a meandering channel and frequent sandbars. They have a moderate to high silt load and have a sand, silt, or gravel bottom.
Characteristic Fish: Channel catfish (Ictalurus punctatus), yellow bullhead (I. natalis), sand shiner (Notropis stramineus), creek chub (Semotilus atromaculatus), red shiner (Notropis lutrensis), fathead minnow (Pimephales promelas), green sunfish (Lepomis cyanellus), and brassy minnow (Hybognathus hankinsoni).
Natural Processes: Spring floods are frequent. Low water levels occur during dry summers.
Similar Communities: WARMWATER RIVERS, SMALL WARMWATER STREAM

COLDWATER STREAM

Element Code: ER0000CS00
Regional Crosswalk Class:
Rank: G?/S2
Overview: This community type is most abundant in the Foothills and Sandhills Region of the State, but also occurs occasionally in the Eastern Lowlands Region.
Base Flow Rate: ≥ 5 cfs but < 250 cfs.
Physical Description: Water temperature seldom exceeds 25 C. These streams are shallow and have a narrow channel. They have a low to moderate silt load and a sand, silt, or gravel bottom.
Characteristic Fish: Though not native to Nebraska, rainbow trout (Salmo gairdneri), brown trout (S. trutta) and brook trout (Salvelinus fontinalis) are now characteristic species in Nebraska's Coldwater Streams. Native characteristic fish include pearl dace (Semotilus margarita), northern redbelly dace (Phoxinus eos), finescale dace (P. neogaeus), longnose dace (Rhinichthys cataractae), lake chub (Couesius plumbeus), brook stickleback (Culaea inconstans), and longnose sucker (Catostomus catostomus).
Natural Processes: Spring floods are frequent.
Similar Communities: COLDWATER RIVERS, SMALL COLDWATER STREAMS

SMALL WARMWATER STREAM

Element Code: ER0000WA00
Regional Crosswalk Class:
Rank: G?/S4
Overview: This community type is distributed over the entire State.
Base Flow Rates: < 5 cfs.
Physical Description: Water temperature commonly exceeds 25 C in the main portion of the stream, near springs temperatures may be lower. These streams are shallow and narrow usually with sand, silt or gravel bottoms.
Characteristic Fish:
Natural Processes: Floods are frequent. These streams may be intermittent
Similar Communities: WARMWATER STREAM

SMALL COLDWATER STREAM

Element Code: ER0000CO00
Regional Crosswalk Class:
Rank: G?/S3
Overview: This community type is generally restricted to the Sandhills and Foothills Region, but occurs occasionally in the other Regions of the State.
Base Flow Rate: < 5 cfs.
Physical Description: Water temperature seldom exceeds 25 C. These streams are shallow and narrow stream usually with a sand, silt or gravel bottoms.
Characteristic Fish:
Natural Processes: Floods are frequent. These streams may be intermittent.
Similar Communities: COLDWATER STREAMS

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Appendix E. Nebraska Natural Community Element Ranking Criteria.

Natural community element ranking criteria serves two basic functions 1) to set protection priorities for occurrences within each natural community type, and 2) to assist in setting stewardship objectives for natural community types. Ranking criteria have been developed for each major physiognomic group (e.g. grasslands or woodlands) within both the Terrestrial and Palustrine Systems. The ranking criteria consists of four Grades - A,B,C, and D; and are based on the "condition" (how much the site has been damaged or altered from its optimal character or condition) of a site. These grades are briefly summarized below.

Grade A - These occurrences are virtually undisturbed or have experienced light disturbance, but recovered to the extent where community structure and composition reflects or nearly reflects natural conditions. They represent "climax" or "subclimax" communities. Grade A occurrences are dominated by conservative plant species (species that decrease under disturbance).

Grade B - These occurrences have experienced light to moderate disturbance from natural or man-induced forces. They represent "seral" or "disclimax" communities. Grade B occurrences have a general increase in the number and density of non-conservative species (species that increase under disturbance) relative to Grade A occurrences. They have usually retained the majority of their natural components and functions and can be restored to Grade A levels with proper management and time.

Grade C - These occurrences have experienced moderate to heavy disturbance. They represent "early seral" or "disclimax" communities. Grade C occurrences are usually dominated by non-conservative plant species. The level of disturbance is often of such severity that components or functions of the community may have been permanently lost. In general, they can be restored to Grade B levels, but not Grade A levels with out an extensive period of time.

Grade D - These occurrences have experienced severe disturbance. They represent "disclimax" communities. Grade D occurrences are dominated by very hardy non-conservative species or exotics. They have little recovery potential without major restoration work.

In most circumstances, protection priority should be placed on Grade A occurrences, all other factors (size, viability, defensibility, and availability) being equal, due to their rarity in the landscape. Though Grade B occurrences might be a sere of Grade A occurrences and thus be "just as natural", they tend to be more common in the present day landscape. Also, it is relatively easy to revert a climax or subclimax community to an earlier state of succession, but it requires more intensive

management to do the opposite. Grade C occurrence should not receive high protection priority unless 1) they are one of the few remaining examples of a community type, 2) they are of very large size, and 3) they are part of a large landscape preserve. Grade D occurrences should not be protected unless intensive restoration efforts are planned.

For most community types stewardship objectives should concentrate on restoring occurrences to higher grade levels (e.g. Grade C to Grade B or Grade B to Grade A) or maintaining Grade A occurrences at Grade A levels. For community types where natural disturbances are a reoccurring function of the system (e.g. grazing in grasslands) maintaining all or portions of a community type at Grade B levels may be a desirable stewardship.

List of conservative and non-conservative plants species for each community type have not yet been developed.

TERRESTRIAL STYSTEM

GRASSLANDS

Grade A - These occurrences are virtually undisturbed or have experienced light disturbance from haying, grazing, fire suppression, and/or infrequent herbicide spraying, but have recovered to an extent where community composition and structure nearly reflects natural conditions. Conservative grassland species are conspicuous throughout each occurrence relative to non-conservative species. There is a virtual lack of exotics.

Grade B - These occurrences have experienced moderate disturbance from haying, grazing, fire suppression, seeding with exotics, and/or infrequent herbicide spraying. There is a decrease in number and density of conservative grassland species and an increase in number and density of non-conservative grassland species relative to Grade A occurrences. Exotics may be present in low to moderate abundance.

Grade C - These occurrences have experienced heavy disturbance from grazing, fire suppression, herbicide spraying, and/or seeding with exotics. There is a low number and density of conservative grassland species relative to Grade A or Grade B occurrences and a general dominance by non-conservative grassland species. Exotics and/or woody species may dominate in localized areas and have a moderate to high overall abundance.

Grade D - These occurrences have experienced severe disturbance from grazing, frequent herbicide spraying, and/or tillage. Conservative grassland species remain only as vestiges. Very hardy non-conservative grassland, woody, and/or exotic species dominate.

SAVANNAS

Grade A - These occurrences are virtually undisturbed or have experienced light disturbance from haying, grazing, fire suppression, cutting, and/or infrequent herbicide spraying, but have recovered to an extent where community composition and structure nearly reflects natural conditions. Grade A occurrences have an overstory dominated by mid-aged (50-90 years), mature (90-120 years), and/or old growth (120 years +) trees which maintain a stable canopy cover (5-30%) with frequent burning. Conservative grassland species are conspicuous throughout the groundlayer relative to non-conservative grassland and/or woody species. There is a virtual lack of exotics.

Grade B - These occurrences include savannas with an overstory dominated by mature and/or old growth trees which have experienced moderate disturbance from haying, grazing, fire suppression, cutting, and/or herbicide spraying. Grade A occurrences have a decrease in the number and density of conservative grassland species within the groundlayer and an increase in number and density of non-conservative grassland and/or woody species relative to Grade A occurrences. Exotics may be present in low to moderate abundance. Grade B occurrences also includes virtually undisturbed to moderately disturbed savannas with an overstory dominated by young (20-50 years) trees. These occurrences have a groundlayer similar to Grade A occurrences. Also included here are occurrences where forest trees are becoming well established in the understory due to fire suppression.

Grade C - These occurrences include savannas with an overstory dominated by young, mid-aged, mature, and/or old growth trees which have experienced heavy disturbance from grazing, fire suppression, cutting and/or herbicide spraying. The groundlayer has a low number and density of conservative grassland species relative to Grade A and Grade B occurrences and a general dominance by non-conservative grassland species. Exotics and/or woody species may dominate in localized areas and have a moderate to high overall abundance.

Grade D - These occurrences include savannas which have experienced severe disturbance from grazing, cutting, herbicide spraying, and/or tillage. Within the groundlayer conservative grassland species occur only as vestiges and very hardy non-conservative grassland, woody and/or exotic species dominate. Grade D occurrences also include stands where forest trees have become dominate in the overstory due to fire suppression.

WOODLANDS

Grade A - These occurrences are virtually undisturbed or have experienced light disturbance from grazing, fire suppression, and/or cutting, but have recovered to an extent where community structure and composition nearly reflects natural conditions. Grade A occurrences have an overstory dominated by mid-aged (50-90 years), mature (90-120 years), and/or old growth (120 years +) trees which maintain a stable canopy cover (30-80%) with occasional burning. These woodlands may be even-aged or all-aged. Conservative woodland species are conspicuous throughout the groundlayer relative to non-conservative woodland species. There is a virtual lack of exotics.

Grade B - These occurrences include woodlands with an overstory dominated by mid-aged, mature, and/or old growth trees which have experienced moderate disturbance from grazing and/or cutting. These woodlands tend towards being even-aged since past grazing may have effected tree reproduction or cutting may have eliminated some age classes. Grade B occurrences have a decrease in the number and density of conservative woodland species within the groundlayer and an increase in number and density of non-conservative woodland species relative to Grade A occurrences. Exotics may be present in low to moderate abundance. Grade B occurrences also include relatively undisturbed to lightly disturbed woodlands with an overstory dominated by young (20-50 years) trees. These woodlands have a groundlayer similar to Grade A occurrences though it may have a somewhat lower species diversity.

Grade C - These occurrences include woodlands with an overstory dominated by mid-aged, mature, and/or old growth trees which have experienced heavy disturbance from grazing and/or cutting. These stands are usually even-aged. The groundlayer has a low number and density of conservative woodland species relative to Grade A and Grade B occurrences, and a general dominance by non-conservative woodland species. Exotics may dominate in localized areas and have a moderate to high overall abundance. Grade C occurrences also include moderately to heavily disturbed woodlands with an overstory dominated by young trees (this includes second growth stands). The groundlayer of these occurrences is similar to that described above. Also included here are occurrences where forest trees are becoming well established in the understory due to fire suppression.

Grade D - These occurrences include woodlands with an overstory dominated by young, mid-aged, mature, and/or old growth trees which have experienced severe disturbance from grazing and/or cutting. If grazing is severe there may be no tree reproduction. Within the groundlayer conservative woodland species remain only as vestiges and very hardy non-conservative woodland and/or exotics dominate. Grade D occurrences also include stands where

forest trees have succeeded woodland trees due to fire suppression and now dominate the stand.

FORESTS

Grade A - These occurrences are virtually undisturbed or have experienced recent light disturbance from grazing and/or cutting, but have recovered to an extent where community structure and composition nearly reflects natural conditions. Grade A occurrences have an all-aged overstory (minor gaps may occur) dominated by mature (90-120 years) and/or old growth trees (120 years +) which maintain a stable canopy cover of > 80% (these stands may be second growth). Conservative forest species are conspicuous throughout the understory and groundlayer relative to non-conservative forest species. There is a virtual lack of exotics.

Grade B - These occurrences include forest with an overstory dominated by mature and/or old growth trees which have experienced recent moderate disturbance from grazing and/or cutting. Grade B occurrences also include virtually undisturbed to lightly disturbed forests with an overstory dominated by mid-aged (50-90 years) trees, these stands may be second growth. These forests may have rather significant gaps in the age class structure of the overstory trees resulting from past grazing and/or cutting. The understory and groundlayer have reduced number and density of conservative forest species and an increase in the number and density of non-conservative forest species relative to Grade A occurrences. Exotics may also be present in low to moderate abundance.

Grade C - These occurrences include forests with an overstory dominated by mid-aged, mature, and/or old growth trees which have experienced recent heavy disturbance from grazing and/or cutting. Also included here are forest dominated by young (20-50 years) trees. These are second growth stands, but have been relatively undisturbed since past cutting. Grade C occurrences may have very significant gaps in the age class structure of the overstory trees resulting from the past grazing and/or cutting. The understory and groundlayer have a low number and density of conservative forest species relative to Grade A and B occurrences and a general dominance by non-conservative forest species. Exotics may dominate in localized areas and have a moderate to high overall abundance.

Grade D - These occurrences include forests dominated by young, mid-aged, mature, and/or old growth trees which have experienced severe disturbance from grazing or cutting. The tree age class structure is highly disrupted and tree reproduction is virtually absent. The understory (if present) and groundlayer have a virtual absence of conservative forest species except for

vestiges and very hardy non-conservative forest species and/or exotics dominate.

SPARSELY VEGETATED COMMUNITIES

Grade A - These occurrences are virtually undisturbed or have experienced light disturbance from grazing, cutting of trees (includes trees which shade wet cliffs but are not on them), and/or off-road vehicle use, but have recovered to an extent where community structure and composition reflects natural conditions. There has been no loss of natural species diversity and there is a virtual lack of exotics.

Grade B - These occurrences have experienced moderate disturbance from grazing, cutting of trees, off-road vehicle use, and/or mechanical removal of substrate. Natural species diversity may be somewhat lower than Grade A occurrences and exotics may be present in low to moderate abundance.

Grade C - These occurrences have experienced heavy disturbance from cutting of trees, off-road vehicle use, and/or mechanical removal of substrate. Natural species diversity is lower than Grade B occurrences and exotics may dominate in localized areas and have a moderate to high overall abundance.

Grade D - These occurrences have been severely disturbed by mechanical removal of substrate. If vegetated, they may be dominated by exotics.

PALUSTRINE STYSTEM

MARSHES

Grade A - These occurrences are virtually undisturbed or have experienced light disturbance from haying and/or grazing, but have recovered to the extent where community structure and composition reflects natural conditions. The hydrology of the marshes is stable, though variable, and has not been altered by roads, dikes, dams, drains, ditches, stream channelization, or reduced water flows in adjacent streams. The water may have slightly increased levels of nutrients and/or pesticides, but not to the point where it effects species composition. Conservative marsh species are conspicuous relative to non-conservative marsh species. Exotics may dominate in localized areas, but have a low overall abundance.

Grade B - These occurrences include wetlands which are hydrologically intact, but have experienced moderate to heavy disturbance from grazing. Grade B occurrences also includes marshes which have been either 1) deepened by local dredging, 2)

have limited accelerated water flow due to drains or ditches, or 3) have limited obstructed water flow due to dikes or dams. Grade B occurrences may have a decrease in the number and density of conservative marsh species and an increase in the number and density of non-conservative marsh species (and possibly upland species) relative to Grade A occurrences. Exotics may dominate in localized areas and have a low to moderate overall abundance. The water may have slightly increased levels of nutrients and/or pesticides, but not to the point where it effects species composition. For Grade B occurrences to be restored to Grade A condition the natural hydrology must be restored.

Grade C - These occurrences include marshes which 1) are stabilized or artificially regulated by dikes or dams, 2) have significantly accelerated water flow due to drains or ditches, 3) have been tilled in past dry years, but still maintains a natural hydrology, and 4) have experienced significant degradation of water quality due to pollution. Grade C occurrences have a decrease in the number and density of conservative marsh species and a general dominance by non-conservative wetland species relative to Grade A and Grade B occurrences. Exotics may dominate substantial portions of Grade C occurrences and have a moderate to high overall abundance. For Grade C occurrences to be restored to Grade B levels the natural hydrology and water quality must be restored.

Grade D - These occurrences include wetlands which have been totally drained due to drains or ditches or have received fill material. These sites may no longer resemble wetlands and may be tilled. The vegetation is dominated by upland species.

GROUNDWATER SEEPAGE COMMUNITIES

Grade A - These occurrences are virtually undisturbed or have experienced light disturbance from haying, grazing, fire suppression, and/or infrequent herbicide spraying, but have recovered to the extent where community structure and composition nearly reflects natural conditions. The hydrology has not been altered by ditches, drains, livestock watering structures, and/or reduced groundwater levels. The groundwater may have slightly increased levels of nutrients and/or pesticides, but not to the point where it affects species composition. Conservative seepage community species are conspicuous throughout each occurrence relative to non-conservative seepage community species. Exotics are virtually absent.

Grade B - These occurrences include groundwater seepage communities which are hyrdrologically intact but have experienced moderate disturbance from haying, grazing, fire suppression, and/or occasional herbicide spraying. Grade B occurrences also include sites with limited alteration of the natural hydrology

from development of livestock watering structures, partial ditching, and/or reduction in groundwater flows. Grade B occurrences have a decrease in the number and density of conservative seepage community species and an increase in number and density of non-conservative seepage community and/or woody species relative to Grade A occurrences. Exotics may be present in low to moderate abundance. The groundwater may have slightly increased levels of nutrients and/or pesticides, but not to the point where it affects species composition. For Grade B occurrences to be restored to Grade A levels the natural hydrology must be restored.

Grade C - These occurrences include groundwater seepage communities which are hydrologically intact but have experienced heavy disturbance from grazing, fire suppression, and/or frequent herbicide spraying. Grade C occurrences also include sites with significant alteration of the natural hydrology from ditching, tilling, or reduction in groundwater levels; and sites where increased levels of nutrients and/or pesticides in the groundwater has affected species composition. Grade C occurrences have a low number and density of conservative seepage community species and a general dominance by non-conservative seepage community and/or woody species. Exotics may dominate localized areas and have a moderate to high overall abundance. For Grade C occurrences to be restored to Grade B levels the natural hydrology and water quality must be restored.

Grade D - These occurrences include groundwater seepage communities which are hydrologically intact but have experienced severe disturbance from grazing and/or herbicide spraying. Grade C occurrences also include sites which have experienced severe alteration of the natural hydrology from ditching, tilling, or reduction in groundwater levels to the point where the sites no longer resemble wetlands; and sites which have been mined for peat. Grade D occurrences are dominated by upland, woody, and/or exotic species.

GRASSLANDS

Grade A - These occurrences are virtually undisturbed or have experienced light disturbance from haying, grazing, fire suppression, and/or infrequent herbicide spraying, but have recovered to an extent where community composition and structure nearly reflects natural conditions. Conservative grassland species are conspicuous throughout each occurrence relative to non-conservative grassland species and exotics. However, since sites are subject to natural flooding and silt deposition localized dominance by non-conservative grassland species and/or exotics may occur. The hydrology has not been altered by dikes, drains, ditches, stream channelization, or reduced groundwater levels resulting from pumping or reduced instream flows of

adjacent streams.

Grade B - These occurrences include grasslands which are hydrologically intact but have experienced moderate disturbance from haying, grazing, fire suppression, seeding with exotics, and/or infrequent herbicide spraying. Grade B occurrences also include occurrences with limited alteration of the natural hydrology from dikes, ditches, drains, or reduced groundwater levels. Grade B occurrences have a decrease in number and density of conservative grassland species and an increase in number and density of non-conservative grassland and/or woody species relative to Grade A occurrences. Exotics may have a low to moderate overall abundance and dominate in localized areas. For Grade B occurrences to be restored to Grade A condition the natural hydrology must be restored.

Grade C - These occurrences include grasslands which are hydrologically intact, but have experienced heavy disturbance from grazing, fire suppression, seeding with exotics, and/or herbicide spraying. Grade C occurrences also include sites with significant alteration of the natural hydrology from dikes, ditches, drains, or reduced groundwater levels. Grade C occurrences have a low number and density of conservative grassland species and a general dominance by non-conservative grassland, upland, and or woody species. Exotics may dominate in localized areas and have a moderate to high overall abundance.

Grade D - These occurrences include grasslands which are hydrologically intact but have experienced severe disturbance from grazing and/or frequent herbicide spraying. Grade D occurrences also includes sites where the hydrology has been severely disrupted by ditching, drains, or reduced groundwater levels to the point where the sites no longer resemble wetlands and may be tilled. Conservative grassland species remain only as vestiges. Very hardy non-conservative grassland, upland, woody, and/or exotic species dominate.

SAVANNAS

Grade A - These occurrences are virtually undisturbed or experienced light disturbance from haying, grazing, fire suppression, cutting, and/or infrequent herbicide spraying, but have recovered to an extent where community composition and structure nearly reflects natural conditions. Grade A occurrences have an overstory dominated by young (20-50 years), mid-aged (50-90 years), mature (90-120 years) and/or old growth (120 years +) trees which maintain a stable cover (5-30%) with frequent burning. Within the groundlayer conservative grassland species are conspicuous relative to non-conservative grassland and/or woody species. Since sites are subject to natural flooding and silt deposition non-conservative grassland and/or exotic species

may dominate in localized areas, but have a low overall abundance. The hydrology has not been altered by dikes, ditches, drains, stream channelization, or reduced groundwater levels resulting from pumping or reduced instream flows in adjacent streams.

Grade B - These occurrences include savannas which are hydrologically intact and have an overstory dominated by young, mid-aged, mature, and/or old growth trees which have experienced moderate disturbance from haying, grazing, fire suppression, cutting, and/or infrequent herbicide spraying. Grade B occurrences also include savannas with limited alteration of the hydrology by dikes, ditches, drains, or reduced groundwater levels. The groundlayer of these occurrences has a decrease in the number and density of conservative grassland species and an increase in the number and density of non-conservative grassland and/or woody species relative to Grade A occurrences. Exotics have a low to moderate overall abundance. For Grade B occurrences to be restored to Grade A levels the natural hydrology must also be restored.

Grade C - These occurrences include savannas which are hydrologically intact and have an overstory dominated by young, mid-aged, mature, and/or old growth trees which have experienced heavy disturbance from grazing, fire suppression, cutting, and/or herbicide spraying. Grade C occurrences also includes sites which have experienced significant alteration of their hydrology from dikes, ditches, drains, or reduced groundwater levels. The groundlayer of Grade C occurrences has a low number and density of conservative grassland species and a general dominance by non-conservative grassland species. Exotics and woody species may dominate in localized areas and have a moderate to high overall abundance. For Grade B occurrences to be restored to Grade A levels the hydrology must also be restored.

Grade D - These occurrences include savannas which are hydrologically intact but have experienced severe disturbance from grazing and/or herbicide spraying. Grade D occurrences also includes sites where the hydrology has been severely disrupted by ditching, draining, or reduced groundwater levels to the point where the sites no longer resemble wetlands. Within the groundlayer of Grade D occurrences conservative grassland species remain only as vestiges and very hardy non-conservative grassland, upland, woody, and/or exotic species dominate. Grade D occurrences also include stands where forest trees have become dominate in the overstory due to fire suppression.

WOODLANDS

Grade A - These occurrences are virtually undisturbed or experienced light disturbance from grazing, fire suppression, and/or cutting but have recovered to an extent where community composition and structure nearly reflects natural conditions. Grade A occurrences have an overstory dominated by mid-aged (50-90 years), mature (90-120 years), and/or old growth (120 years +) trees which maintain a stable cover (40-80%) with occasional burning. Conservative woodland species are conspicuous throughout the groundlayer relative to non-conservative woodland species. Since sites are subject to natural flooding and silt deposition non-conservative woodland and/or exotic species may dominate in localized areas, but have a low overall abundance. The hydrology has not been altered by dikes, ditches, drains, or reduced groundwater levels resulting from pumping or reduced instream flows in adjacent streams.

Grade B - These occurrences include hydrologically intact woodlands with an overstory dominated by young (20-50 years), mid-aged, mature, and/or old growth trees which have experienced light to moderate disturbance from grazing, cutting, and/or fire suppression. Grade B occurrences also includes sites where the hydrology has been somewhat altered by dikes, ditches, or reduced groundwater levels. The groundlayer of these occurrences has a decrease in number and density of conservative woodland species and an increase in the number and density of non-conservative woodland species. Exotics may dominate in localized areas and have a low to moderate overall abundance. For Grade B occurrences to be restored to Grade A conditions the natural hydrology must also be restored to the site.

Grade C - These occurrences include woodlands with an overstory dominated by young, mid-aged, mature, and/or old growth trees which have experienced heavy disturbance from grazing and/or cutting. The groundlayer of such occurrences has a low number and density of conservative woodland and/or grassland species and a general dominance by non-conservative woodland and/or grassland species. Exotics may dominate in localized areas and have a moderate to high overall abundance. Grade C occurrences also includes woodlands where the hydrology has been significantly altered by dikes, ditches, or reduced groundwater levels. For Grade C occurrences to be restored to Grade B levels the natural hydrology of the site must also be restored.

Grade D - These occurrences include woodlands with an overstory dominated by young, mid-aged, mature, and/or old growth trees which have experienced severe disturbance from grazing and/or cutting. Grade D occurrences also includes sites where the hydrology has been severely disrupted by ditching or reduced groundwater levels to the point where the sites no longer resemble wetlands. Within the groundlayer conservative woodland

species remain only as vestiges and there is a dominance by very hardy non-conservative woodland species and/or exotics.

FORESTS

Grade A - These occurrences are virtually undisturbed or have experienced light disturbance from grazing and/or cutting, but have recovered to the extent where community composition reflects natural conditions. Grade A occurrences have an overstory dominated by mature (90-120 years) and/or old growth (120 years +) trees which maintain a stable cover (> 80%). These stands are all-aged, though stands dominated by Populus deltoides (seral stands) may be even-aged. Conservative forest species are conspicuous throughout the understory and groundlayer relative to non-conservative forest species. Since sites are subject to natural flooding and silt deposition non-conservative forest and/or exotic species may dominate the groundlayer in localized areas, but have a low overall abundance. The hydrology is natural and intact, and has not been altered by dikes, ditches, or reduced groundwater levels resulting from pumping or channelization of or reduced instream flows in adjacent streams.

Grade B - Grade B occurrences include hydrologically intact forests with 1) an overstory dominated by mature and/or old growth trees which have experienced moderate disturbance from grazing and/or cutting, or 2) an overstory dominated by young (20-50 years) and/or mid-aged (50-90 years) trees which are relatively undisturbed or have experienced light disturbance from grazing and/or cutting. Grade B occurrences also includes forests where the hydrology has been somewhat altered by dikes, ditches, or reduced groundwater levels. Grade B occurrences may have significant gaps in the tree age class structure as a result of the disturbance. The understory and groundlayer have a decrease in the number and density of conservative forest species and an increase in the number and density of non-conservative forest species relative to Grade A occurrences. For Grade B occurrences to be restored to Grade A condition the natural hydrology must also be restored.

Grade C - These occurrences include hydrologically intact forests with 1) an overstory dominated by young, mid-aged, mature, and/or old growth trees which have experienced heavy disturbance from grazing and/or cutting, or 2) an overstory dominated by young trees which have experienced moderate disturbance from grazing and/or cutting. Grade B occurrences also includes forests where the hydrology has been somewhat altered by dikes, ditches, or reduced groundwater levels. These forests often have significant gaps in the tree age class structure resulting from the disturbance. The understory and groundlayer have a low number and density of conservative forest species relative to Grade A and Grade B occurrences and a general dominance by non-conservative

forest species. Exotics may dominate localized areas and have a moderate to high overall abundance. For Grade C occurrences to be restored to Grade B condition the hydrology must be restored to Grade B levels.

Grade D - These occurrences include forests with an overstory dominated by young, mid-aged, mature, and/or old growth trees which have experienced severe disturbance from grazing and/or cutting. Grade D occurrences also includes sites where the hydrology has been severely disrupted by ditching or reduced groundwater levels to the point where the sites no longer resemble wetlands. Within the groundlayer conservative forest species remain only as vestiges and very hardy non-conservative forest, upland, and/or exotics species dominate.

SPARSELY VEGETATED COMMUNITIES

The following rank descriptions apply only to the Sandbar natural community type.

Grade A - The hydrology of these occurrences is relatively natural and intact, though adjacent streams may experience reduced instream flows and disruption of the natural flood regime, but not to the extent where it allows woody species encroachment. These occurrences are unaffected by grazing and receive only minor off-road vehicle use.

Grade B - These occurrences include sandbars where the natural hydrology has been somewhat altered from reduced instream flows and modification of the natural flood regime to the point where woody species encroachment is a problem. Grade B occurrences also include sandbars that receive light to moderate disturbance from grazing or off-road vehicle use.

Grade C - These occurrences include sandbars where the natural hydrology has been significantly altered from reduced instream flows and modification of the natural flood regime to the point where woody species encroachment is a major problem. Also included here are sandbars that receive moderate to heavy disturbance from grazing or off-road vehicle use.

Grade D - These occurrences include sandbars where the natural hydrology has been so severely altered from reduced instream flows and modification of the natural flood regime that the sandbars no longer resemble a palustrine system. The sandbar formation process no longer occurs.