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### The Nebraska Natural Legacy Project

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# **The Nebraska Natural Legacy Project**



**A Comprehensive Wildlife Conservation  
Strategy**

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A Comprehensive Wildlife Conservation Strategy

Rick Schneider  
Mark Humpert  
Kristal Stoner  
Gerry Steinauer

The Nebraska Game and Parks Commission  
Lincoln, Nebraska  
August, 2005



Numerous individuals contributed to the success of this endeavor. Appendix 1 lists the members of the various teams that worked on the Natural Legacy Project.



# Table of Contents

<b>Forward</b>	<i>vii</i>
<b>Chapter 1 Introduction and Purpose</b>	<b>1</b>
Mission Statement and Guiding Principles	1
Purpose and Need	2
Eight Required Elements of the Strategy	3
Value of CWCS to Nebraska	4
<b>Chapter 2 Plan Development Process / Approach</b>	<b>6</b>
Organizational Structure	6
Public Involvement	8
Conservation Practitioner Involvement in Development	8
Additional Input	9
Involving Partners in Plan Implementation	10
Plan to Review and Revise the Strategy	11
<b>Chapter 3 Methodology: Identifying Ecological Communities, At-risk Species and Biologically Unique Landscapes</b>	<b>12</b>
A Systematic Approach to Biological Diversity	
Conservation	12
Ecological Communities: A Coarse Filter	15
At-risk Species: The Fine Filter	17
Selecting Biologically Unique Landscapes	21
<b>Chapter 4 Conservation Actions to Address Barriers to Conservation and Stresses Affecting Species and Habitats</b>	<b>25</b>
Increase collaboration and communication	26
Increase environmental education	28
Improve conservation programs and incentives	30
Promote management that is more compatible with conserving biological diversity	32
Focus conservation on the best opportunities	43
Expand the network of public and private conservation lands	44
Increase participation in nature-based recreation	46
<b>Chapter 5 Tallgrass Prairie Ecoregion</b>	<b>49</b>
Introduction	49
Dominant Landuse and History	52

	Nature-based Recreation	53
	Education	54
	Partnerships	55
	Ecoregion-specific Stresses and Conservation Actions	56
	Biologically Unique Landscapes	58
<b>Chapter 6</b>	<b>Mixedgrass Prairie Ecoregion</b>	<b>78</b>
	Introduction	78
	Dominant Land use and History	82
	Nature-based Recreation	83
	Education	84
	Partnerships	85
	Ecoregion-specific Stresses and Conservation Actions	87
	Biologically Unique Landscapes	89
<b>Chapter 7</b>	<b>Sandhills Ecoregion</b>	<b>106</b>
	Introduction	106
	Dominant Land use and History	110
	Nature-based Recreation	111
	Education	112
	Partnerships	113
	Ecoregion-specific Stresses and Conservation Actions	114
	Biologically Unique Landscapes	116
<b>Chapter 8</b>	<b>Shortgrass Prairie Ecoregion</b>	<b>133</b>
	Introduction	133
	Dominant Land use and History	136
	Nature-based Recreation	137
	Education	138
	Partnerships	139
	Ecoregion-specific Stresses and Conservation Actions	140
	Biologically Unique Landscapes	142
<b>Chapter 9</b>	<b>Adaptive Management, Monitoring, Inventory and Research</b>	<b>157</b>
	Adaptive Management	157
	Monitoring	158
	Databases	160
	Inventory and Research	160
<b>References</b>		<b>164</b>

## **Appendices**

1. Natural Legacy Project Teams
2. National Guidance on Strategy Development
3. State Wildlife Grants
4. Natural Heritage Conservation Status Ranks
5. SPOT Analysis
6. Heritage Hotspots Analysis
7. Ecological Communities of Nebraska
8. Tier I At-risk Species
9. Tier II At-risk Species
10. Map of the Ecoregions of Nebraska





## Forward

As Nebraskan's we value wildlife for many different reasons. Whether you are a hunter who is fervent about stalking a mule deer, an angler who lives for the thrill of catching a trophy, a birdwatcher who rises before the sun to see an elusive warbler, or simply a grandparent who looks forward to sharing a passion for butterflies with a child—wildlife is interwoven in the fabric of our culture. The animals and plants that make up Nebraska's natural legacy offer all of us a vital connection to our past, a resource to be enjoyed in the present, and a responsibility to conserve for future generations. The Nebraska Natural Legacy Project lays out a vision for conserving our state's rarest species while at the same time perpetuating the continued existence of more common species.

When the Nebraska Game and Parks Commission began work on a comprehensive wildlife conservation strategy (Nebraska Natural Legacy Project) two and a half years ago, we had to decide on an approach that would ensure we developed the best plan possible. The agency could have drawn only from the expertise of professional biologists, or alternatively sought input from a wide diversity of stakeholders. We decided to utilize both and what resulted was one of the largest collaborative efforts ever undertaken on behalf of wildlife in the state's history. Sixteen public input meetings, a conservation practitioners workshop, and dozens of meetings with the state's biological experts and conservation and agricultural leaders has culminated in a proactive conservation plan that is based on the best available science and has a high probability for successful implementation.

This plan, for the first time, uses a comprehensive dataset to identify priorities for the conservation of the state's rarest species and natural habitats. It also provides a roadmap to guide conservation work in those landscapes that offer our greatest hope for conserving the full array of biological diversity. Through this process we have significantly increased our understanding of species and habitats, identified critical threats to animals and plants, developed actions that will lead to conservation of Nebraska's biological diversity, and established a solid partnership approach.

A twenty member Partnership Team that represented the interests of Nebraska's conservation, agricultural, and Native American communities guided this planning process. The efforts of these individuals helped ensure that this plan is supported by and useful to the majority of the state's citizens. The Partnership Team also provided a forum for the exchange of ideas and collaborative decision-making and raised the level of trust and respect amongst its participants. The success of this team is exhibited by the eagerness of its members to continue working together as we move to the next stage of implementation.

In today's ever changing society, it's more important than ever that we have a plan for the future. Although we are headed towards uncharted waters, we now have a compass and a roadmap that better prepares us for the challenges ahead. The future for Nebraska's natural legacy looks bright.

Dr. Mark Pinkerton, Chair

Bill Grewcock, Vice Chair  
Nebraska Game and Parks Commission

## Chapter 1: Introduction and Purpose

### *Mission Statement*

*The mission of Nebraska's Natural Legacy Project is to develop and implement a blueprint for conserving Nebraska's flora, fauna and natural habitats through the proactive, voluntary conservation actions of partners, communities and individuals.*

To facilitate the development and implementation of a comprehensive wildlife conservation plan for Nebraska, the following guiding principles were developed by the Partnership Team.

### *Guiding Principles*

#### **Through the process of development, Nebraska's Natural Legacy Project shall...**

- ❖ ... be open, transparent and inclusive.
- ❖ ... be built on a foundation of sound economic and scientific principles.
- ❖ ... keep the public informed and involved.

#### **The blueprint produced by Nebraska's Natural Legacy Project shall...**

- ❖ ...recognize private landowner participation is critical to the success of NNLP.
- ❖ ...recognize and respect property rights and address property issues.
- ❖ ...have opportunities for conservation actions and partnerships across the state.
- ❖ ...ensure all participating with NNLP are respected and treated fairly.
- ❖ ...encourage involvement through consistent and thorough information exchange.
- ❖ ...provide opportunities for developing conservation partnerships regardless of ownership.

#### **Conservation actions as a result of Nebraska's Natural Legacy Project shall...**

- ❖ ... be voluntary and incentive based.
- ❖ ... minimize the use of land acquisition as the primary tool for habitat conservation and instead principally use actions directed toward conservation on private lands.

## Purpose and Need

Nebraska's rich biological diversity is composed of thousands of plant and animal species interacting with each other and the environment. The flora and fauna of the state, along with natural habitats they occupy, form Nebraska's natural heritage – a legacy that should be treasured just as we do our cultural heritage. Unfortunately, populations of many once common species have declined due to a variety of stresses including habitat loss, habitat degradation, diseases, and competition and predation from invasive exotic species. While conservation actions in the past have had notable successes, they have not been sufficient to stem the tide of species decline. There is a need for a comprehensive, systematic and proactive approach to conserving the full array of Nebraska's biological diversity.

The goals of the Natural Legacy Project are to:

- ❖ Reverse the decline of at-risk species (and avoid the need for state or federal listing as threatened or endangered)
- ❖ Recover currently listed species and allow for their de-listing
- ❖ Keep common species common

Almost all existing natural habitat in Nebraska, and the biological diversity it supports, resides on lands under private ownership. All Nebraskan's benefit from the strong conservation tradition and sound stewardship of private landowners. The Nebraska Natural Legacy Project seeks to continue this tradition while at the same time creating new opportunities for collaboration between farmers, ranchers, communities, private and governmental organizations and others for conserving Nebraska's biological diversity, our natural heritage. As stewards for the next generation, it is our responsibility to ensure the treasures that were handed to us by nature and our predecessors are still here for future generations of Nebraskans to enjoy.

## Conservation Funding

For more than fifty years, state fish and wildlife agencies have benefited from funds provided by the Federal Aid in Wildlife Restoration Act (Pittman-Robertson), the Federal Aid in Sport Fisheries Restoration Act (Dingell-Johnson, Wallop-Breaux). These monies are collected through a federal excise tax on hunting and fishing equipment. In conjunction with revenues collected through the sale of hunting and fishing licenses and habitat stamps, these funds have provided consistent support for the conservation and management of game fish and wildlife species. These monies have been critical to the establishment of the Game and Parks Commission's long-term conservation planning and have led to significant results in Nebraska. Species such as white-tailed deer, pronghorn antelope, bighorn sheep, elk, Canada geese, turkey and walleye, which were in low numbers or extirpated from the state in the early 1900s, have shown dramatic rebounds.

In Nebraska, game species make up about 1% of the estimated 30,000 species. While many of the state's nongame species have received substantial benefits from habitat conservation and restoration directed at game species, their needs have not been fully met. Conservation efforts for these species have in large part been opportunistic and crisis-driven, limited by a lack of funding and by a lack of strategic approaches to species

and habitat conservation. Today, with more than 1,200 species in the U.S. listed on the Federal Endangered and Threatened species list, and many more species in decline, the need has never been greater for a complimentary source of funding to support the conservation, protection, and restoration of the full array of species, especially those not covered under traditional funding strategies. It is time to take measures that aid in the recovery of declining species and ensure that common species remain common.

A coalition including more than 3,000 organizations representing wildlife enthusiasts such as birdwatchers hunters, anglers, and others was organized in the mid 1990's and is one of the largest grassroots coalitions of its kind in the nation's history. This coalition, known as Teaming with Wildlife, was created in part to demonstrate support for federal wildlife conservation funding that can be used to address the needs of declining fish and wildlife. In response to the Teaming with Wildlife Coalition, Congress established the Wildlife Conservation and Restoration program and the State Wildlife Grants Programs in 2001.

As a requirement for receiving funding through these two new programs, Congress required each state to develop a "Comprehensive Wildlife Conservation Strategy" (CWCS). Nebraska's comprehensive wildlife conservation strategy is called the "Nebraska Natural Legacy Project". The CWCS developed in Nebraska and in every other state will provide an essential foundation for the future of wildlife conservation and a stimulus to engage the States, federal agencies, and other conservation partners to strategically think about their individual and coordinated roles in prioritizing and delivering conservation work. The Natural Legacy Project is designed to be a blueprint for conservation that all organizations can use in Nebraska, not simply a plan for the Nebraska Game and Parks Commission.

#### Eight Required Elements of the Comprehensive Wildlife Conservation Strategy

Congress identified eight required elements to be addressed in each state's Comprehensive Wildlife Conservation Strategy. Congress also directed that the strategies must identify and be focused on the "species in greatest need of conservation," yet address the "full array of wildlife" and wildlife-related issues. The U.S. Fish and Wildlife Service and the International Association of Fish and Wildlife Agencies have developed additional guidance on information needed to meet the eight elements (see Appendix 2). The strategies must provide and make use of these eight elements:

- (1) Information on the distribution and abundance of species of wildlife, including low and declining populations, as the state fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the state's wildlife; and,
- (2) Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1); and,

- (3) Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats; and,
- (4) Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions; and,
- (5) Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions; and,
- (6) Descriptions of procedures to review the strategy at intervals not to exceed 10 years; and,
- (7) Plans for coordinating the development, implementation, review, and revision of the plan with federal, state, and local agencies and Indian tribes that manage significant land and water areas within the state or administer programs that significantly affect the conservation of identified species and habitats.
- (8) Congress also affirmed through this legislation that broad public participation is an essential element of developing and implementing these plans.

To address both “species in greatest need of conservation,” and the “full array of wildlife”, the Natural Legacy Project used a two-pronged approach – focusing on habitats and selected individual species. The Project has identified as a priority the conservation of multiple examples of each of the ecological communities (habitat types) in the state. This approach will conserve the vast majority of species – keeping common species common. For those species missed by this approach, typically the rare and imperiled species, attention was focused on individual at-risk species. To identify locations of key habitats, information on known locations of ecological communities and at-risk species was used to identify a series of Biologically Unique Landscapes. These landscapes offer some of the best opportunities to conserve the full array of biological diversity (see Chapter 3 for explanation of methods used), though conservation in the state will not be limited solely to these landscapes. In addition to identifying problems or stresses affecting species and their habitats, we also identified a number of barriers that are impeding effective conservation. We have identified a set of overarching conservation strategies and actions to address the stresses and barriers that can be applied anywhere in the state (Chapter 4), as well as site-specific actions for each of the Biologically Unique Landscapes (Chapters 5-8).

#### Value of a Comprehensive Wildlife Conservation Strategy to Nebraska

The nationwide completion of Comprehensive Wildlife Conservation Strategies is being viewed as a watershed event in the history of conservation in the United States.

Conservation has traditionally taken a species-by-species approach and focused on a limited number of species. Previous conservation efforts aimed at non-game species have often focused on those species that were on the brink of extinction, however, these “emergency room” efforts at recovery are expensive and not always successful. A new proactive approach is needed that addresses the full array of wildlife - that keeps common species common while also preventing our at-risk species from declining to the point of threatened or endangered status.

State Wildlife Grant (SWG) funding has been instrumental in helping the state undertake this comprehensive planning process, the Nebraska Natural Legacy Project. The development process itself has engaged new partners, strengthened existing partnerships, and significantly raised awareness about the state's biological diversity. The resulting blueprint is designed to provide guidance and strategic focus to agencies, organizations, communities and individuals interested in implementing conservation.

The Wildlife Conservation and Restoration Program and State Wildlife Grants Programs have provided new funding opportunities for conservation organizations in Nebraska. The Nebraska Game and Parks Commission has made a large share of these funds available to conservation organizations and universities through a competitive grants program. From 2001 – 2004 the Commission awarded over \$2 million in grants to dozens of conservation partners (see Appendix 3). Projects currently underway and already completed have increased our knowledge about the species and habitats found in Nebraska and contributed towards their conservation. Continuation of a competitive grants program will be integral to implementation of the Natural Legacy Project.

State Wildlife Grant funding is a turning point in wildlife conservation funding, but it cannot possibly meet all the needs of Nebraska's wildlife species. The actions outlined in this document suggest ways to use existing monetary resources efficiently, but new funding sources and new partnerships must also be explored. The responsibility for implementation of this plan rests with *all* Nebraskans.

One of the greatest strengths of the Natural Legacy Project has been the diverse collaboration that has resulted from this planning process. Ecoregion teams will be formed with representatives of a variety of stakeholders to assist with development of operational plans that will be critical to implementation of the plan.

## Chapter 2: Plan Development Process

### Organizational Structure

The Nebraska Natural Legacy Project is designed to be a blueprint for biological diversity conservation in Nebraska. To be comprehensive, its development required the input of a wide variety of agencies, organizations and individuals. Implementing a blueprint of this magnitude cannot be accomplished by one agency – it must be a collaborative effort of many entities and individuals. For its implementation to be successful there must be broad participation in developing the blueprint. To facilitate this collaboration and accomplish the many tasks required to develop the plan, eight teams were established. Six of the eight teams included members from outside of the Game and Parks Commission. See Appendix 1 for a list of the members of each team.

### **Partnership Team**

The partnership team was composed of representatives from 20 federal and state agencies, non-governmental organizations, and the Ponca Tribe of Nebraska (see box). Its roles included developing guiding principles for plan development, ensuring the plan was effective and useful to a variety of entities, developing and participating in a public participation process, and reviewing initial drafts of the plan. The partnership team represented many of the entities and individuals that likely would be involved with implementing this blueprint.

### **Partnership Team**

Audubon Nebraska  
 Ducks Unlimited, Inc.  
 Grassland Foundation (*formerly Conservation Alliance of the Great Plains*)  
 Farmers Union  
 Nebraska Alliance for Conservation and Environment Education  
 Nebraska Association of Resources Districts  
 Nebraska Cattlemen  
 Nebraska Department of Agriculture  
 Nebraska Farm Bureau  
 Nebraska Forest Service  
 Nebraska Game and Parks Commission  
 Nebraska Partnership for All-Bird Conservation  
 Nebraska Wildlife Federation  
 Pheasants Forever, Inc.  
 Ponca Tribe of Nebraska  
 Rainwater Basin Joint Venture of Nebraska  
 The Nature Conservancy  
 USDA Natural Resources Conservation Service  
 US Fish and Wildlife Service  
 US Forest Service

### **Internal Support Team**

This team was composed of the Game and Parks Commission's (NGPC) upper level administrative staff and two commissioners from the agency's Board of Commissioners. This team's responsibility was to provide policy oversight, ensure that the blueprint met the required elements and provide guidance for the Commission's conservation efforts.

### **Science Team**

This team was composed of science staff from the NGPC Wildlife and Fisheries Divisions and two faculty from the University of Nebraska-Lincoln School of Natural Resources. The team was charged with developing the scientific approach of the plan (see Chapter 3), identifying at-risk species and biologically unique landscapes, overseeing field inventory work, identifying future research needs and conducting species expert workshops to gather information on at-risk species.

### **Outreach Team**

This team included staff from the USDA Natural Resources Conservation Service, Audubon Nebraska, Nebraska Environmental Trust, The University of Nebraska-Lincoln and four Divisions within the Game and Parks Commission. The team assisted with planning for public input meetings and provided guidance regarding multiple methods of reaching the public.

### **Wildlife Education/Recreation Team**

This team was composed of naturalists, formal educators, Project Wild, Project Wet and Learning Tree Coordinators and administration staff from the Nebraska Department of Education. The role of this team was to identify the needs for both formal and non-formal conservation and environmental education and develop statewide strategies to address these needs. To gain additional input, a survey was sent to each school in Nebraska with questions regarding available and desired education resources.

### **Conservation Actions "Team"**

This "team" included over 400 individuals who provided input at public input meetings, a conservation practitioners workshop, expert meetings and other forums to identify stresses affecting species and habitats and conservation actions to address those stresses. Input provided by team members was used to draft the statewide and ecoregional chapters.

### **Ecoregional Writing Teams**

These four teams were composed of members from each of the four respective ecoregions. Team members consisted of a private landowner, Partnership Team member, public lands manager, private lands biologist, and a member of private conservation organization. Their role was to help draft the chapters on each ecoregion.

### **Core Team**

This team was composed of Commission staff including the two co-chairs of this planning effort, a planning assistant, a GIS specialist, and support staff. The primary role of this team was to coordinate and support the efforts of the other teams, oversee public and professional input, and oversee development of final document.



### Public Involvement

The Partnership Team assumed an active role and ownership in the public input process. Each member asked additional representatives from their organization or agency to attend a meeting to plan the public participation process. At this meeting, participants were asked to determine how best to reach out to the public and gather input on the stresses affecting species and habitats and the conservation actions needed to address those stresses. This group developed a process that included four public input meetings in each of the four ecoregions (Tallgrass Prairie, Mixedgrass Prairie, Shortgrass Prairie and Sandhills). Partnership Team members volunteered to co-sponsor and co-facilitate public input meetings. To ensure good attendance at the meetings, Partnership Team members utilized their organizations' outreach capabilities to encourage their members to attend. A professional facilitator was used to conduct facilitation training for Partnership Team members and to facilitate four of the sixteen public input meetings.

In each of the 16 public input meetings, participants were asked to answer the following questions.

#### **Questions asked at Public Input Meetings**

1. What stresses are changing wildlife habitat in your area?
2. What conservation actions could positively impact Nebraska's species and their habitats?
3. What is needed to increase collaboration between private landowners, agencies and organizations interested in wildlife conservation?
4. What could be included in a blueprint that would call Nebraskan's to action?
5. What should be measured as an indicator to determine if Nebraska's conservation plan is working?

Public input meetings were held during the fall of 2004. Facilitation techniques were customized to individual group size. The method proved to be highly successful in gathering relevant public input. Over 350 citizens participated in the public input meetings and an average of over 100 comments were recorded at each meeting. To be used, comments and suggestions had to adhere to guiding principles developed by the Partnership Team. Input was categorized and similar comments were grouped into summary statements that were then incorporated into the plan.

In June, 2005, a draft of the plan was placed on the Commission's website and interested members of the public and conservation community were asked to provide comments on the plan. In addition, during the public comment period, four public input meetings were held across the state to gather input on the draft plan.

### Conservation Practitioner Involvement

Nearly 100 conservation practitioners attended a 2-day professionally facilitated workshop in Kearney, NE on October, 2004. The purpose of the meeting was to gather

input on stresses, conservation actions, barriers to conservation, and research and inventory needs. Participants included individuals from local, state and federal natural resource agencies, private conservation organizations, and universities. Individuals were divided into four groups based on the ecoregion about which they were most knowledgeable (Tallgrass, Mixedgrass, Shortgrass and Sandhills). A small group facilitator and recorder gathered input based on the following questions.

**Questions asked at the Conservation Practitioners Workshop**

1. What are the stresses to aquatic species and habitats in your ecoregion?
2. What are the stresses to terrestrial species and habitats in your ecoregion?
3. What should be measured as an indicator to determine if conservation actions are successful?
4. What are the barriers to conservation in your ecoregion?
5. What private land incentives are needed to conserve the state's biological diversity?
6. What land management activities are needed to conserve the state's biological diversity?
7. What land protection options are needed to conserve the state's biological diversity?
8. What research and inventory is needed to conserve the state's biological diversity?
9. What educational strategies are needed to conserve the state's biological diversity?
10. What policy/legislation is needed to conserve the state's biological diversity?
11. What capacity issues are barriers to implementation of conservation actions?

This input was categorized and grouped and used to identify stresses to species and habitats, develop conservation actions (in conjunction with the aforementioned public input) and identify research and inventory needs.

Additional input

A series of one-day workshops were conducted with experts on birds, fishes, mammals, insects, and reptiles/amphibians in Nebraska. The goals of the workshops were to review and revise the Nebraska Natural Heritage conservation status ranks (S-Ranks) of species, review and revise the Natural Legacy Project list of at-risk species, and gather information on at-risk species including habitat requirements, stresses, research and inventory needs, and locations of populations that are not already in the Natural Heritage database. A wealth of information was gathered, much of which is included in Appendix 8. Information on locations of at-risk species was used to help select the biologically unique landscapes (see Chapter 3).

A series of one-day workshops was conducted with Commission field staff in each of the Commission's six Districts. The primary goal of the workshops was to identify and gather information on sites in each District that contain terrestrial and aquatic habitats in good condition. Additional information collected included habitat types and relative condition of habitat, current land use, and stresses changing habitats in the area. This information was used to help select biologically unique landscapes and identify stresses in those landscapes.

To gain additional knowledge about the distribution and abundance of at-risk species and ecological communities, field inventory work was conducted during the 2003 and 2004 field seasons. The Science Team prioritized survey work by selecting for inventory those species and communities that were most at-risk and for which we had the least amount of data. Inventories were conducted for selected small mammals (including bats), birds, reptiles, insects, fishes, and ecological communities. Inventory work was conducted by qualified biologists, under contract to the Commission. All inventory data was entered into Natural Heritage database and used in the analyses.

### Involving Partners in Plan Implementation

The task of conserving Nebraska's biological diversity is far larger than one organization can accomplish on its own. For this reason, the Natural Legacy Project was designed from the beginning to be a statewide blueprint for many to use. We involved a wide variety of agencies, organizations and individuals in developing the Natural Legacy Plan and throughout this document we stress the importance of involving these partners in its implementation. In the ecoregion chapters we identify some existing conservation partnerships and in Chapter 4 list specific conservation actions to encourage the development of new and support existing partnerships that can facilitate the conservation of biological diversity.

Many current members of the Partnership Team have already indicated an eagerness to assist with implementation of the Natural Legacy Plan. Additional partners will be sought to ensure an even higher level of stakeholder involvement. Four ecoregion implementation teams, comprised of local stakeholders and others, will be formed to help develop the operational details necessary to effectively implement the plan. One or several flagship conservation projects will be initiated in each ecoregion shortly after approval of the plan. The selection and implementation of flagship projects will include broad input from practitioners and the public and the principles of adaptive management will be employed. Flagship projects will strive to integrate components of research, monitoring, management, education, community collaboration, and nature-based recreation to conduct landscape-scale conservation projects on both public and private lands.

Partners will continue to be involved in implementation through their participation in an external competitive grants program. Since the inception of federal wildlife diversity funding in 2001, a significant portion of Nebraska's Wildlife Conservation and Restoration Program and State Wildlife Grants funding has been made available to partners through a competitive grants program. These grants have resulted in on-the-ground conservation projects/initiatives, added to our knowledge of the state's biological diversity, and built capacity to improve delivery of conservation. Criteria used to evaluate these grants will be revised to correspond directly to actions identified in the Nebraska Natural Legacy Plan.

### Plan to Review and Revise the Natural Legacy Project

A living and working document requires periodic review and revision. Every 5 years, the plan will undergo an interim review by those involved in its development and implementation. The Partnership Team will be asked to help evaluate accomplishments and assess if goals, actions and strategies need to be adjusted. Every 10 years a more extensive formal revision of the plan will be conducted. The formal revision process will be similar to this initial process in that we will have a team of partner agencies and organizations involved in guiding the process and will have significant participation by conservation practitioners and the public. During that process we will gather information regarding success of implementation of conservation actions, outreach and education efforts, and accomplishment of priority goals. An adaptive management approach will be used to adjust strategies and actions based on lessons learned. Natural Legacy Project revision will be an open process; at each iteration invitations will be extended to additional stakeholders to increase involvement.

The Natural Legacy Project revision will also address implementation successes and lessons learned. Time is required to quantify and assess results of conservation actions, but they also need to be adaptable and flexible. A database will be developed to track plan implementation. Information tracked will include conservation goals, types of conservation actions implemented, agencies, organizations or individuals involved in the implementation, species and habitats affected, number of acres or miles of stream affected, location, project cost, funding sources, etc.

Information on at-risk species, habitats and biologically unique landscapes will be maintained in the Commission's Natural Heritage database. This will be updated annually as new information becomes available through inventory and research projects. The biologically unique landscapes database is linked to the species and habitat database and will automatically be updated with new information, which will facilitate revisions to the landscape boundaries and evaluation of goals.

The Tier I and Tier II at-risk species lists will be periodically reviewed and revised by taxon experts. This revision will occur on an ongoing basis as new information on abundance, distribution, and population trends becomes available, with an overall review at least every five years.

## Chapter 3: Methodology: identifying ecological communities, at-risk species and biologically unique landscapes

### A systematic approach to biological diversity conservation

The task of conserving the biological diversity of Nebraska is daunting. Loss of habitat continues to occur and the list of species that are declining and becoming at-risk is growing, while human and financial resources for conducting conservation remain limited. Due to competing societal demands and limited funds, it is not feasible to conserve every tract of undeveloped land and certainly in a given year only a small fraction of the land may be conserved. While opportunistic or ad hoc approaches to conservation in the past have done good work, they do not appear to have stemmed the tide of species decline. Therefore, we need to improve the efficiency and effectiveness of conservation action by taking a more systematic approach to identifying and prioritizing what components of biological diversity we are trying to conserve and where in the state we should focus conservation efforts. (See Margules and Pressey 2000, Groves 2003 for excellent overviews of systematic approaches to conservation planning)

#### A Systematic Approach to Conservation

Identify which components of biological diversity to focus conservation actions on (e.g. species, ecological communities)

Identify where to focus conservation actions

Select sites based on known occurrences of target species and ecological communities

Select sites where there is a high probability that the target species and communities will persist over the long term

Select sites from across the range of distribution of the species or community to capture important variation

Set quantitative conservation goals so that multiple populations of each target species and occurrences of each ecological community are conserved

There are estimated to be more than 30,000 species in the state, the majority of which are insects. There is simply not enough time, personnel, knowledge or money to work on all these species individually. Fortunately, these species do not occur randomly but co-occur in assemblages (ecological communities or habitats) that are repeated across the landscape. The challenge is to focus on a subset of species and communities that will have a high likelihood of conserving the full array of biological diversity. One approach

that has been used is known as the coarse filter/fine filter approach (Noss 1987, Hunter 1991). The coarse filter focuses at the scale of ecological communities (habitats), both aquatic and terrestrial. Conserving and managing multiple, high quality examples of each of the various community types in the state (e.g. different types of prairies, wetlands, forests, etc.) should conserve viable populations of most species. For those species that fall through the pores in the coarse filter (primarily rare, imperiled, or wide-ranging species), a species by species (fine filter) approach is needed. For this planning process, we identified a set of ecological communities to use as the coarse filter and a set of at-risk species to use as the fine filter.

#### **Example of the coarse filter/ fine filter approach**

Conserving multiple examples of headwater streams should conserve most, but not all, of the species that occur in that habitat. The blacknose shiner is a rare, state-listed fish species that occurs in headwater streams in the northern portions of the Sandhills, Shortgrass Prairie and Mixedgrass Prairie ecoregions in Nebraska. If one were to conserve 20 randomly selected, high quality examples of headwater streams across this range, there is a high probability that none of them would contain blacknose shiner. Thus, to conserve this species we must focus on this species individually and conserve headwater streams that contain blacknose shiner populations.

While we want to increase conservation throughout the state, there is a need to focus scarce resources on those areas that offer the best opportunities to conserve the full array of biological diversity and the best chances for success. To utilize the coarse filter/fine filter approach, we have selected as priorities those sites that have known occurrences of ecological communities and populations of at-risk species. For many species that have low mobility or high site fidelity, it is important to conserve sites with known populations rather than sites with potential habitat for the species.

In order to be most effective at conserving biological diversity, we need to focus on those sites where there is the highest likelihood that the populations and communities will persist over the long term. For individual species this would include sites with a large population size, good age class structure and evidence of successful reproduction. For ecological communities this would include sites with a good representation of expected native species, few invasive exotics, and relatively intact ecological processes that maintain these communities (e.g. fire, grazing, flooding). Unfortunately, for some community types such as saline or playa wetlands, there are few high quality examples remaining and for other types such as tallgrass prairie, there are no examples left that are of a size similar to what historically would have been found here. In these cases, habitat restoration will play an important role in conservation.

Another factor that affects viability is the landscape context within which the population or community exists. Species and communities do not occur in isolation but are part of a landscape mosaic. A number of species, particularly birds and mammals, utilize more than one habitat type during their life cycle and these habitats need to co-occur in close

enough proximity to be useful. Species and communities are inextricably linked to the landscapes in which they occur and thus may not persist over the long term without adequate conservation of the larger system. Functional landscapes can be defined as those in which the mosaic of native community types is relatively intact and the ecological processes that sustain the species and communities are still functioning or can be simulated through management (Poiani et al. 2000). We need to identify not only high quality examples of at-risk species populations and ecological communities but those that are nested together and exist within functional landscapes. Seeking landscapes with clusters of at-risk species and high quality communities also increases the efficiency of our conservation efforts.

A strategic approach to conservation also needs to take into account the distribution of species and communities when selecting sites. Species vary genetically across their range of distribution. This variation may be important to the long-term survival of the species in the face of environmental change. In a similar fashion, the species composition of individual community types can vary across the range of the type. For example, tallgrass prairie in the southeast portion of Nebraska can have a somewhat different mix of plants and animals than tallgrass prairie in the northeast part of the state. In order for the coarse filter to be effective, this variation needs to be captured in the planning process. While it is not practical to conduct detailed genetic analyses of all at-risk species or inventory all community types, a prudent alternative is to try and conserve examples of populations and communities from across their range.

One of the most difficult questions facing conservation planners is: How much is enough? How many populations of a species or examples of a community do we need to conserve in order to ensure long-term survival? We know that conserving just one example is likely inadequate and that we need to conserve multiple, high quality examples of each species and community type to provide redundancy and ensure persistence in the face of environmental and human-induced change. In addition to identifying “how much”, conservation goals should have a geographic component so that examples are selected from across the range of the species or communities. This will help capture the variation and ensure that “not all your eggs are in one basket”.

Although principles from genetics, conservation biology and ecology can offer guidance in setting quantitative conservation goals, our knowledge of the life history requirements of species and how ecosystems function is too incomplete to provide definitive answers. Groves (2003) suggests four reasons it is important to set quantitative conservation goals, even with the uncertainties involved:

1. Goals allow an evaluation of how effective a proposed system of conservation areas will be in representing the conservation targets.
2. Setting goals allows planners and managers to better understand and account for the tradeoffs that often must be made in trying to sustain human communities and ecological communities.
3. Goals will have a strong influence in determining the number of conservation areas that are needed.

4. Goals provide a vision for conservation success.

For the Natural Legacy Project, we have set quantitative conservation goals using the best guidance currently available with the realization that these goals are a first approximation and will no doubt change as new knowledge becomes available. Our conservation goals were set for the number of populations of a given species to be conserved rather than an overall population size and for the number of occurrences of a given ecological community type rather than an overall number of acres of that type. These goals facilitate a conservation strategy that focuses on sites with known occurrences of species populations and high quality examples of ecological communities.

One of the goals of the Natural Legacy Project is to identify a set of priority landscapes that, if properly managed, would conserve the majority of Nebraska's biological diversity. These landscapes, which we are calling Biologically Unique Landscapes, were selected based on known occurrences of at-risk species and ecological communities. In addition to at-risk species, these landscapes support a broad array of common species. The following sections describe the approach we used to identify the at-risk species, ecological communities and biologically unique landscapes.

### **Ecological Communities: A Coarse Filter**

A variety of entities have been used as a coarse filter in conservation planning including ecological communities (Anderson et al. 1999), ecological systems (Comer et al. 2003), physical features and landscapes. We have chosen to use ecological communities as described in Natural Communities of Nebraska (Steinauer and Rolfsmeier 2003, see Appendix 7). The 69 terrestrial community types described here cover wetland and upland type (any habitat with rooted vegetation) and are part of the National Vegetation Classification system (Grossman et al. 1998), which is the standard classification used by federal agencies. Unfortunately, there currently is no statewide classification system for open water habitats (lakes, rivers, streams) and there is an urgent need for the development of such a system.

We have chosen to use ecological communities due to the fine scale of resolution of this system, which can be more effective at capturing the full array of species and ecological processes. For example, the upland hardwood forests along the Missouri River bluffs harbor an almost completely different suite of plants and animals than the shortgrass prairies in the panhandle, and both of these species assemblages would be distinct from the saline marshes in Lancaster County. In order to conserve the full array of species, we need to conserve examples of each of the community types.

For ecological communities to be an effective coarse filter in "capturing" biological diversity, we need to select examples of communities that contain, as much as possible, the full complement of species one would expect in that type. For example, a never-plowed prairie that is used as pasture and has been treated with a broadleaf herbicide will harbor far fewer species than a similar prairie that has not been so treated. Broadleaf



species (forbs) typically make up 80-90% of the plant species diversity in a prairie and there are numerous insects that utilize those forbs. So the conservation of the pasture would be less effective at “capturing” biological diversity than conservation of the untreated prairie.

Examples of communities selected for conservation should also be part of an intact landscape and have more ecological processes intact or able to be simulated with management (e.g. fire, grazing). These examples have higher ecological integrity and are more likely to persist over the long term.

The Nebraska Natural Heritage Program has been collecting and maintaining information on ecological communities since 1987. Field surveys record not only the location of occurrences and species present, but also rate the overall condition of the habitat. The Element Occurrence Ranking (EORanking) uses a four level scale (A-D) to rank the habitat based on its size, condition and landscape context. For example, an “A” quality occurrence of a prairie would be of relatively large size, containing most of the native species one would expect in that prairie type and few invasive exotic species, and be surrounded by relatively intact landscape. Data from the Heritage database on the location and condition of ecological communities was one of the data layers used in selecting the biologically unique landscapes (see below).

### **Setting conservation goals**

Conservation goals for ecological communities were set following the guidance in Anderson et al. (1999). Under these guidelines, the distribution of the community type in Nebraska relative to the rest of its range is a factor in setting goals. For example, a community type that occurs only in Nebraska (e.g. Sandhills fen, paper birch springbranch canyon forest) would have the highest quantitative goal since it's conservation is entirely dependent on actions taken in Nebraska. Those types for which most of their distribution is outside of Nebraska (peripheral) would have the lowest goal since it will be conserved primarily by action outside of the state.

In addition to the distribution of the community, the patch type of the community was used in setting goals. Communities can be classified into 3 main types: matrix, large patch, and small patch. A few community types are dominant (matrix-forming) and historically covered thousands to millions of acres. In Nebraska, these would include the main prairie types (e.g. tallgrass, mixedgrass, sandsage). The majority of community types are patch types and nest within the matrix types, covering only a small portion of the landscape. Large patch communities may form extensive cover over some areas but usually their boundaries are correlated with a dominant local process such as hydrology, landform, soil type or fire regime. These large patch types typically occur in patches of less than 1,000 acres. Examples in Nebraska include many of the forest and woodland communities. Small patch communities are even smaller and more restricted, requiring specific ecological conditions. They typically occur in patches of 100 acres or less. Examples in Nebraska include many of the wetland and shrubland types.

Anderson et al. (1999) noted that as a general rule, conservation planners need to include more examples of patch communities to buffer against the higher probability of attrition over time due to environmental change. Patch communities are smaller in extent and multiple examples may be needed to add up to substantial area and viable populations for specialist component species. In addition, individual examples may be less likely to contain the full complement of component species than a large example of a matrix community and thus more examples are needed to capture the full complement of species.

We developed the following criteria for setting goals for the number of occurrences of ecological communities to conserve. Goals for each of the community types (e.g. Tallgrass Prairie) can be found in Appendix 7.

<b>Goals for Ecological Communities: Number of Occurrences to be Conserved</b>			
<b>Distribution</b>	<b>Matrix</b>	<b>Large Patch</b>	<b>Small Patch</b>
Endemic/restricted	8	14	20
Limited	3	5	10
Widespread	1	2	5
Peripheral	1	2	5

Endemic/Restricted: communities that only occur within NE or generally have more than 90% of their range within the state.

Limited: communities that occur primarily within one region (e.g. Great Plains).

Widespread: communities that are common in a number of regions and widespread in NE.

Peripheral: communities that are found mainly in other regions, generally less than 10% of the range is within NE.

### **At-risk Species: The Fine Filter**

In order to prioritize which species to focus scarce resources on, the Science Team developed a two-tiered approach to identifying those species that may be at-risk of extinction or extirpation from the state. The Tier I species are those that are globally or nationally at-risk. The Tier II list contains those species that are at-risk within Nebraska while apparently doing well in other parts of their range. The rationale for the two-tiered list was to focus attention and resources first on those species that may be headed for global extinction (and federal listing as Threatened or Endangered) and secondarily focus on those species that may be facing extirpation from Nebraska but appear to be stable globally. The Tier I list includes species that are currently state or federally listed as well

as those that may be headed for listing. One goal of the Natural Legacy Project is to prevent imperilment of species and the need for listing and another goal is recover currently listed species to allow for their de-listing. Additionally, there is a goal to keep common species common and the coarse filter (described in the previous section) should ensure this goal is met.

Species were chosen from a variety of taxa including mammals, birds, reptiles, amphibians, fishes, mollusks, insects, and plants. We did not have adequate information to evaluate certain taxa (e.g. fungi, bryophytes) and only certain types of invertebrates (mollusks, some groups of insects) had adequate information to allow evaluation of their imperilment status.

The Science Team developed criteria for selecting the Tier I and II species (see box) and selected an initial set of species that fit the Tier 1 criteria. This list was sent to experts on the various taxa for review. These reviews were used to revise the list. Toward the end of the process to develop the Legacy Project, we conducted a series of expert workshops (birds, fish, insects, mammals, reptiles) and the list was reviewed again and revised.

### **Criteria for selecting Tier I at-risk species**

Species were included in the Tier I list that met one or more of the following criteria:

**State and Federally Listed Species:** Species listed as Threatened or Endangered under the federal Endangered Species Act or the Nebraska Non-game and Endangered Species Conservation Act. Recovery and de-listing of these species is a goal of the plan.

**G1-G3 Species:** Species ranked by NatureServe and the international Natural Heritage Network as either Globally Critically Imperiled (G1), Globally Imperiled (G2) or Globally Vulnerable (G3) (see Appendix 4 for explanation of ranks).

**Declining species:** Species whose abundance and/or distribution has been declining across much of their entire range. For land birds, the Partners in Flight national watch list was used as a guide.

**Endemic Species** (or nearly so): Species whose entire range of distribution occurs within or primarily within Nebraska. Conservation actions in Nebraska would be critical to the conservation of the species.

**Disjunct Species:** Species whose populations in Nebraska are widely disjunct (200+ miles) from the species' main range of distribution. Such populations may contain genetic variations that could be important to the long-term survival of the species.

### **Criteria for selecting Tier II at-risk species**

Tier II species were those that did not meet the Tier I criteria but were ranked by the Nebraska Natural Heritage Program as either State Critically Imperiled (S1), State Imperiled (S2) or State Vulnerable (S3) (see Appendix 4 for explanation of ranks).

Eighty species were identified as meeting the Tier I criteria. The list of Tier I species is found in Appendix 8 along with information about their conservation status, range in Nebraska, stresses, inventory and research needs and a list of the biologically unique landscapes where they are known to occur. We identified 532 species as meeting the Tier II criteria. During the development of the Legacy Project, the Heritage state ranks were reviewed and revised for amphibians, reptiles, mammals, fish, Tier I birds and a limited number of insects. The “S-ranks” for the remaining birds are in need of revision. Some bird species are included on the Tier II list that have an unrevised rank of S4 or S5, due to expert opinion that indicated when the ranks are revised they would likely be within the S1-S3 range.

We have identified more than 600 species in Nebraska as at-risk (i.e. met Tier I or Tier II criteria). This is far too many to deal with in a detailed manner in conservation planning. For the first iteration of our conservation strategy, we will focus most of our effort on the Tier I species. These are the species for which we are setting quantitative goals and identifying sites important to the conservation of the species. Tier II species were also used in identifying biologically unique landscapes but did not have goals set for them.

The Tier I and Tier II at-risk species lists will be periodically reviewed and updated by taxon experts. As new information on abundance, distribution, and population trends becomes available, species will be added to or removed from the lists. These lists were developed to help prioritize conservation planning/action and do not have legal or regulatory ramifications.

### **Setting conservation goals**

Population viability analyses (PVAs) have been used for setting conservation goals for a limited number of species. These analyses are a quantitative method used to predict the future status of a population or collection of populations. During conservation planning in Florida (Cox et al 1994, Kautz and Cox 2001), population viability analyses were conducted on 11 focal species (birds, reptiles, mammals). Their results suggested that an appropriate goal for all the target species was to conserve a minimum of 10 populations. While detailed PVAs have been conducted for only a small number of species, the thought processes behind PVAs can be used in setting goals for other species. Using a simple equation (Morris et al. 1999) one can calculate the probability that all populations of a species will go extinct over a period of time given the probability of extinction of

any given population. This model assumes that the fates of the individual populations are not correlated and that there is little movement among the populations.

We set an initial goal of 10 populations as a minimum for conserving a species. Using the equation from Morris et al. (1999) and assuming moderate viability of each population (40% chance of survival over a 100 year period), conservation of 10 populations gave a greater than 99% probability of at least one population surviving over that time period. This goal was then modified based on the proportion of the species' total distribution that was contained within Nebraska. For species that were endemic to Nebraska (or found also within a limited range outside the state), the goal was set at 10. These are species whose long-term protection will depend primarily on conservation actions taken in Nebraska. The goals were then reduced as the proportion of the species range outside of the state increased (see box below for goals). These species will be conserved by actions in a number of states, not just action in Nebraska. Regardless of distribution patterns, we set a minimum goal of 10 populations for state listed threatened and endangered species. This was to ensure the long-term survival of the species within Nebraska and enable de-listing.

Goals were also occasionally modified on a case by case basis. For example, the Ute Ladies' Tresses orchid (state and federally listed), after extensive surveys, has only two known populations in Nebraska. Populations of this species are sparsely distributed across its entire range and it is likely the current distribution in the state represents its pre-Euroamerican settlement distribution. The goal for this species was set at two. Goals for all Tier I species are listed in Appendix 8.

<b>Goals for Tier I Species: Number of Populations to be Conserved</b>	
Endemic/restricted/state listed	10
Limited	7
Widespread	4
Peripheral	1
Disjunct	1
Endemic/Restricted: species that only occur within NE or generally have more than 90% of their range within the state.	
Limited: species that occur primarily within one region (e.g. Great Plains).	
Widespread: species that are common in a number of regions and widespread in NE.	
Peripheral: species that are found mainly in other regions, generally less than 10% of the range is within NE.	
Disjunct: Species whose populations in Nebraska are widely disjunct (200+ miles) from the species' main range of distribution.	

## Selecting Biologically Unique Landscapes

The goal of this process was to identify a set of landscapes that offer some of the best opportunities for conserving the full array of biological diversity in Nebraska. Landscapes were selected based on known occurrences of ecological communities and at-risk species and were selected to meet the goals we had set for each community type and Tier I species.

We conducted two different analyses (SPOT and Heritage Hotspots) of data in the Natural Heritage database. Results of these analyses were used in conjunction with other spatial data layers to help delineate the boundaries of the landscapes.

SPOT (Spatial Portfolio Optimization Tool, see Appendix 5) is a computer algorithm that selects areas based on the goals, set by the user, for the number of occurrences of communities and species that are to be conserved. The program identifies a set of areas that meet identified goals in the least amount of total area with the least amount of fragmentation (most clustering of species and communities). In this analysis we used data in the Heritage database for all terrestrial communities and the Tier 1 at-risk species. To help ensure that the best examples were selected, we used only those occurrences with an EORank of A or B, (for those occurrences that were ranked). The areas identified by this process can be viewed as the minimum area needed to meet the goals. The results can be displayed as a GIS layer or map.

The Heritage Hotspots layer was developed using the Section (square mile) grid of Nebraska (see Appendix 6). Each Section was given a score based on the number and conservation ranks of species and communities found within them. Sections were classified by score range (1-5, 6-10, etc) and the classes were portrayed in different colors to allow us to visually identify hotspots of natural community and at-risk species diversity. Data from all Heritage tracked species (Tier I and II) were used as well as the community data.

While the Heritage Database represents the most comprehensive, statewide data on at-risk species and ecological communities in the state, inventory work is far from complete in Nebraska. Supplemental expert information was used to help delineate the landscapes. In addition to the above spatial data, we developed a GIS layer in which the Commission's District field staff had delineated areas that contain relatively intact and high quality habitat. We also conducted a series of workshops with species experts (fish, birds, mammals, insects, reptiles and amphibians). Participants in these workshops delineated areas in the state with high concentrations of at-risk species. In the case of the fish experts workshop, they also identified areas with high quality streams with a good overall diversity of species. And finally, we utilized the National Land Cover Data (1993) to help identify relatively intact landscapes.

The results from the SPOT analysis were used to identify the nuclei of the landscapes. The additional layers were used to expand the boundaries of the landscapes so that they

were clusters of community and at-risk species occurrences within a relatively intact landscape.

In certain landscapes there were obvious concentrations of natural community and at-risk species occurrences. These were delineated as “core” areas and could be considered as higher priority within the landscape. There was no prioritization among landscapes, each contains a somewhat different assemblage of communities and species and therefore each is needed to complete the conservation on Nebraska's biological diversity.

### **Results of landscape analysis**

Forty biologically unique landscapes were selected during the process (see map, page 24). An analysis was conducted to see how well this set of landscapes met the quantitative conservation goals set for communities and Tier I species. By “met”, we mean that the number of populations or occurrences set as the goal for a particular species or community type were documented to occur within the selected landscapes. The identified landscapes met or exceeded the goals for 44 Tier I species (55%), partially met the goals for 28 species (35%) and did not meet any of the goals for 8 species (10%). For ecological communities, the selected landscapes met or exceeded the goals for 28 types (41%), partially met for 24 types (35%) and did not meet any of the goals for 17 types (24%).

In nearly all cases in which goals were not fully met, the cause was lack of data rather than inappropriate selection of landscapes: in other words, the goals were higher than the number of documented occurrences. Given that the landscapes selected were rather large, no doubt a number of additional Tier I species populations and likely a great number of community occurrences, have been “captured” by this suite of landscapes. In preparing the descriptions of each landscape which are found in Chapters 5-8, staff used personal knowledge to identify additional community types that they knew occur in particular landscapes, even though records were not in the database for this analysis. Additional inventory of these landscapes is warranted.

An additional analysis was conducted to determine how well the existing network of public conservation lands did at meeting the goals set for Tier I species. Public conservation lands were considered to be those owned and managed by the U.S. Forest Service, the U.S. Fish and Wildlife Service, the National Park Service, and the Nebraska Game and Parks Commission. The analysis included all these lands in the state, regardless of whether they were in an identified landscape. These lands met or exceeded the goals for 18 Tier I species (23%), partially met the goals for 22 species (27%) and did not meet any of the goals for 40 species (50%). This indicates that the current network of public lands is inadequate to fully conserve our biological diversity.

Certain community types were not captured adequately by our approach to selecting landscapes that emphasized the value of having landscapes that are relatively intact. There are a number of wetlands in the state (e.g. Todd Valley wetlands, central table playas, southwest playas) that occur as isolated small patches within a highly agricultural

matrix and thus were not selected. There is a need to conduct an analysis of these and other similar types of communities to identify priority sites for conservation action.

This set of landscapes may not be adequate to address the needs of wide-ranging species. We did not attempt to identify corridors or connections between landscapes that would allow for the movement of these species. In addition, migratory bird species that do not have high fidelity to nesting sites (e.g. many grassland nesting birds) may not be captured well by this approach. While nesting record data was used to identify landscapes, there is no guarantee that the birds will return to those sites in subsequent years. However, given our limited knowledge of the habitat requirements of most species, it may be safest to target action at those sites where they are known to nest rather than potential habitat. Similarly, those species that only occur in Nebraska during their migration and do not have high fidelity to particular stopover sites (e.g. whooping crane) may not be well served. While a number of selected landscapes have documented occurrences of whooping crane roost sites, we do not have data indicating which of those may be used more often than others.

While the set of landscapes described here does not meet the needs of all species in Nebraska, it is an important first step. Conservation of these landscapes should conserve the vast majority of species in the state. These sites represent the current state of information and further inventory is needed to be able to identify additional sites to round out the network.





## **Chapter 4: Conservation Actions to Address Barriers to Conservation and Stresses Affecting Species and Habitats**

During the planning phase of the Nebraska Natural Legacy Project, conservation practitioners and the public were asked to help identify the barriers that limit or preclude conservation, key stresses to species and habitats, and actions needed to overcome barriers and stresses to species and habitats. Barriers, stresses and actions were identified by (1) the public at sixteen public input meetings and through the Nebraska Annual Social Indicators Survey (NASIS), (2) by conservation practitioners who participated in a two-day workshop and at six regional meetings (3) by species experts who attended a series of workshops and (4) from members of the public and conservation practitioners who provided comments during the review of the plan. Existing conservation plans were also reviewed and appropriate stresses, barriers and actions were incorporated into this plan.

Proposed conservation actions were run through a filter of guiding principles developed by the Natural Legacy Partnership Team to ensure they were biologically sound, economically feasible and sensitive to private landowner needs. Although most input was gathered on an ecoregional basis and specific barriers, stresses and conservation actions have differing levels of importance in each of Nebraska's four ecoregions, most have statewide relevance so they were incorporated into a single chapter to reduce redundancy. Key barriers, stresses and actions in each ecoregion and biologically unique landscape are identified in ecoregion chapters.

The Natural Legacy Project has focused on voluntary, incentive based approaches to conservation. It did not evaluate existing state or federal regulatory programs that affect biological diversity (e.g. water or air quality regulatory programs or at-risk species protection laws). This strategy therefore does not provide recommendations for changes to existing regulatory programs or the need for additional such programs.

Since 97% of the state is in private ownership (principally farms and ranches), conservation of the state's flora and fauna will be largely dependent upon the support and participation by private landowners. Extensive input by the public helped ensure proposed conservation actions are reasonable and practical. Although actions have not been prioritized, operational planning will begin in Fall 2005 to establish priorities, describe more specific details that will guide implementation, and to develop a timeline. Input from private landowners and conservation practitioners will be sought throughout implementation.

The stresses and actions identified in the following section along with the at-risk species, communities, and priority landscapes identified in Chapters 5-8 comprise the nucleus of the conservation blueprint. Implementation of the conservation actions on a statewide level will help ensure that opportunities for conservation of biological diversity exist in every corner of the state.

### **Actions Needed to Overcome Barriers and Threats**

- Increase collaboration and communication
- Increase environmental education
- Improve conservation programs and incentives
- Promote management that is more compatible with conserving biological diversity
- Focus conservation on the best opportunities
- Expand the network of public and private conservation lands
- Increase participation in nature-based recreation

## **Increase collaboration and communication**

No single government agency or private organization has the authority, financial resources, or staff to assume the entire responsibility for conserving Nebraska's biological diversity. Implementation of a comprehensive wildlife conservation strategy will require the cooperative efforts of a wide range of governmental entities, private organizations and citizens. Partnerships and cooperative arrangements can be used to promote collaboration and communication. This approach should help reduce duplication, increase information sharing, establish trust, and promote more efficient allocation of resources to conservation priorities.

In the past, a lack of communication and collaboration between resource professionals and agricultural producers has created tension and conflict regarding fish and wildlife conservation. Many of these conflicts have arisen from issues related to endangered species, water management, and a perceived lack of respect for private property rights. As a result, trust has eroded and collaboration on a broader range of conservation issues has been impeded.

82% of Nebraskan's feel that "at-risk" species would be conserved most effectively by a partnership of governmental and private organizations.  
*Source 2004 NASIS Survey*

Information about conservation opportunities to landowners is often insufficient or unclear. Many individuals who are interested in conservation programs may not be aware of conservation opportunities or know whom to contact.

Communication amongst conservation practitioners is often inadequate. Without a consistent exchange of information and opportunities to collaborate, conservation practitioners run the risk of being uninformed about programs and species needs. Improved communication and collaboration between agencies and conservation practitioners can lead to greater efficiency and result in new and innovative solutions to conservation problems.

## **Conservation Actions needed to advance collaboration and communication**

- ❖ Develop new and support existing locally-based conservation partnerships in each of Nebraska's ecoregions that includes a diversity of stakeholders (e.g. farmers, ranchers, community leaders, public and private conservation organizations, etc.) and is charged

with conserving biological diversity. When possible, new partnerships should be modeled after existing successful partnerships (e.g. Sandhills Taskforce, Rainwater Basin Joint Venture).

- ❖ Develop new and support existing regional forums that include diverse representation from landowners, agencies, private organizations and others that facilitates the exchange of ideas, promotes networking, and engages in problem-solving to address issues related to endangered species management, public lands ownership and management, landowner confidentiality, private property rights, etc. Address concerns by conducting seminars, workshops, and social functions that promote communication, cooperation and the exchange of ideas.
- ❖ Develop and widely distribute clear and concise publications about conservation programs, stresses to biological diversity, and actions needed to conserve biological diversity. Make it widely available in printed and electronic formats.
- ❖ Regularly inform the public of proposed initiatives, management actions, policy changes, and conservation successes and failures through public meetings, workshops, field trips, one-on-one meetings, seminars, presentations at stakeholder meetings, and other effective venues.
- ❖ Develop and implement recognition and appreciation programs to acknowledge the efforts of farmers, ranchers, acreage owners, organizations, community leaders, and others who demonstrate meritorious achievement in the conservation of biological diversity.
- ❖ Design and conduct training programs that instruct conservation practitioners and others in effective public participation techniques.
- ❖ Strive for shared responsibility between landowners, agencies, organizations, and communities when implementing the Nebraska Natural Legacy Project.
- ❖ Institute a citizen-science and education initiative that draws on volunteers of all ages to assist with monitoring, research, stewardship, and education of natural habitats and wildlife. Accomplish this by developing new (e.g. Master Naturalist Program) and supporting existing programs (e.g. Adopt-A-Stream, Project FeederWatch).
- ❖ Improve existing and establish new communication channels among conservation practitioners and their agencies/organization to improve coordination, reduce conflicting and confusing messages conveyed to the public, and to develop a shared vision for the conservation of biological diversity.
- ❖ Seek opportunities to facilitate understanding and collaboration between the rural and urban publics.

- ❖ Establish networks between public land managers and neighboring private landowners to improve communication, increase respect, and build trust.

## **Increase environmental education**

Education is an essential part of conservation. For the Nebraska Natural Legacy Project to succeed, more Nebraskan's need to be made aware of and become knowledgeable about the state's rich biological diversity and the stresses that threaten their existence. An environmentally literate citizenry is critically important to sustaining the natural and built environments. When presented in an unbiased and scientifically accurate manner, environmental education (EE) is an essential tool that empowers learners of all ages to rise to the challenge of making sound decisions.

Nebraska's natural environment provides numerous opportunities for student learning. Most children have an innate interest in the natural world, yet time constraints, transportation issues, inadequate teacher training, lack of materials, curriculum requirements, and other factors are barriers to teachers wishing to deliver environmental education. The interdisciplinary nature of environmental education makes it appropriate for many subject areas, yet EE is mainly used in science disciplines. Although the 2003 Nebraska Conservation and Environment Literacy Survey indicated that 98% of Nebraskans support the teaching of environmental education in classrooms, most school districts provide only token support.

The motto "Nebraska-The Good Life" underscores the importance of a healthy and sustainable environment to the well-being of the state's residents. The increasing urbanization of Nebraska, reliance on technology, and competing interests for unscheduled time is changing people's level of attachment and perceived reliance on the environment. It's critically important that both urban and rural Nebraskans maintain or establish a sense of place whereby they value, understand and appreciate the local environment in which they live. Achieving a sense of place is contingent upon Nebraskans of all ages having easy access to materials, trained educators, and opportunities to be immersed in the natural environment.

An environmentally literate citizenry has large social, ecological, and economic implications. The important role of education in furthering biological diversity conservation is becoming better understood and more widely accepted. According to the 2004 NASIS survey, 94% of Nebraskans feel that increasing education programs is very or moderately important to reverse the decline of "at-risk" species. Putting more resources into education can produce long-term societal benefits and help ensure continued and expanded support for the actions necessary to conserve biological diversity.

## **Conservation actions needed to increase environmental education**

- ❖ Assess the need for environmental education resources across the state including the number of qualified educators, education centers, materials, etc. throughout the state.

- ❖ Increase educational capacity for biological diversity education by providing increased support to organizations and agencies that deliver environmental education providing quality training to formal and nonformal educators.
- ❖ Support existing and develop new programs/partnerships/materials to improve learning opportunities that will increase awareness, knowledge, appreciation, and shared responsibility of Nebraska's biological diversity at all age levels (pre-school, students, adults). Examples include but are not limited to Nebraska-specific curricula, activity guides, workshops/programs, educational trunks, portable classroom/laboratory, field trips, distance learning opportunities, websites, videos, posters, etc.
- ❖ In collaboration with the state Department of Education, seek to address important issues related to biological diversity in state education content standards.
- ❖ Increase opportunities for students and adults to experience and learn about Nebraska's natural communities by improving access to and organizing events such as tours, workdays, environmental festivals, etc. oriented around these natural communities.
- ❖ Develop a diverse taskforce with ecoregional representation that can address obstacles related to increasing Nebraskan's awareness, knowledge, and commitment to conserve biological diversity. Members should include leaders from private and public conservation groups, educational institutions, formal and nonformal educators, community leaders, private landowners and others.
- ❖ Support existing and start new programs that promote the development of replica natural communities (e.g. prairies, wetlands, native woodlands, etc.) at schools, parks, government offices, housing developments, businesses, etc. that can be used by the public to learn about biological diversity.
- ❖ Raise awareness about the role of farming, ranching and home ownership in biological diversity conservation.
- ❖ Develop and conduct workshops for landowners, community leaders, conservation practitioners and others on topics such as prairie conservation, at-risk species management, forest management, aquatic resources, etc.
- ❖ Develop demonstration sites that illustrate management techniques (e.g. wetland restoration, prescribed burning, planned grazing, forest management, etc.) that can be used to educate conservation practitioners, private landowners, and the public about management alternatives.
- ❖ Use multiple media outlets (e.g. television/radio, print advertisements, internet, billboards, public displays, etc.) to increase awareness and support for Nebraska's biological diversity and inform the public of progress made to conserve species and habitats.

## **Improve conservation programs and incentives**

Most conservation practitioners and many private landowners can attest to the large number and complexity of conservation programs. Landowners with an interest in conservation often have to wade through a sea of paperwork and long lists of options in order to enroll in programs or initiatives. It's often difficult for conservation practitioners to keep abreast of the many program offerings and it can be overwhelming for landowners who are interested in conservation but also want to make the best business decision. Although varying organizational missions and policies will likely always necessitate that there be multiple programs, better collaboration on the part of agencies implementing existing or developing new programs is needed to make conservation more "landowner-friendly:"

The demand for technical and financial incentives by landowners to do conservation work is growing and is outpacing our ability to meet demand. Current resources need to be increased or made more efficient to meet the growing demand for landowner assistance. Some landowners simply need technical guidance provided from a best management practice guide and others need direct assistance through one-on-one consultation by a wildlife biologist. Many landowners also need financial incentives such as cost-share for doing habitat improvements, infrastructure to change management, or direct payments to set aside habitat or to enroll in conservation easements. Delivery of technical and financial assistance can include local (e.g. Natural Resource Districts), state (e.g. Nebraska Game and Parks Commission, Nebraska Forest Service), federal (e.g. Natural Resources Conservation Service, US Fish and Wildlife Service) agencies or private organizations (e.g. Pheasants Forever, The Nature Conservancy, National Wild Turkey Federation, Ducks Unlimited).

To be effective, biologists providing technical assistance must have a familiarity and understanding of conservation programs and knowledge of habitat requirements of species. Although no two conservation practitioners are likely to give identical advice to a landowner, it's important that management recommendations be based on the best available science. Landowners often become frustrated and lose confidence in organizations and agencies when resource professionals fail to communicate and give conflicting or contrasting advice. In many cases inconsistencies between related conservation programs are due to a lack of communication within the conservation community. In other cases, agency missions differ and program rules reflect those differences. Policy differences (e.g. where to site tree plantings) between agencies can lead to confusion by the public and conflict between resource professionals. When possible, conservation agencies and organizations should strive for consistent policies to maximize biological diversity conservation throughout the state.

Conservation programs and financial incentives need to be voluntary, uncomplicated, flexible, and make economic sense in order for them to meet the test as "landowner-friendly". Private landowners may feel that too much of their decision-making authority or income potential is surrendered in order to participate in conservation programs. In addition, some programs are overly rigid and don't allow for changing conditions or the use of adaptive management practices. Although limited funding will often not allow conservation program payments to meet or surpass the income potential of intensive land uses such as cropping, it can provide an economic cushion when transitioning to management systems that may be more economically

sustainable (e.g. changing from season-long to rotational grazing). Many landowners are willing to incur some loss in income, to increase wildlife populations and improve recreational opportunities.

Property taxes serve as one of the most significant barriers to conservation program participation. Even many recreational landowners need to generate sufficient income to pay property tax obligations. This leads many landowners to seek management alternatives that provide fewer benefits for “at-risk” species. Changes in land use or policies that result in lower property taxes are often not desirable because the revenues available for schools and roads are reduced. In recent years, the value of high quality wildlife recreation lands has risen at a higher rate than other lands, causing property values and associated property taxes to increase on working lands.

### **Actions needed to improve conservation programs and incentives**

- ❖ Seek private landowner and multi-organizational input when developing conservation incentive programs to 1) help ensure they are landowner-friendly (voluntary, incentive-based, adaptable, economically feasible, confidential, etc.), 2) support the missions of a broad array of conservation organizations and 3) are effective at conserving biological diversity. When possible, model new programs after successful programs used elsewhere.
- ❖ Assess the barriers to landowner participation in conservation programs and use that information to improve existing programs and in developing new programs.
- ❖ Explore opportunities to provide private landowners with incentives/income for assisting with restoration projects (e.g. native seed harvest), engaging in activities that support biological diversity (e.g. providing nature-based recreation opportunities, marketing of biological diversity-sustainable products), or are willing to tolerate wildlife-associated economic losses.
- ❖ Seek opportunities to increase the focus of existing conservation programs (e.g. Wild Nebraska) and funding sources to better conserve biological diversity and natural communities.
- ❖ Develop a best management practice handbook to assist private landowners and land managers in the best methods to restore and manage natural communities.
- ❖ Explore new funding sources that provide sustainable and equitable compensation for landowners who participate in programs that conserve biological diversity. Regularly adjust incentive rates to reflect changing economic conditions.
- ❖ Seek to increase the capacity of agencies and organizations to provide efficient and high quality technical assistance to private landowners who are interested in conserving biological diversity.



- ❖ When possible seek to safeguard the local tax base by providing equitable compensation (e.g. payment in lieu of taxes) when conservation projects result in a significant reduction in property taxes.
- ❖ Seek out and promote innovative solutions to economic constraints on landowners interested in conserving biological diversity. These could include but are not limited to tax deferments, capital gains tax relief, conservation buyer programs.
- ❖ Develop and promote voluntary projects/programs aimed at conserving threatened and endangered species on private land and provide assurances to participating landowners that no additional future regulatory restrictions will be imposed (e.g., Safe Harbor Agreements).
- ❖ Develop partnerships with community planning leaders, business leaders, and private organizations to develop best management practices (e.g. cluster housing) that can help ensure residential and commercial developments minimize the impacts to natural communities and biological diversity.
- ❖ Collaborate with the Department of Natural Resources and Natural Resource Districts to discuss the impacts of watershed planning decisions made under LB 962 on fish, wildlife, and related resources in those watersheds. Undertake a watershed-by-watershed assessment of the impacts of changing streamflow conditions on biological diversity, starting with the watersheds under the most threat from increased water use.

### **Promote management that is more compatible with conserving biological diversity**

Nebraska's 48,000 farms and ranches cover nearly 46 million acres (93% of the total land area) and support a significant share of Nebraska's overall biological diversity. Activities on these lands directly impact individual species, natural communities, and larger ecosystem processes (e.g. hydrology, stream quality, nutrient cycling, etc.). According to the 2004 NASIS survey, over 90% of Nebraskans felt that farmers and ranchers should have a major or moderate role in conserving "at-risk" species in the state. In order to meet this public expectation, the state's farmers, ranchers, and conservation organizations will need to collaborate and share responsibility for the conservation of biological diversity.

Nebraska has nearly 1,600 square miles of public conservation lands. These existing protected areas (e.g. national wildlife refuges, national forests, national monuments, state parks, wildlife management areas) are critical to the conservation of biological diversity. However, past management approaches have not always taken into consideration the needs of the greatest array of species. Public perception reflects these sentiments. According to the 2004 NASIS survey, 90% of Nebraskans feel that improving management on existing public lands is very or moderately important to reversing the decline of at-risk species. In order to more fully conserve biological diversity on public lands, increased resources, training, support, and encouragement will be needed.

Maintenance of biological diversity will require that conservation efforts be directed at a broad range of land use issues and management practices on both private and public lands. In the past, management actions on public and private lands have been directed disproportionately at a relatively small subset of species (e.g. game species, threatened and endangered species) and inadequately at conserving intact natural communities. There is a need to broaden the focus of management and seek to implement strategies that benefit a broader array of Nebraska's biological diversity.

Nebraska's urban and rural citizens need to share responsibility for our culture's impacts on biological diversity and play a role in future conservation efforts. Biological diversity cannot be conserved solely on public lands or solely on private lands. Instead, conservation efforts will need to combine improved management on existing public lands, by protecting some additional lands through acquisition and conservation easements, and by implementing voluntary and incentive-based conservation actions on private lands.

In the last two centuries, land use and land management practices have significantly altered Nebraska's biological landscape and the ecological processes that sustain the flora and fauna of the state. Historically, the primary forces that shaped the pattern of plants and animals on our landscape have been climate (e.g. droughts, floods), fire, and grazing. Today additional factors such as artificial changes to hydrology, competition and predation from invasive species, habitat fragmentation, and pollution directly impact species and alter ecological processes, leading to degradation of habitat. Conservation practitioners identified six key stresses that are impacting biological diversity in Nebraska. These include altered fire regime, altered grazing regime, altered hydrologic regime, introduction of invasive species and pathogens, fragmentation, and pollution.

### **Altered Fire Regime**

Fire historically was a natural component of Nebraska's ecosystems and is important for maintaining biological diversity. Prior to European settlement, fires likely occurred on a 1-5 year interval in eastern Nebraska and a 10-20 year interval in western Nebraska. Suppression of fire is one of the primary factors that has altered Nebraska's natural communities. Today, less than 1% of the state's grasslands and woodlands are likely burned in any given year. The Loess Hills region of the mixed-grass prairie of Nebraska is a prime example of the problems associated with fire suppression. The rapid expansion of eastern red cedar trees across this region has degraded and fragmented natural communities and is leading to declines in native species and reduced livestock forage. Fire also plays an important role in prairie maintenance by promoting nutrient cycling, creating microhabitats, and increasing plant vigor and native plant diversity. Fire leads to similar benefits in woodland communities. Though some areas with dense tree cover may require mechanical thinning prior to burning in order to reduce fuel loads and prevent stand-replacement fires. There is also an important but poorly understood interaction between fire and grazing. Historically, burned areas often received intense grazing from bison or other herbivores following fire. This combination is rarely applied in today's landscape.

Although most private landowners see few benefits to burning, a growing number of individuals are becoming interested in using fire to control woody plant invasion or revitalize grasslands. Most don't have the capacity (e.g. equipment, burn crews) or expertise to carry out fires safely. Conservation practitioners often lack the resources to carry out the desired level of burning on private or public lands and few private contractors are willing to do burning because of liability concerns. Several cooperative efforts are underway to increase interest in prescribed fire. The Prescribed Burn Task Force and Great Plains Fire Learning Network are helping to educate landowners about burning by holding workshops and demonstration burns for private landowners.

### **Conservation actions related to fire**

- ❖ Promote the safe use of prescribed fire as a tool for grassland/wetland/forest restoration and management through public outreach and internal communication among conservation organizations and agencies. Conduct demonstration burns as a means to facilitate understanding and acceptance of burning.
- ❖ Increase the capacity of private landowners to burn by providing technical and financial assistance, equipment, fire-training workshops, how-to guides and other assistance.
- ❖ Identify and seek to overcome barriers that limit managers and private individuals ability to conduct prescribed burning on private and public lands.
- ❖ Develop and distribute a “best management practices guide” on prescribed burning that can be used to improve management of grasslands and riparian areas for biological diversity. Include information on sources of technical information, funding programs, equipment needed, etc.
- ❖ Promote and evaluate the use of patch burn grazing systems and other innovations that combine the effects of fire with grazing and other disturbance regimes than more closely mirror natural processes.
- ❖ Seek to minimize impacts to species that may lack the ability to recolonize a site following burning through consultation with species experts and pre-burn evaluation.
- ❖ Promote and support the establishment of burning cooperatives made up of local landowners, agencies and partners that cooperate on prescribed burning by assisting with education, training, and burning.
- ❖ Provide training and support to landowners and others to conduct rapid pre/post burn monitoring and assessment.

## **Altered Grazing Regime**

Nebraska contains approximately 22 million acres of rangeland and pastureland, most of which is grazed. Most grassland-associated species have evolved with and are maintained by grazing. When applied appropriately, grazing promotes structural heterogeneity, native plant diversity, and can help control invasive species. Managing both the timing and intensity of grazing is important to achieving plant health and diversity and maximizing benefits to the widest variety of species. Proper grazing can also help ensure that the state's 22 million acres of range and pastureland are sustained for cattle grazing.

Historically, grazing patterns were likely driven by fire frequency and weather. Today, most grazing takes place in the absence of fire and with relatively little variation in timing and intensity. As a result, large areas of prairie have shifted from diverse mixes of native grasses and forbs to grasslands dominated by a relatively small number of grasses (often non-native species such as Kentucky bluegrass, smooth brome) and less palatable early successional forbs such as western ragweed, snow-on-the-mountain, soapweed and musk thistle. This conversion has taken place after years of season-long grazing and has been intensified by broadcast applications of herbicide and inter-seeding of non-native grasses. Restoration of these sites is often very difficult even if a more diversity-friendly grazing system is introduced.

Both overgrazing and a lack of grazing can be detrimental to biological diversity. Overgrazing can severely impact the composition of grasslands, favoring species rarely grazed by cattle and adapted to consistent grazing pressure. Overgrazing near streams and wetlands can increase the amount of sediment and other pollutants entering water bodies. Conversely, the lack of grazing can lead to a loss in plant diversity due to thatch accumulation, competition by non-native species, and loss of microhabitats necessary for propagation of some species. A lack of grazing on wetlands can favor the establishment of monotypic stands of robust emergent plants.

Haying and mowing can serve as alternatives to grazing and provide benefits to species and habitats. Haying and mowing can be particularly effective at controlling woody encroachment and removing thatch but lack some benefits of grazing such as selective herbivory, soil disturbance from hoof action and nutrient recycling through animal waste. Under homogenous haying or mowing practices, plant composition and habitat structure often decline and natural re-seeding can be inhibited.

### **Conservation actions related to grazing/haying**

- ❖ Promote and support the use of diverse grazing/haying systems on private and public lands that enhance biological diversity and sustain natural communities. Initiate research that evaluates the profitability of biological diversity-friendly grazing/haying systems (e.g. reduced stocking rates, rotational systems, patch-burn systems).
- ❖ Develop and distribute a “best management practices” guide on grazing that can be used to improve management of grasslands and riparian areas for biological diversity. Include information on sources of technical information, funding programs, wildlife-friendly fencing specifications, etc.

- ❖ Promote and support the development of locally-based grazing cooperatives and incentive programs that can be used to facilitate grazing of playa wetlands, small disjunct prairie sites, woodlands and other sites with low grazing income potential.
- ❖ Support diverse haying regimes (e.g. on wet meadows) that stagger timing and height of cutting, promote increased plant and animal diversity, and avoid peak nesting periods for grassland birds.
- ❖ Promote the use and availability of locally adapted native seed sources for pasture and rangeland seedings.
- ❖ When possible seek to reduce or minimize fragmentation caused by permanent fencing and water development in new and existing grazing systems.
- ❖ Promote livestock grazing/haying systems that have built-in drought management contingencies (e.g. grass banking).
- ❖ Seek and promote economic alternatives that help reduce further conversion of important rangelands and pastures to cropland.

### **Altered Hydrologic Regime**

Historically, Nebraska had approximately 3 million acres of wetlands and nearly 24,000 miles of rivers and streams. Today, approximately 35% of the state's wetlands have been lost including nearly 90% of some playas, saline wetlands, and wet meadows. Although most of the state's rivers and streams have been significantly modified due to reductions in flows and through channelization, the Sandhills ecoregion stands out as containing some of the most unaltered rivers and streams remaining in the Great Plains. Continued conservation of the state's wetlands, rivers, and streams are critically important to sustaining biological diversity. Nearly half of Nebraska's Tier 1 at-risk species are dependent upon wetland or riverine habitats.

Approximately one million acres of wetlands have been lost in Nebraska, principally through drainage for agricultural development. The loss and alteration of wetlands has reduced habitat for many resident and migratory species and has resulted in severe overcrowding for spring migrating waterbirds. In addition, the lack of management or disturbance of existing wetlands has led to the spread of invasive species and the usurping of wetlands by a few dominant plants, resulting in a decline in natural biological diversity. Although past governmental programs facilitated wetland drainage, a shift in public attitudes in the 1970's and 1980's has resulted in increased interest by agencies, communities and private landowners to understand and conserve wetlands.

There have been substantial changes to Nebraska's rivers during the last two centuries. Nebraska's largest rivers historically experienced large fluctuations in flows, particularly in the

spring when snow melt and spring rains scoured sandbars and moved sediment creating treeless expanses favored by migratory birds and other species. Direct diversion of surface flows and pumping from alluvial wells for irrigation and municipal water supplies has substantially reduced stream flows in many rivers, caused others to dry up completely, and impacted native aquatic and terrestrial communities.

Although, droughts are a natural phenomenon in the Great Plains, conflicts over water use are intensified during extended dry periods. Healthy wildlife and plant communities are well adapted to withstanding long periods of drought but biological diversity is threatened as rivers and streams reach or exceed full appropriations. Diversion of water from streams and rivers during drought can greatly reduce the amount of deep-water refugia available to fish and raises water temperatures that can result in fish and invertebrate mortality. Pumping of groundwater for irrigation, municipal and other uses lowers water table levels that would otherwise sustain grassland plants through hot and dry periods. Dams and other impediments on rivers and streams restrict fish and wildlife movements, leaving large expanses of potential habitat uninhabited and or suppressing gene flow among populations.

As public awareness of the value of wetlands and natural flowing rivers has changed, efforts to restore these important habitats on both private and public lands have increased. Across the state, hundreds of wetlands have been voluntarily restored and countless other restoration projects are planned in the future. The ability of landowners to use wetlands for grazing and hay production after restoration helps meet landowner needs for income and while maintaining disturbance that promotes wetland health.

The conservation of Nebraska's streams, rivers, and their associated aquatic habitats will require hard work, compromise, and a shared vision for conserving Nebraska's biological diversity and sustaining an agricultural economy. Much is to be gained by conserving both, but change will be necessary. Ensuring there is enough water to meet the needs of people and wildlife and that effective measures are taken to maintain water quality will require innovative solutions.

### **Conservation actions related to hydrology**

- ❖ Seek to maintain or restore the natural hydrology of rivers, streams, and wetlands to sustain biological diversity and ecosystem function. Accomplish this through the use of voluntary incentives, sound bio-engineering solutions, and through collaborative decision-making.
- ❖ Establish an interdisciplinary working group that can develop a shared vision for the judicious use of limited water resources by developing drought mitigation strategies, alternative cropping/irrigation methods etc. that conserve and enhance biological diversity and lead to increased economic sustainability.
- ❖ Assess where current stream flows are inadequate and flow appropriations would most effectively contribute to the maintenance of biological diversity in Nebraska.

- ❖ Promote the development of an integrated water management plan for all water uses throughout the state.
- ❖ Promote and provide incentives for the use of wildlife-friendly conservation buffers, grassed waterways, sediment traps etc. on lands adjacent to wetlands, rivers, streams, reservoirs, and lakes to prevent siltation and protect water quality.
- ❖ Strengthen existing or establish new statewide partnerships responsible for promoting wetland, river, and stream conservation.
- ❖ Promote the value of naturally meandering rivers and streams, role of floodplains as habitat, and the need to maintain or closely simulate the natural hydrograph of rivers and streams to benefit biological diversity.
- ❖ Evaluate the impacts of new dams, additional groundwater and surface water withdrawals, channelization, and levy/dike construction on biological diversity.
- ❖ Promote the development and use of water conservation measures such as more water efficient irrigation systems, xeriscape landscaping, water-conserving appliances, etc.

### **Introduction of Invasive Species and Pathogens**

Most natural communities in Nebraska have been impacted by invasive species, in most cases by plants that were deliberately or accidentally introduced by people. Many naturalized species such as common dandelion and ring-necked pheasant appear to have little impact whereas others significantly affect biological diversity. Aggressive exotic species negatively impact native species through competition, direct predation, disruption of food chains, or by altering habitat or ecological processes. Nationally, invasive species are considered the second leading threat to biological diversity, second only to direct habitat loss. According to the 2004 NASIS survey, 58% of Nebraskans feel that non-native species are very or moderately likely to threaten at-risk species in the state and another 21% didn't know if it was important.

Most of Nebraska's native grasslands include a mix of native and non-native species. Exotic grasses such as smooth brome, Kentucky bluegrass, and cheatgrass are aggressive and often increase under season-long grazing or when there is soil disturbance. Invasive forbs such as musk thistle, leafy spurge, and sericea lespedeza impact both natural communities and grazing lands resulting in impacts to biological diversity and the grazing industry. The control of noxious weeds often results in unintentional impacts to native plants.

Invasive plants such as reed canary grass, common reed, purple loosestrife are threatening many of Nebraska's wetlands. Other species such as Canada thistle and Russian/Autumn olive, and Eurasian water-milfoil, have impacted many of the state's wetlands. Introduced species significantly reduce plant diversity and animal use of wetlands. Some species such as salt cedar may impact the hydrology of wetlands and rivers by increasing water consumption. Nebraska's

forests are threatened by garlic mustard and other plants that competitively exclude native species.

There are many introduced animal species that directly threaten biological diversity. The western mosquitofish competes with and often excludes the native plains topminnow. Common carp can alter bottom substrates and impact water quality and silver carp can disrupt food chains. House sparrows and European starlings compete with native cavity nesting birds for nest sites. The zebra mussel may threaten the state's native mollusks and feral hogs have become established at several sites in the state. The impacts of introduced species that are important for recreation such as Rainbow trout, bullfrogs, and red fox are not well known but need to be assessed.

Less is known about the impact of pathogens on wildlife in Nebraska. Diseases such as avian cholera have resulted in large die-offs of waterfowl during spring migration. West Nile virus has been documented to cause mortality in more than 150 species, including humans, but its impact on overall biological diversity is not known. Blue tongue can result in severe mortality and chronic wasting disease could potentially have a devastating affect on native ungulates. More resources need to be dedicated to understanding the impacts of diseases and other pathogens on biological diversity and proactive solutions need to be identified and implemented.

### **Conservation actions needed to reduce the impacts of invasive species and pathogens**

- ❖ Organize a diverse network of agencies and organizations to gather and share information about invasive species including, new control measures, control efforts that are underway, distribution of invasive species, and funding issues. Collaboratively develop and widely distribute a list of all known invasive species that threaten the state's biological diversity and develop best management practices that can be used to control or reduce the spread of those species.
- ❖ Use and promote restoration and management techniques that utilize native, locally-adapted species whenever possible. Discourage the use of non-native species in restoration/management projects.
- ❖ Encourage private seed companies to provide local-ecotype seed and harvesting and planting services.
- ❖ Renovate aquatic habitats by removing introduced rough fish to improve water quality, enhance aquatic vegetation and increase biological diversity.
- ❖ Seek measures that prevent the introduction, breeding, and use of potentially invasive non-native species by nurseries, hatcheries, universities, etc.
- ❖ Collaborate with natural resource organizations and others to develop a list of preferred plant materials (e.g. trees, shrubs, grasses, forbs) that can be used in urban and rural settings with little threat to biological diversity. Develop guidelines that will help ensure potentially invasive species do not spread to natural communities.



- ❖ Develop guidelines for the application of herbicides and use of biocontrols targeted at invasive species so that impacts to biological diversity are minimized.
- ❖ Initiate a public outreach campaign on the impacts of invasive species on biological diversity.
- ❖ Investigate the factors leading to the spread of invasive species, diseases, and other pathogens and their impacts on biological diversity. Develop and implement proactive conservation actions.
- ❖ Develop and implement protocols to better monitor, assess impacts, respond to, and manage disease stresses in Nebraska.
- ❖ Develop proactive management actions to impending disease stresses (e.g. chronic wasting disease, West Nile virus) to help limit future impacts to biological diversity.
- ❖ Assess the risks and/or benefits to biological diversity of commercialized wildlife and facilities.

### **Habitat Fragmentation**

Large-scale habitat fragmentation has occurred over most of the state with the exception of the Sandhills. Conversion of native habitats to crop fields, housing developments, and roads are the principal sources of fragmentation. Acreage development particularly on native prairie sites is resulting in accelerated loss and fragmentation of remaining grasslands. Infrastructure such as roads, dams, cell phone towers, and fences can impact species directly by altering movement or increasing mortality. Other forms of fragmentation can lead to the introduction or spread of invasive species or alteration of ecological processes such as predator prey relationships. Habitat fragmentation has particular consequences for species that are relatively immobile, or area sensitive species that require large intact landscapes. Fragmentation is often the result of a lack of long-term planning.

Nebraska, the Arbor Day state, has a long and proud history of tree planting. Tens of millions of trees have been planted to provide shelter to livestock, as windbreaks for homes, for aesthetics and as wildlife habitat. However, the planting of trees in native grasslands can negatively impact grassland-dependent species and some invasive trees like red cedar can rapidly spread into adjacent habitats.

### **Conservation actions needed to reduce habitat fragmentation**

- ❖ Provide incentives to private landowners to maintain natural habitats and to cooperatively manage large blocks of habitat as complexes that conserve biological diversity.

- ❖ Collaborate with planning commissions, county commissions, and building associations to site new housing units in a manner that reduces fragmentation of existing natural communities.
- ❖ Seek to enlarge habitat complexes by restoring converted or degraded sites within larger landscapes of habitat. Create habitat corridors to connect disjunct tracts of habitat.
- ❖ Discourage the placement of woody plantings and food plots within natural grassland communities, especially when it will result in increased fragmentation.
- ❖ When possible, take into consideration potential impacts to biological diversity when selecting sites for cell phone towers, wind turbines, dams, and fences.
- ❖ Collaborate with transportation planners (e.g. NE Dept. of Roads, Federal Highway Administration) to minimize impacts to at-risk species and key habitats.
- ❖ Seek to remove or create bypass structures around dams and other impediments that restrict the natural movement of aquatic species.

## **Pollution**

Although pollution can occur in many forms, water pollution is considered to be a principal stress to biological diversity, particularly for aquatic species. Water pollution includes both point and non-point sources and can include toxic chemicals, sediment, nutrients, minerals such as road salt, pesticides, and animal or human waste. Water pollution can result in direct mortality to species (e.g. fish kills due to toxic chemicals) or can alter natural communities and ecosystem function (e.g. eutrophication due to phosphorus runoff). Bioaccumulation of toxic substances can impact entire food chains and reduce the recreational value of aquatic resources.

According to the Nebraska Department of Environmental Quality, of 203 stream/river segments with sufficient data, 67% met the threshold for supporting aquatic life and of 140 lakes and reservoirs, 49% rated favorably in 2004. Of those surface waters considered impaired, 68% were due to the presence of fecal coliform bacteria, 26% due to excessive nutrients, 11% due to sedimentation, 9% due to low dissolved oxygen, and 4% due to ammonia, atrazine, turbidity and total suspended solids

Most Nebraskans recognize water pollution as an important threat to biological diversity. According to the 2004 NASIS survey, 92% of Nebraskans stated that water pollution is very likely or moderately likely to threaten at-risk species. In Nebraska, local Natural Resources Districts, the Nebraska Department of Environmental Quality, and the federal Environmental Protection Agency regulate water quality. These agencies and others help implement a number of voluntary best management practices to help prevent or mitigate sources of water pollution.

Although many scientists agree that the burning of fossil fuels and the emission of greenhouse gasses is contributing to global climate change, the impacts on biological diversity are difficult to

predict. Some recent studies have linked warming temperatures to shifts in distribution and migratory patterns in some bird species. Increased temperatures associated with global climate change will likely impact natural communities and species. Some global climate change models predict that the Great Plains will become more arid, putting further stresses on aquatic habitats and the species that use them. Communities and species that are most imperiled may be least capable of overcoming new stresses associated with global warming.

### **Conservation actions needed to reduce the impacts of pollution**

- ❖ Promote the practice of integrated pest management (e.g. non-chemical controls such as bio-control and tillage, spot spraying) through outreach and incentives to minimize impacts to biological diversity.
- ❖ Facilitate information exchange between conservation practitioners, landowners, and the public regarding the sources and impacts of pollution on wildlife. Provide regulatory agencies (like NDEQ) with information on the impacts of pollution on biological diversity to help make better decisions.
- ❖ Implement and seek funding for conservation practices such as filter strips, grassed waterways, sediment control basins, and grassed buffers to minimize the effects of fertilizers and pesticides on wetlands, streams, rivers and reservoirs.
- ❖ Work with agricultural and conservation partners to prioritize installation of conservation buffers, conservation tillage practices, etc. within watersheds where benefits to biological diversity would be highest.
- ❖ Provide voluntary incentives through existing or new conservation programs for the adoption of organic and low-chemical farming and livestock production, especially in watersheds where changes would have the most impact on biological diversity.
- ❖ Promote management practices that limit the impacts of nutrients, sedimentation, bacteria and pesticides to help protect water quality. Examples include nutrient application on cropland, sediment control on construction sites, etc.
- ❖ Share information with agencies and stakeholders about the importance of biological diversity and the benefits of locating powerplants, factories, animal feeding operations, homes and other potential sources of pollution in places that will have minimal impact on river, stream, and wetland water quality. When optimal siting is not feasible, state-of-the-art waste containment facilities should be constructed.
- ❖ Seek to understand the impacts of global climate change on Nebraska's biological resources and propose management actions to reduce those impacts.

## **Focus conservation on the best opportunities**

Conservation of Nebraska's biological diversity is an enormous undertaking and the human and financial resources needed to address this task remain limited, even with new federal funding. Conservation efforts in the past have been largely opportunistic and while important work has been done, it was not always the most efficient and effective use of limited resources. For example, using scarce funds to protect a lower quality tallgrass prairie with less biological diversity may preclude the protection of a higher quality prairie with more biological diversity. Given that habitat loss will continue, those higher quality prairies may be lost before an "opportunistic" approach would conserve them.

We need to improve the efficiency and effectiveness of conservation by taking a more systematic approach to identifying and prioritizing the components of biological diversity we wish to conserve and where in the state we should focus conservation efforts. Being more efficient and effective means implementing conservation actions that provide the best opportunities to maximize conservation of biological diversity, minimize resource conflicts, and avoid future stresses.

Whenever possible, agencies and organizations should pursue strategic rather than opportunistic approaches to biological diversity conservation. Multiple objectives can often be met by taking a habitat-based approach that benefits multiple species and habitats. Conservation efforts should be focused, when possible, on areas with multiple habitat types and opportunities to benefit at-risk species. They should also focus on those sites that offer the best opportunity for long-term success in sustaining species and ecological communities. For target species, these include sites at which the species' populations have a high estimated viability (large population size, appropriate age class, successful reproduction, few threats). For ecological communities, these would include sites with a high percentage of expected native species, few invasive exotic species, and where ecological processes essential to maintaining the community (e.g. fire, grazing, flooding) persist or can be simulated through management.

In developing the Natural Legacy Project, we utilized a systematic approach to identifying at-risk species, ecological communities, and biologically unique landscapes in the state (see chapter 3). This effort was based on the best available data and represents a first attempt to take a statewide, systematic and strategic approach to the conservation of biological diversity. We hope this effort will provide a useful tool to prioritize conservation targets and areas in the state and provide maximum benefits from our scarce conservation resources.

### **Conservation action needed to focus conservation on best opportunities**

- ❖ Conduct inventories to identify additional Biologically Unique Landscapes that contain high-quality examples of ecological communities and populations of at-risk species.
- ❖ Continue inventory of the currently described Biologically Unique Landscapes to better identify areas within them where multiple conservation objectives can be met.

- ❖ Provide information to conservation planners and practitioners to help focus conservation actions.
- ❖ Implement actions at those sites that offer the best opportunity for success in the long-term conservation of species and ecological communities.
- ❖ Work to ensure that high-quality occurrences of all terrestrial and aquatic community types in Nebraska are under long-term protection and management.
- ❖ Work to ensure that occurrences of viable populations of at-risk species are under long-term protection and management.

### **Expand the network of public and private conservation lands**

The continued loss and degradation of natural habitats undermine efforts to conserve biological diversity in the state. Nebraska's ranches, farms and private and public conservation lands provide the foundation for a support system for the state's flora and fauna. Almost all existing habitat in Nebraska is due to the stewardship of private landowners, and this will continue. Maintaining and improving existing habitat on working farms and ranches is key to conserving biological diversity and offers the greatest hope for success. There is also a need to set aside some lands that can be put under long-term protection and managed specifically for biological diversity. A network of conservation lands is needed that includes a combination of protected working private lands and public and private conservation areas managed for the purpose of perpetuating biological diversity.

Habitat loss is the primary cause of species decline. Most of the state's natural communities with the exception of those found in the Sandhills and a few other areas have undergone extensive losses. Some, like the tallgrass prairie have been reduced to less than 2% of their original extent. While it is possible to restore cropland and other altered lands, reestablishing the full complement of biological diversity is often impractical and prohibitively expensive. John Weaver the acclaimed prairie ecologist noted that "Prairie is much more than land covered with grass. It is slowly evolved, highly complex, and centuries old. Once destroyed it can never be replaced by man". To be able to conserve the full array of biological diversity, we need to conserve existing natural habitats that are still in relatively good condition.

An important way to ensure that species, habitats, and ecosystem processes are maintained over time is to devote some portion of the landscape to those specific purposes. This can be done by expanding the network of lands that have long-term protection from conversion/degradation and to manage these lands principally for biological diversity. This network of conservation lands does not have to be limited to those owned by government agencies or conservation organizations. Private lands with conservation easements, long term leases or management agreements could also be included. Collaboration with private landowners adjacent to lands under long-term protection can enlarge or buffer these lands resulting in larger blocks of habitat. These lands do not need to be managed to the exclusion of human uses. The key lies in the

emphasis on biological diversity values, not as a collateral or subsidiary benefit, but as a primary goal for managing the land.

In some cases, acquisition of land by public agencies or private conservation organizations is an appropriate conservation alternative. With less than 3% of the state in public conservation lands, Nebraska has one of the lowest percentages of public land in the country. A large proportion of the state's public land is in the Sandhills and the northwestern corner of the state leaving many natural communities under-represented or not included at all as public trust lands. Acquisition of under-represented natural communities from willing sellers by private or public conservation groups would help ensure the long-term conservation of biological diversity. In addition, 50% of the Tier I at-risk species have no documented occurrences on public lands and therefore are not ensured long-term habitat protection. A number of these species may have habitat management requirements that are not conducive to achieving an economic return. Thus public or private conservation ownership may be the most practical way to maintain them. To be acceptable to the public, these acquisitions should ensure that payments are made in lieu of property taxes to maintain the local tax base. Public lands have the additional benefits of meeting recreational, educational, research and other societal needs

There is also a need to improve management on existing public and private conservation lands so that the needs of a greater array of species can be met. Public land managers and private conservation groups often lack the financial and human resources to adequately manage their lands for biological diversity. Demands on manager's time to control invasive species and manage public use often leave little additional time to restore or manage natural communities. Insufficient capacity to monitor and evaluate management activities and a lack of information about species habitat requirements and management alternatives serve as barriers to improved conservation land management. These issues need to be addresses so that public and private conservation organizations lands can more fully contribute to the conservation of our natural heritage.

### **Conservation actions needed to improve the network of public and private conservation lands**

- ❖ Identify and secure long-term protection for unique or high quality natural communities through actions such as conservation easements, land exchanges, voluntary acquisition, or conservation buyer programs.
- ❖ Promote land acquisition policies that are founded on willing-seller/willing buyer principles, that maintain the local tax base, and provide equitable compensation to landowners.
- ❖ Start a natural areas program (modeled after successful programs in other states) that identifies and protects biologically unique sites that are managed to perpetuate Nebraska's biological diversity.

- ❖ Encourage and support the formation of new or expansion of existing land trusts to acquire and manage conservation easements that conserve biological diversity in Nebraska.
- ❖ Improve or change management on public lands to better protect, enhance and sustain biological diversity and natural communities.
- ❖ Establish voluntary cooperative agreements with private landowners adjacent or near existing public or private conservation lands to facilitate large-block management for conservation and recreation. Provide financial incentives, technical expertise, and recognition to landowners willing to enter into management agreements.
- ❖ Create a forum whereby landowners, community leaders, and conservation practitioners can discuss land management issues and observe management practices in use on public lands. Use the forum to engage in collaborative problem-solving.
- ❖ Facilitate the long-term protection of biologically important lands enrolled in short-term conservation programs (e.g. Conservation Reserve Program, private lands programs) through conservation easements.
- ❖ Seek opportunities to improve management on publicly owned lands that are not part of the conservation network (e.g. Bureau of Education Land Fund holdings) to increase benefits to biological diversity.
- ❖ Support efforts to provide voluntary public access to private conservation lands that are managed for biological diversity.

### **Increase participation in nature-based recreation**

Broad participation in nature-based recreation (e.g. wildlife viewing, hunting, fishing, canoeing, etc.) has social, ecological, and economic benefits. According to the 2004 NASIS survey, 77% of Nebraskans felt it was very important that people have an opportunity to view wildlife and 66% felt it was very important that people have the opportunity to hunt and fish. Increasing opportunities for high quality nature-based recreation will help establish or maintain personal connections to biological diversity, motivate individuals to support conservation efforts, and meet an obligation to provide recreation to the state's citizens.

Without sustainable populations of wildlife and intact natural communities, nature-based recreation is unsustainable. Nature-based recreation can serve as a strong incentive for conserving biological diversity. However, without adequate controls, recreation and conservation can be in conflict. Nature-based recreation must be appropriately managed and at times controlled to limit impacts to species and habitats and to maintain quality recreational experiences.

The economic diversification that can result from nature-based recreation or natural amenities can help provide a much-needed boost to rural communities. Many Nebraska communities are facing long-term population declines that are leading to economic stagnation. Community leaders are seeking new and innovative ways to reverse this decline. The high level of interest in the Nebraska Birding Trails initiative is one example of how nature-based tourism is seen as a partial solution to economic troubles. For biological diversity conservation to succeed it will be necessary for conservation decision-makers, community leaders, and the business sector to collaboratively develop a long-term sustainable economic vision that includes conservation of the state's natural assets.

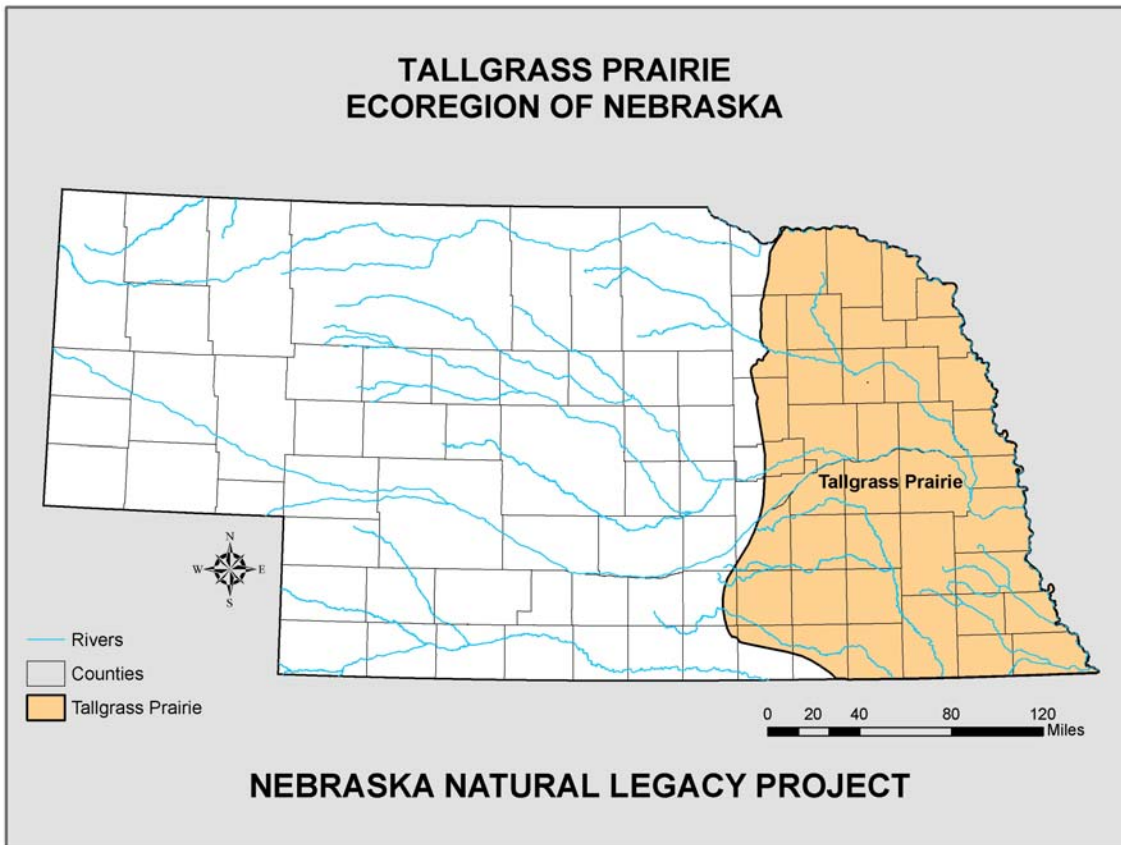
### **Conservation actions needed to increase participation in nature-based recreation**

- ❖ Collaborate with agencies, private organizations, and communities to develop new and enhance existing wildlife-viewing infrastructure (e.g. roadside pull-offs, interpretive signage, viewing platforms). Promote the use of wildlife viewing sites through the media and established networks of nature enthusiasts.
- ❖ Develop resources and a support system to assist communities with sponsorship of wildlife-related events (e.g. eagle viewing days, crane celebrations, hunter breakfasts, fishing tournaments, etc) that have recreation, educational and entertainment value and provide community economic benefits.
- ❖ Identify sites conducive to greenway development and provide resources and support to help communities engage in collaborative planning to develop long-term strategies that meet conservation, economic, and recreational goals.
- ❖ Form a task force that includes economic experts, conservation practitioners, community leaders, and private landowners that can examine the economic, social, and conservation value of a natural amenities-based economy throughout the ecoregion.
- ❖ Develop a train-the-trainer program that increases the number of individuals who are knowledgeable about and committed to promoting nature-based recreational opportunities. Support the establishment of naturalist programs in state parks and other recreational areas.
- ❖ Develop partnerships with landowners to provide wildlife viewing (e.g. birding trails), hunting, and fishing opportunities on private lands and seek to provide fair compensation for providing these services. Develop collaborative eco-tourism marketing plans for different regions of the state that can be used to expand nature-based tourism and increase economic sustainability.
- ❖ Develop and populate a database of private and public nature-based recreation sites. Make the information available to the public in a user-friendly manner through the Internet and a printed publication.



- ❖ Distribute education material for nature-based users that identify potential problems associated with recreation use (e.g. ATV's, impacts of boaters, wildlife viewing disrupting wildlife.)

## Chapter 5: TALLGRASS PRAIRIE ECOREGION



### INTRODUCTION

Early explorers described the tallgrass region as a sea of grass with open horizons and flowers rooted in rich organic soils. Grasses are significantly taller than those found in the mixed-grass and shortgrass prairies. The tallgrass prairie once extended from eastern Nebraska to Indiana and from Texas to southern Canada. Today less than 1% of tallgrass prairie remains in the continental United States. Approximately 2% of tallgrass prairie remains in Nebraska, mostly as remnants less than 80 acres in size. In Nebraska, the tallgrass prairie ecoregion covers the eastern fourth of the state but this prairie type also extends further westward into the mixed-grass and Sandhills ecoregion along stream valleys of the Republican, Platte, Loup, and Niobrara rivers.

Glaciers, wind and water have shaped the topography of the tallgrass region over the last several million years. Today, the land surface is mainly rolling hills intersected by stream valleys. The elevation changes from 850 feet above sea level in the far southeastern corner of Nebraska to approximately 1700 feet at the edge of the tallgrass prairie ecoregion. Receding glaciers left

evidence of their passing through till deposits and hilly moraines. After the glaciers receded windblown loess was deposited over the till. These materials, with organic matter provided by thousands of years of prairie vegetation, form the basis for the deep, fertile soils that typify eastern Nebraska. These soils have excellent water holding capabilities creating a rich environment for plant growth.

The tallgrass prairie ecoregion receives more precipitation than other Nebraska ecoregions with 25 to 36 inches of annual precipitation. Roughly three-fourths of the rainfall is during the growing season, between April and September with May and June being the wettest months. Temperatures average highs of 90 degrees Fahrenheit in mid summer and lows of 10 degrees Fahrenheit in winter.

The ecoregion contains stretches of two of Nebraska's major rivers. The Missouri River is the state's largest river and forms the northern and eastern boundaries of the tallgrass prairie ecoregion flowing approximately 350 miles in Nebraska. Along the river, the terrain includes bluffs and river terraces and floodplains. The Missouri River drains approximately 529,350 square miles of land (including the entire state of Nebraska). Historically the Missouri River was more than a mile wide and up to 20 feet deep with abundant sandbars and forested islands. The river's floodplain was a mosaic of oxbow lakes, backwater marshes, wet prairies and forests.

The Platte River is a classic example of a prairie river. Historically, the river was shallow with a braided channel measuring three miles at its widest and a multitude of sandbars. The floodplain was 15 miles wide and was typically covered with lush wet meadows and freshwater marshes. Spring floods limited tree growth and created wide sandbars barren of vegetation. The ecoregion has many smaller streams including Papio Creek, Turkey Creek, and Bazile Creek.

This ecoregion includes several types of wetlands including saline wetlands and Todd Valley playas. Eastern saline wetlands occur in swales and depressions within the floodplains of Salt Creek and its tributaries in Lancaster and Saunders counties. The salinity originates from groundwater inflow that passes through an underground rock formation containing salts deposited by an ancient sea that once covered Nebraska. These wetlands have very saline soils and salt-tolerant vegetation with some of the more unusual plant communities. The wetlands can be bare with salt encrusted mudflats or have salt-tolerant plants, such as saltwort, saltgrass, and sea blite, dominating the highly saline soils. Todd Valley playas include small, clay-lined closed depressions located in loess soils. They are seasonally and temporarily flooded and are found in an ancient valley of the Platte – termed the Todd Valley.

## **Vegetation**

Though historically upland tallgrass prairie was the dominant plant community of the region, eastern Nebraska has a diversity of other community types ranging from deciduous woodlands to saline wetlands. Upland tallgrass prairie is dominated by big bluestem, Indiangrass, switchgrass and Canada wildrye. These grass species can reach six feet or taller especially when rooted in rich moist stream valleys. Tallgrass prairies also include hundreds of species of wildflowers and other forbs that support a diversity of other prairie species. Examples of these include showy goldenrod, prairie blazing star, sky blue aster and purple coneflower.

Native woodlands are found mainly in the more mesic and fire-protected stream valleys and bluffs. They are most extensive in the Missouri River valley. Cottonwoods, willows, boxelders, and American elm dominate wetter floodplain woodlands in the tallgrass region. The drier river bluffs support oaks, hickories, basswood, black walnut and other deciduous trees. These woodland habitats, particularly oak and hickory woodland bluff areas provide essential habitat for migrating birds.

Wet meadows occurred in stream valleys where the water table remains near the soil surface throughout the year. The loamy to sandy soils support lush vegetation dominated by sedges, spikerushes, prairie cordgrass and switchgrass. Marshes were common in river floodplains prior to settlement. Common marsh plants included broad-leaf cattail, bulrushes, bur reed, smartweeds, and arrowheads.

## **Animals**

More than 300 species of resident and migratory birds have been documented in the tallgrass prairie ecoregion. Nesting waterbirds include wood duck, green heron, northern pintail, blue-winged teal and mallard. The region supports populations of greater prairie chicken and a full complement of grassland birds including Henslow's sparrow, dickcissel, grasshopper sparrow, bobolink, vesper sparrow and Swainson's hawk. Although woodlands are mostly confined to stream corridors, woodland species such as Bell's vireo, black-and-white warbler, rose-breasted grosbeak, and orchard oriole are common breeding species.

The tallgrass prairie region is home to more than 55 mammal species; most have a widespread distribution and can also be found in central and western Nebraska. The small mammal fauna of the region includes plains pocket gopher, prairie vole, plains pocket mouse, thirteen-lined ground squirrel, and Franklin's ground squirrel. Species such as the masked shrew and jumping mouse can be found associated with wet meadows and other wetlands. Prior to European settlement the tallgrass prairie region was home to large mammals such as bison, elk, and mule deer. Free roaming bison no longer occur in the region however white-tailed deer are common big game animals and mule deer are infrequently found in upland grasslands. The most abundant large predator of the region is the coyote, but other predators such as the red fox and badger can be found here as well. The bobcat, least weasel, long-tailed weasel and mink can be found in wooded areas, wetlands and along river valleys. The native large predators that were present prior to European settlement such as the mountain lion, black bear, grizzly bear, and gray wolf are extremely rare or extirpated from the region.

Streams, rivers and lakes in the tallgrass prairie region are home to over 75 species of fish. Many common species are big river generalists that can withstand wide variation of environmental extremes. Among these are the channel catfish, flathead chub and river carpsucker. Game fish, primarily northern pike, largemouth bass, walleye, and bluegill, have been introduced into many lakes and ponds. Exotic species such as grass, common, silver and big head carp have found their way into most of the major rivers and lakes in the region.

Fifty-three species of amphibians and reptiles are found in the tallgrass prairie ecoregion, including two salamanders, five toads, six frogs, eight turtles, up to eight lizard species and twenty-four snakes. All of the amphibians use wetlands for breeding, however the Great Plains

toad, plains spadefoot and Woodhouse toad spend most of their adult life in the uplands. Aquatic turtles such as the painted turtle, false map turtle and snapping turtle are common in wetlands, lakes and ponds. The six-lined racerunner and northern prairie skink inhabit dense grasslands and are relatively common but seldom seen. The five-lined skink inhabits the tallgrass prairie region but is rare. The bull snake, fox snake, yellow-bellied racer and plains garter snake are the most common snakes. The timber rattlesnake, massasagua and copperhead snakes are venomous snakes with highly limited distributions.

Insects are the most diverse and least studied animal group in the tallgrass prairie region. They may also be the most important group ecologically and economically. They play vital roles as herbivores, predators, pollinators, decomposers, soil aerators, and as food for other wildlife.

## **DOMINANT LAND USE AND HISTORY**

Archeological evidence suggests that the first human inhabitants in Nebraska were big game hunting Native Americans around 12,000 years ago. Native American tribes who raised crops of corn and other vegetables followed those early big game hunters. They entered and abandoned this area as the climate fluctuated between periods of drought and times of plentiful moisture. During the late 18<sup>th</sup> century, the farming tribes of eastern Nebraska were Otoe, Omaha, Ponca, and Pawnee. They lived in earth-lodge villages and cultivated crops, and engaged in buffalo hunting.

Early 19<sup>th</sup> century perceptions of the plains grassland as an area unfit for agriculture left people thinking that lands west of the Missouri were unsuitable for settlement. It was a land open to explorers, traders and travelers on a journey west through the country. In 1804 the Lewis and Clark expedition mapped what was to become the eastern boundary of Nebraska. In 1812, the St. Louis Missouri Fur Company built a post near the site where Lewis and Clark met with Native American tribes in present Washington County, one of the first establishments in Nebraska. Steamboats, which became well established in 1819, brought business and people to the Missouri River ports. Bellevue, founded in 1823, was the first permanent settlement in Nebraska. Tens of thousands of people traveled through the area on the Oregon/California Trail during the 1840s and 1850s.

The settlement in the tallgrass region increased as a result of the passing of the Homestead Act in 1862. This enabled farmers to settle on 160 acres of free land in return for living on the land. By 1900, most prime farmland in eastern Nebraska was settled by inhabitants of European descent. The Native American tribes had been decimated by disease, and relocated and bison herds exterminated. Presently, five reservations exist in eastern Nebraska: the Santee Sioux, Omaha, Winnebago and portions of Sac and Fox and Iowa reservations.

The land use changes initiated by the Homestead Act helped Nebraska develop an agriculture-based economy. The Tallgrass Prairie ecoregion is generally considered to have more diversified farming operations than the western part of Nebraska. Major crops grown in the tallgrass region include corn, soybeans, wheat, oats and alfalfa. The dairy, pork and poultry industries are located primarily in the eastern part of the state. Beef cattle are also housed in the tallgrass prairie region. The livestock and poultry industries found here are great consumers of the corn, soybeans and other crops, helping add value to these raw commodities.

Since the initial development of agriculture, farms have become fewer in number and larger in size. Since the 1950's machinery and modern farming methods have made agriculture more efficient, thereby decreasing the number employed directly by agriculture. This trend caused rural residents to move to larger communities in search of jobs.

The state's largest urban centers, Lincoln and Omaha are located in the tallgrass region. Omaha was originally laid out in 1854 by a ferry company and quickly grew into a thriving commercial and cultural center. The eastern terminus of the first transcontinental railroad stimulated its growth. Agriculture also played a role in Omaha's development. Stockyards spurred growth in South Omaha, and by 1893 Omaha housed the nation's third largest stockyards. From these roots, Omaha has steadily grown and is now the 42nd largest city and the 60th largest metro area in the nation.

Lincoln is the second largest city in Nebraska. Settlers were attracted to the Lincoln area by the potential industry of salt mining. For a time this was a thriving industry. In sunny weather a crust of salt would form on the ground that could be harvested. The salt mining industry was never fully developed and came to a halt when salt mines were developed in Kansas. When Lincoln was named as the state capitol, the city thrived and continues to expand today.

## **NATURE-BASED RECREATION**

Several of the state's top tourist attractions are outdoor in nature and provide conservation, education and recreation opportunities. The Henry Doorly Zoo sits on 110 acres and contains the largest indoor jungle, largest indoor desert, an aquarium, and gorilla valley and orangutan forest. The Bill and Berniece Grewcock Center for Conservation and Research provides state of the art medical and research capabilities in animal care and management, reproductive physiology, nutrition, genetics and genome resource banking. Ak-Sar-Ben Aquarium and Outdoor Education Center provide the opportunity to see fish native to Nebraska.

Several state parks and recreation areas offer a plethora of recreation activities that are easily accessible. For example, E.T. Mahoney State Park offers a water playground, hiking, camping and many other activities. Ponca State Park offers activities year round with the Missouri National River Resource and Education Center. At Platte River State Park you can rent a tepee, go horseback riding and challenge yourself with some of the best mountain biking in eastern Nebraska. Two Rivers State Recreation Area and Branched Oak Recreation Area offer fishing, boating, swimming and hunting.

The tallgrass prairie offers a diversity of hunting opportunities. Quail hunters find greater success south of the Platte River in Johnson and Pawnee counties. Turkeys are abundant along the Missouri River, Platte River, Big Nemaha and Little Blue Rivers. Waterfowl hunting along the Missouri River and its marshy backwaters is some of the best Nebraska has to offer. White-tail deer can be found throughout the region. The Missouri Bluffs also support an excellent squirrel population.

Wildlife viewing and birding enthusiasts find ample opportunities in this region with the diversity of habitats. This region's prairie chicken population has been rising steadily in recent

years allowing a limited hunting season and ample spring viewing opportunities. Fontenelle Forest, Indian Cave State Parks and Schramm State Park have wooded bluffs of the Missouri River that provide habitat for many migrating birds. Some warblers, thrushes, tanagers and other birds are seen almost exclusively in these areas during migration. Tallgrass prairie remnants like Nine-Mile Prairie and Spring Creek Prairie provide the opportunity to see grassland nesting birds.

There are opportunities for canoeing, hiking and biking in this region. The Elkhorn River meanders through hilly areas with steep slopes, woodlands and dense forested areas interspersed with farmland. The Platte River is braided but usually has one deeper, darker channel suitable for canoeing. Sandbars in the river are used by waterfowl and shorebirds. The cowboy trail, Steamboat Trace Trail, MoPac East Trail and Oak Creek Trail all offer hiking and biking opportunities.

The Missouri River has perhaps the greatest untapped potential as a nature-based tourism destination. The ecoregion includes a 59-mile stretch of the unchannelized Missouri River that has been designated as a National Recreation River. The portion of this stretch from Gavin's Point Dam to Ponca State Park is used by canoeists but requires caution for navigating. Unique geology of orange and white chalk and gray shale is often exposed where the river has carved away at the bluffs.

Anglers can enjoy a diversity of fishing opportunities from large rivers to small farm ponds. Missouri River anglers can take advantage of smallmouth bass, walleye, sauger and catfish, which are plentiful in the river. Paddlefish archery in the Missouri River offers a different fishing experience. Trout are found at Grove Lake, Crystal Cove Lake, David City Park Ponds and several other lakes and ponds. Numerous impoundments and prairie streams offer warm-water angling opportunities throughout this region.

Nebraska Scenic Byway encourages travelers to enjoy the journey. The Lewis and Clark Scenic Byway retraces the path of Lewis and Clark from Omaha to South Sioux City on U.S. Highway 75 where you can see wooded bluffs, open bottomlands, cropland and historic waterways. The Heritage Highway stretches from the Missouri River to south central Nebraska along U.S. Highway 136 and cuts across the land memorialized by Willa Cather. Travelers can enjoy Homestead National Monument of America, where they can enjoy the second oldest restored prairie. The Outlaw Trail Scenic Byway along Highway 12 begins at South Sioux City and ends in Valentine. Along this route you can observe the transition from forested bluffs to the sandhills.

Over half of Nebraskan's live in the Lincoln and Omaha metropolitan areas. The continuing urbanization of Nebraska has significantly increased demands for outdoor recreation in eastern Nebraska of both traditional outdoor recreation and recreation with modern amenities and facilities.

## **EDUCATION**

There is a great demand for education in the Tallgrass Prairie ecoregion, and the region does have the organizations to provide it. There are currently at least three private organizations in

the ecoregion whose principal purpose is environmental education. These include Fontenelle Nature Association in Bellevue, Pioneer Park Nature Center in Lincoln, and Audubon Nebraska's Spring Creek Prairie Education Center near Denton. The region's NRD's and state parks, especially Ponca State Park, Mahoney State Park, and Indian Cave State are increasingly delivering nature-based education programming.

Education centers at Ponca State Park and the new Lewis and Clark Interpretive Center in Nebraska City were constructed to help interpret and celebrate the 200<sup>th</sup> anniversary of the Lewis and Clark expedition. These facilities also help to increase awareness and appreciation for the Missouri River. The ecoregion also includes two zoos, which provide many learning opportunities. The Folsom's Children's Zoo in Lincoln has an innovative zoo school that allows students to attend classes at the zoo. The Henry Doorly Zoo in Omaha and the Wildlife Safari near Gretna provide educational opportunities.

## **PARTNERSHIPS**

The tallgrass prairie ecoregion is home to a diversity of partnerships, coalitions and nature centers that have been formed to conserve the region's wildlife. These include but are not limited to:

- ❖ The **Nebraska Eastern Saline Wetland Conservation Partnership** is focused on a small geographic area, but has significant impact for species conservation. This partnership was formed to address the long-term needs of the saline wetlands, an area of approximately 100 square miles forming a wetland complex in Lancaster and Saunders counties. This partnership consists of nearly 20 partners with 5 full-share partners. The challenge for this partnership was to design conservation objectives that meet the needs of the wetland complex and the community. An implementation plan for the conservation of Nebraska's Eastern Saline Wetlands was completed in 2003. The plan goal is "No net loss of saline wetlands and their associated functions with a long-term gain in sustaining wetland functions through the restoration of hydrology, prescribed wetland management and watershed protection.
- ❖ **Missouri River Futures** is a collaborative effort primarily between agencies to address the natural resource, recreational and navigation concerns along the Missouri River between Fort Randall Dam and Ponca. The initiation of this group in 2003 was needed since, in the past, organizations and agencies would typically work on similar Missouri River issues individually. Over 30 entities including state and federal agencies, community and local groups have given support to this effort. This group strives to find a balance between navigation needs and meet the needs of wildlife.
- ❖ **Missouri River Life** is a locally led effort that began in 2003 and involves both South Dakota and Nebraska. This group involves landowners, local communities, businesses and natural resource professionals. The purpose of this group is to engage local people in the decisions made regarding Missouri River resource issues.
- ❖ **Back to the River** began with a planning alliance in 1995 for the Missouri River corridor. This partnership includes local city representatives, city commissioners, NRD managers, educators, Nebraska Game and Parks staff, nature center, Omaha Parks and Recreation staff,



tourism representatives and Iowa Department of Natural Resources. Back to the River envisions a riverfront that is attractive to wildlife and to commerce. The goals of this group are to promote recreation and river access, encourage compatible economic development, emphasize historic and cultural resources, improve wildlife habitat, promote education, improve water quality and to endorse responsible floodplain management.

- ❖ **The Nebraska Tallgrass Prairie Partnership** was formed in 2003. The mission of the partnership is the enhancement, conservation, and restoration of Nebraska's tallgrass prairie ecosystem and its associated at-risk species while meeting the needs and objectives of landowners. Partners include the NGPC, USFWS, Natural Resource Conservation Service, Pheasants Forever, Audubon Nebraska, Wachiska Audubon, Prairie Plains Resource Institute, The Nature Conservancy, Northern Prairies Land Trust, Nemaha Natural Resource District, Nebraska Wildlife Federation, Chet Ager Nature Center, and private landowners. The long-term goals of the Tallgrass Prairie Partnership is to increase the knowledge among the public, landowners, and politicians regarding the economic, cultural, and ecological value of tallgrass prairie, prairie inventory and identification of priority conservation areas (focus areas), initiate cooperative planning efforts at multiple scales, develop enhanced methods of prairie management, monitoring, and research, and increase funding for tallgrass prairie conservation and education efforts.
- ❖ **The Upper Mississippi River and Great Lakes Region Joint Venture** involves ten states and was established in 1993 in response to the needs of breeding and migrating waterfowl in northern part of the Mississippi Flyway. The goal of the Joint Venture is to increase populations of waterfowl and other wetland wildlife by protecting, restoring and enhancing wetland and associated habitat. In 2003 a resolution was passed to provide all bird conservation consistent with the North American Bird Conservation Initiative.

## ECOREGION-SPECIFIC STRESSES AND CONSERVATION ACTIONS

### Key Stresses

Stresses and conservation actions in the tallgrass prairie ecoregion are identified in chapter four and in descriptions of biologically unique landscapes. The following stresses were identified by conservation practitioners as the top stresses in the ecoregion.

- ❖ Alteration of natural disturbance regime: Tallgrass prairie, wetland, and forest habitats in the ecoregion were maintained historically by periodic fires and grazing. Today the loss of fire has resulted in the degradation of thousands of acres of prairie by invasive species. Grazing systems used on prairie remnants in the ecoregion do not mirror historical grazing patterns resulting in a loss of plant and animal diversity and ecological function.
- ❖ Spread of invasive species: Invasive species are severely threatening the ecoregion's biological diversity. Smooth brome, Kentucky bluegrass, reed canary grass and other species have competitively excluded native plants and degraded habitat for fish and wildlife. The introduction of carp, feral hogs, and other species have altered habitats and increased competition to native species.

- ❖ Altered hydrology and channel degradation of rivers and streams: Historically the ecoregion's large rivers experienced spikes in flows during the spring and early summer. These spikes enabled sediment to be transported and deposited and for channels to meander and migrate creating habitats important to many species. Reductions in natural flows have reduced habitat available to fish and other species. Channelization has caused streams to become incised, lowering water tables of adjacent wetlands and affecting plant composition.
- ❖ Lack of awareness and knowledge about the region's biological diversity and ecological processes: Although the region's remaining native grasslands, woodlands, and wetlands are unique and of high value, most of the ecoregion's residents lack an awareness of the importance of these habitats to biological diversity. Citizens have limited knowledge and opportunities to learn about the ecoregion's natural communities and fish and wildlife. Many private landowners have a limited understanding of the complex ecological processes that are necessary to maintain biological diversity in the tallgrass region.
- ❖ Sedimentation of rivers, streams, and wetlands: The close proximity of agricultural fields to rivers, streams, and wetlands has resulted in large volumes of sediment entering the ecoregion's water bodies. Sedimentation increases stream turbidity and changes bottom substrates degrading habitat for fish and other aquatic species. Sedimentation of wetlands alters storage capacity and changes plant composition, reducing habitat available to waterfowl and other species.
- ❖ Pollution by pesticides and urban and industrial runoff: The introduction of pesticides, storm sewer runoff, and industrial pollutants into rivers and streams is impacting water quality and exposes fish and other species to harmful agents. The indiscriminate use of herbicides on native habitats reduces plant diversity and overall biological diversity.
- ❖ Conversion and fragmentation of natural habitats: Although the majority of the ecoregion's natural habitats have already been converted, many remaining natural communities are threatened by continued agricultural development. The expansion of urban areas into surrounding rural communities is accelerating conversion of prairies, bluff woodlands, and wetlands.
- ❖ Loss of lands enrolled in conservation programs: Lands enrolled in programs such as the Conservation Reserve Program provide significant benefits to some species of wildlife. Changing economic conditions and reduced support may result in large tracts of conservation lands being converted to agricultural cropland. The loss of even a modest percentage of these lands will result in impacts to aquatic and other species.

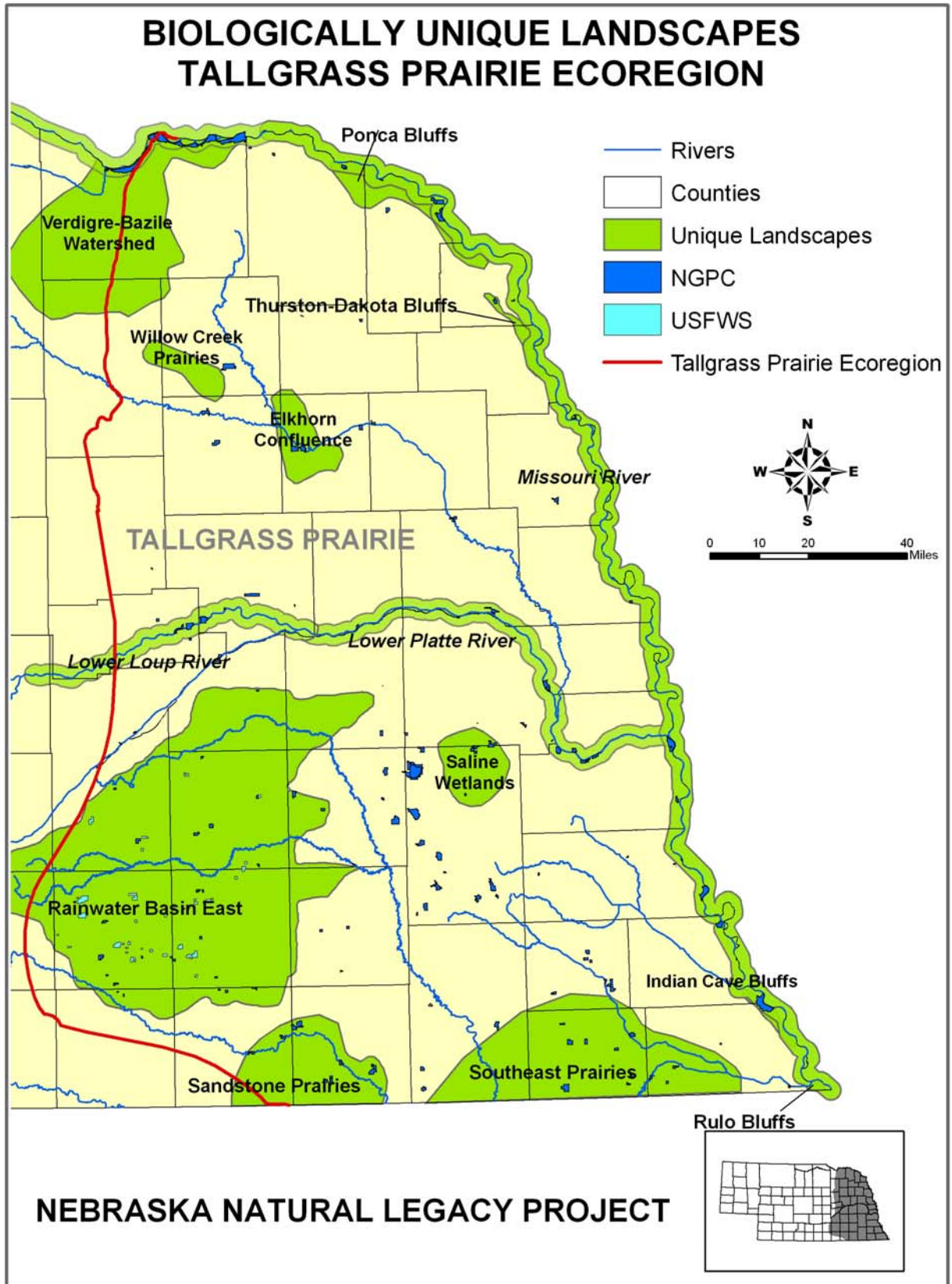
## **Biologically Unique Landscapes of the Tallgrass Prairie Ecoregion**

One of the goals of the Legacy Project is to identify a set of priority landscapes that, if properly managed, would conserve the majority of Nebraska's biological diversity. These landscapes, which we are calling Biologically Unique Landscapes, were selected based on known occurrences of at-risk species and ecological communities. See Chapter 3 for a description of the methods used to select the landscapes.

The map on the following page shows the biologically unique landscapes for the Tallgrass Prairie ecoregion. Following the map are brief descriptions of each landscape including stresses affecting species and habitats, proposed conservation actions, and lists of Tier I at-risk species and ecological communities found in the landscape. An asterisk next to a community name indicates that it is a priority for conservation in that landscape.

### **Tallgrass Landscapes**

Elkhorn Confluence  
Indian Cave Bluffs  
Lower Platte River  
Missouri River  
Ponca Bluffs  
Rainwater Basin East (see Mixed-grass Ecoregion for Rainwater Basin description)  
Rulo Bluffs  
Saline Wetlands  
Sandstone Prairies  
Southeast Prairies  
Thurston-Dakota Bluffs  
Verdigre-Bazile Watershed (see Mixedgrass Ecoregion for description)  
Willow Creek Prairies



**Landscape Name: Elkhorn Confluence****Landscape Description**

This landscape includes the land around the confluence of the North Fork and South Fork of the Elkhorn River in Stanton County. The Elkhorn river floodplain is primarily cropland, but also contains cottonwood-dominated woodlands, wet meadows and freshwater marshes. The uplands on the south side of the river are composed of sand dunes originating from river alluvium. Dry-mesic sand prairie, mostly grazed, and bur oak woodlands occupy the dunes. Most of the sandy soils south of the river have been converted to cropland. The uplands north of the rivers contain more loam and are mostly in cropland though some degraded tallgrass prairies remain. There are currently no protected areas in this landscape.

**Stresses Affecting Species and Habitats**

- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Conversion of native prairies to cropland.
- ❖ Invasive tree encroachment in prairies and woodland (e.g. Siberian elm and eastern red cedar).
- ❖ Exotic herbaceous plant invasion of prairies and woodlands, primarily leafy spurge and Canada thistle. Overgrazing has promoted exotic invasion.
- ❖ Housing development.
- ❖ Wetland drainage.

**Conservation Strategies**

- ❖ Implement planned grazing and haying systems on private and public lands in combination with prescribed fire. Prescribed spring fire in combination with spring grazing can be used to reduce exotic grasses, such as smooth brome and Kentucky bluegrass, and promote native plant diversity. Rotational grazing with moderate stocking rates can be implemented on some pastures that are currently grazed season long.
- ❖ Implement tree clearing programs on private and public lands in combination with the prescribed fire and planned grazing.
- ❖ Use conservation easements to protect key high-quality prairies.
- ❖ Restore wetland hydrology at key sites.

**Tier 1 At-risk Species:****Plants:**

None

**Animals:**

Bucholz black dash

Interior least tern

Piping plover  
Fat mucket  
Pimpleback  
Plain pocketbook  
Pondmussel  
Regal fritillary  
Blanding's turtle

**Aquatic Communities:**

Mid-order, Warm Water River

**Terrestrial Communities:**

Eastern Cottonwood-Dogwood Riparian Woodland  
Bur Oak Woodland\*  
Sandbar Willow Shrubland  
Sumac Dogwood Shrubland  
Freshwater Marsh\*  
Spring Seep  
Tallgrass Prairie\*  
Wet-mesic Tallgrass Prairie\*  
Dry-mesic Sand Prairie\*  
Sandbar/Mudflat

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**Landscape Name: Indian Cave Bluffs**

**Landscape Description**

This landscape includes the steep bluffs of the Missouri River in Nemaha and Richardson counties. The majority of the bluffs support an eastern deciduous forest of oaks, hickories and basswood. Due its location in southeastern Nebraska these woodlands support a high diversity of eastern deciduous forest plant and animal species. Tallgrass prairie remnants still occur on some bluff tops and south- and west-facing slopes. These have been greatly reduced in size and degraded over the years by shrub and tree encroachment due to lack of wildfires. Indian Cave State Park is the only protected area in the landscape.

**Stresses Affecting Species and Habitats**

- ❖ Invasion of garlic mustard, common buckthorn and other exotic plants.
- ❖ Housing development and other forms of fragmentation.
- ❖ Logging on private lands.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Tree and shrub encroachment of prairie remnants.

## Conservation Strategies

- ❖ Conduct annual surveys for garlic mustard, common buckthorn and other invasive plants on protected areas.
- ❖ Develop and implement (especially on protected areas) control programs for garlic mustard and other exotic species.
- ❖ Use conservation easements or voluntary fee title acquisition to protect key habitats from development and commercial logging of mature forests.
- ❖ Develop and implement conservation planning for Indian Cave State Park.
- ❖ Offer voluntary financial incentives to private landowners to eliminate grazing and implement prescribed fire in key woodlands.

## Tier 1 At-risk Species:

### Plants:

American ginseng

### Animals:

Southern flying squirrel

Bell's vireo

Timber rattlesnake

Cerulean warbler

### Aquatic Communities:

None

### Terrestrial Communities:

Oak-Hickory-Ironwood Forest\*

Red Oak-Basswood-Ironwood Forest\*

Sumac-Dogwood Shrubland

Tallgrass Prairie

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## Landscape Name: Lower Platte River

### Landscape Description

This landscape includes the Platte River channel and its floodplain from the river's confluence with the Loup River in Platte County eastward to its mouth in Sarpy County. The lower Platte River is a mid-size, shallow, braided river. Sandbars and wooded islands are common within the channel. Much of the stream bank is wooded with the dominant species being cottonwood and eastern red cedar. Sand pits are common along the river and in many areas the riverbank is lined with cabins. Most of the river floodplain is now cropland, though there are scattered wet meadows and marshes.

The lower Platte River receives water from the Loup and Elkhorn rivers and has a more stable flow than the central Platte River. The lower Platte River is unique in that its sandbars support

numerous colonies of the federally and state listed piping plover and interior least terns. The construction of dikes and levees has constricted the natural channel and eliminated or isolated most of the floodplain sloughs, backwaters and wetlands. The narrowing of the channel has resulted in higher flow stages after heavy rain events that wash away tern and plover nests. The lower Platte also supports many rare large river fish including the lake sturgeon, blue sucker, sturgeon chub, and pallid sturgeon. Protected areas along this reach of the Platte River include Two Rivers SRA, Louisville SRA, Platte River State Park, and Mahoney State Park.

### **Stresses Affecting Species and Habitats**

- ❖ Alteration of natural flows that maintain sandbars and fish habitat.
- ❖ Dike and levee construction.
- ❖ Water withdrawal.
- ❖ Continued cabin and house development adjacent to the river.
- ❖ Recreational use of the river (e.g. air boats and 4-wheelers), which disturbs tern and plover nesting.
- ❖ Invasive tree encroachment of woodlands and meadows (e.g. eastern red cedar).
- ❖ Sandpit development, which eliminates native meadows, woodlands, and river channel.
- ❖ Conversion of wet meadows to cropland, including wetland drainage and dewatering due to lowering groundwater levels.
- ❖ Exotic herbaceous species invasion in meadows, marshes and woodlands.

### **Conservation Strategies**

- ❖ Seek to maintain natural hydrology necessary to sustain ecosystem function and biodiversity.
- ❖ Place conservation easements on key undeveloped reaches of the river, wet meadows, and woodlands to protect them from development.
- ❖ Undertake invasive tree clearing programs on selected stretches of the river to protect woodlands (especially eastern red cedar, Russian olive and buckthorn).
- ❖ Work with sand and gravel companies to site gravel pits away from ecologically sensitive areas of the floodplain and to restore pits to wetland habitat after sand and gravel extraction has been completed.
- ❖ Work to restore and maintain natural wetland hydrology.
- ❖ Maintain and widen river corridor.

### **Tier 1 At-risk Species:**

#### **Plants:**

Western prairie fringed orchid  
Small white lady's-slipper

#### **Animals:**

Regal fritillary  
Lake sturgeon  
Blue sucker  
Plains topminnow



Sturgeon chub  
Pallid sturgeon  
Blandings turtle  
Massasauga  
Bald eagle  
Interior least tern  
Piping plover  
River otter  
Slough sandshell

**Aquatic Communities:**

Mid-order, Warm Water River

**Terrestrial Communities:**

Eastern Riparian Forest\*  
Oak-Hickory-Ironwood Forest\*  
Red Oak-Basswood-Ironwood Forest\*  
Eastern Cottonwood-Dogwood Riparian Woodland\*  
Eastern Cottonwood-Willow Riparian Woodland\*  
Oak Woodland\*  
Sandbar Willow Shrubland\*  
Riparian Dogwood-False Indigo Shrubland\*  
Sumac-Dogwood Shrubland\*  
Pondweed Aquatic Wetland  
Freshwater Marsh\*  
Spring Seep  
Perennial Sandbar\*  
Eastern Cordgrass Wet Prairie\*  
Eastern Sedge Wet Meadow\*  
Wet-mesic Tallgrass Prairie\*  
Tallgrass Prairie  
Sandbar Mudflat\*

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**Landscape Name: Missouri River**

**Landscape Description**

This landscape includes the Missouri River channel and floodplain from the Nebraska/Kansas border to the Nebraska/South Dakota border. The Missouri River drains approximately 529,350 square miles of land including the entire state of Nebraska. Historically, the Missouri was one of the most dynamic large rivers in North America. Natural runoff events (floods) in March/April and June were instrumental in creating its constantly meandering course. The River was more than a mile wide and 20 feet deep in places, and its channel laced with sandbars and forested islands. The river's floodplain was a mosaic of oxbow lakes, backwater marshes, wet prairies and floodplain forests.

Alteration of the Missouri River began in 1829 when snag removal was initiated to improve steamboat navigation. Between the 1930's and 1960's a bank stabilization project armored the banks and created a navigational channel between St. Louis, Missouri and Sioux City, Iowa. Between 1940 and 1964, six mainstream dams were constructed, which resulted in managed flows.

From an ecological perspective, these attempts to "tame the river" have had many negative consequences for riverine flora and fauna. Sediment transport has been interrupted, resulting in increased sedimentation above Gavins Point Dam and degradation of the streambed and draining of floodplain wetlands below the dam. Channelization has resulted in the elimination of sloughs, backwaters and oxbows. Many riverine species depend upon spring flood pulses as spawning cues and upon the availability of floodplain habitat for many of their life requisites. Alteration of natural flows and elimination of lateral riverine movement has resulted in declining populations of many big river species. There are eleven state-listed species that occur within the Missouri river corridor, six of which are also federally listed. The lack of properly timed flows has also impacted the hydrology of the floodplain wetlands. The majority of the floodplain is now in cropland.

The stretches of the Missouri River from Sioux City to Gavins Point Dam and from the upper end of Lewis and Clark Lake to the South Dakota border have remained unchannelized and are designated as a National Recreational River. Although these reaches remain unchannelized, regulated flows have altered many natural riverine processes (e.g. sediment transport, annual flooding).

Federal mitigation dollars have helped fund several chute and channel restoration projects on the Missouri River in recent years, such as the Hamburg Bend, Kansas Bend, Langdon Bend, Decatur Bend and Tobacco Bend projects. In addition, Wetland Reserve Program dollars have become available for the restoration of Missouri River floodplain wetlands and associated habitats.

### **Stresses Affecting Species and Habitats**

- ❖ Altered natural flows will continue to threaten at-risk aquatic species.
- ❖ Channel downcutting due to lack of sediment, restricted channel, and constructed jetties.
- ❖ Exotic species invasion, such as zebra mussels and exotic fish.
- ❖ Wetland drainage and conversion.

### **Conservation Strategies**

- ❖ Seek to alter river flow management to conform to a more natural flow regime.
- ❖ Encourage levee setbacks and a functional connected floodplain according to the Galloway Plan (IFMRC 1994) and the National Research Council Report (2002).
- ❖ Restore river meandering where possible, restore meandering in off-channel chutes especially, reduce navigation channel where possible.
- ❖ Restore sediment availability for river reaches downstream of Fort Randall Dam.
- ❖ Restore coarse particulate organic matter and large woody debris in the river.

- ❖ Increase top width of the channelized reach in order to establish shallow water habitat diversity for fish and wildlife purposes.
- ❖ Restore natural plant communities (e.g. wetlands, prairies, and woodlands) on the river floodplain and terraces.

**Tier 1 At-risk Species:**

**Plants:**

American ginseng

**Animals:**

Lake sturgeon

Pallid sturgeon

Blue sucker

Sturgeon chub

Sicklefin Chub

Timber rattlesnake

Piping plover

Interior least tern

Bell's vireo

Cerulean Warbler

Bald eagle

Southern flying squirrel

Fat mucket

Flat floater

Higgins eye

Pistolgrip

Scaleshell

Threeridge

**Aquatic Communities:**

Large, Warm Water River\*

**Terrestrial Communities:**

Eastern Riparian Forest\*

Oak-Hickory-Ironwood Forest\*

Bur Oak-Basswood-Ironwood Forest\*

Red Oak-Basswood-Ironwood Forest\*

Lowland Hackberry-Black Walnut Forest\*

Eastern Cottonwood-Dogwood Riparian Woodland\*

Eastern Cottonwood-Willow Riparian Woodland\*

Oak Woodland

Sandbar Willow Shrubland\*

Riparian Dogwood-False Indigo Shrubland\*

Sumac-Dogwood Shrubland

Pondweed Aquatic Wetland\*  
 Freshwater Marsh\*  
 Spring Seep  
 Marsh Seep  
 Eastern Cordgrass Wet Prairie\*  
 Eastern Sedge Wet Meadow \*  
 Perennial Sandbar\*  
 Wet-mesic Tallgrass Prairie\*  
 Tallgrass Prairie\*  
 Loess Bluff Prairie\*  
 Missouri River Valley Dune Prairie\*  
 Missouri River Floodplain Terrace Grassland\*  
 Sandbar/Mudflat\*

**Landscape Name: Ponca Bluffs**

**Landscape Description**

This landscape includes the steep bluffs of the Missouri along the unchannelized Missouri River in Dakota, Dixon, and Cedar counties. This reach of the Missouri River has been designated as a National Recreational River. The majority of the bluffs support eastern deciduous forest dominated by bur oak, basswood and ironwood. Remnants of tallgrass prairie and loess bluff prairie occur scattered on the bluffs. Cropland is scattered throughout the landscape on the more rolling hills. Ponca State Park is the largest protected area in the landscape.

**Stresses Affecting Species and Habitats**

- ❖ Invasion of garlic mustard, common buckthorn and other exotic plants.
- ❖ Housing development and other forms of fragmentation.
- ❖ Logging.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Tree and shrub encroachment of prairie remnants.

**Conservation Strategies**

- ❖ Conduct annual surveys within core areas for garlic mustard, common buckthorn and other invasive plants, especially on protected areas.
- ❖ Develop and implement (especially on protected areas) control programs for garlic mustard and other invasive exotic species.
- ❖ Use conservation easements and voluntary fee title acquisition to protect key habitats from development and commercial logging of mature forests.
- ❖ Develop and implement a conservation management plan for Ponca State Park.
- ❖ Implement improved grazing practices and prescribed fire on private lands.

**Tier 1 At-risk Species:**

**Plants:**

American ginseng

**Animals:**

Cerulean warbler

Bell's vireo

**Aquatic Communities:**

None

**Terrestrial Communities:**

Bur Oak-Basswood-Ironwood Forest\*

Red Oak-Basswood-Ironwood Forest

Lowland Hackberry-Black Walnut Forest\*

Oak Woodland\*

Sumac-Dogwood Shrubland

Tallgrass Prairie

Loess Bluff Prairie\*

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**Landscape Name: Rulo Bluffs**

**Landscape Description**

This landscape includes the steep bluffs of the Missouri River in the far southeast corner of the state. The majority of the bluffs support eastern deciduous forest of oaks, hickories and basswood. Due to its location in extreme southeastern Nebraska, this landscape has a high diversity of eastern deciduous forest plant and animal species. Tallgrass prairie remnants occur on some bluff tops and south- and west-facing slopes. These have been reduced in size and degraded over the years by shrub and tree encroachment due to lack of wildfires. Scattered cropland and pastureland occur in the landscape. Some areas of woodland have been farmed or logged in the past. The Nature Conservancy's Rulo Bluffs Preserve is the only protected area in the landscape.

**Stresses Affecting Species and Habitats**

- ❖ Invasion of garlic mustard, common buckthorn and other exotic plants.
- ❖ Housing development and other forms of fragmentation.
- ❖ Logging.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Tree and shrub encroachment of prairie remnants.

## Conservation Strategies

- ❖ Conduct annual surveys for garlic mustard and other invasive plants, especially on protected areas.
- ❖ Develop and implement (especially on protected areas) control programs for garlic mustard and other exotic plants.
- ❖ Use conservation easements or voluntary fee title acquisition to protect key habitats from development and commercial logging of mature forests.
- ❖ Offer voluntary financial incentives to private landowners to eliminate grazing and implement prescribed fire within key woodlands.

## Tier 1 At-risk Species:

### Plants:

American ginseng

### Animals:

Southern flying squirrel

### Aquatic Communities:

None

### Terrestrial Communities:

Oak-Hickory-Ironwood Forest\*

Red Oak-Basswood-Ironwood Forest\*

Sumac-Dogwood Shrubland

Tallgrass Prairie

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## Landscape Name: Saline Wetlands

### Landscape Description

This landscape includes the saline wetlands that occur in the floodplains of Salt Creek, Little Salt Creek and Rock Creek and surrounding uplands. The wetlands' salinity is derived from deeply buried salts brought to the soil surface through artesian groundwater flow. The marshes' vegetation is dominated by salt-tolerant species such as saltgrass, seablite, and saltwort. The majority of the uplands surrounding the marshes are in cropland, though there are a few tallgrass prairie remnants. Commercial and residential development is common in the landscape.

This landscape is significant in that it includes Nebraska's only saline wetland complex. Over 90 percent of the original saline wetlands within this landscape have been lost or highly degraded. The most viable remaining marshes occur in the two core areas in the upper reaches of the Little Salt Creek valley near Raymond and the Rock Creek valley near Ceresco. The Little Salt Creek wetlands contain the world's only known populations of the Salt Creek tiger beetle. This species is state endangered and proposed for federal listing. Several protected areas occur within this landscape including Arbor Lake WMA, Little Salt Creek WMA, Jack Sinn WMA, the City of Lincoln's Shoemaker Marsh, Anderson Tract, and King Tract, the Lower Platte South NRD's

Lincoln Saline Wetland Nature Center and Warner Wetland, and The Nature Conservancy's Little Salt Fork Marsh.

The Saline Wetlands Conservation Partnership has developed the *Implementation Plan for the Conservation of Nebraska's Eastern Wetlands*. The plan's goal is "no net loss of saline wetlands and their associated functions with a long-term gain in sustaining wetland functions through the restoration of hydrology, prescribed wetland management, and watershed protection." The plan has identified three categories of saline wetlands with Category 1 wetlands being the highest quality.

### **Stresses Affecting Species and Habitats**

- ❖ Urban and residential development.
- ❖ Light pollution which may adversely impact Salt Creek tiger beetles.
- ❖ Downcutting of streams leading to decline in groundwater levels and loss of salts from the wetlands. Interruption of hydrologic regime.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Exotic species invasion, the most problematic species being reed canary grass and narrow-leaved cattail, with some Phragmites (European variety) and salt cedar also present..
- ❖ Wetland drainage and sedimentation.
- ❖ Conversion of saline wetlands to freshwater wetlands.

### **Conservation Strategies**

- ❖ Protect high-quality wetlands through use of conservation easements or voluntary fee title acquisition. The wetlands in need of protection have been prioritized by the Saline Wetland Conservation Partnership along with identifying strategies for their protection. Priority should be given to the saline wetland complexes in the upper reaches of Little Salt Creek near TNC's Little Salt Fork Marsh and those on Rock Creek near Jack Sinn WMA where stream downcutting is still manageable.
- ❖ Protect uplands in the watersheds surrounding these wetlands from development through use of conservation easements or other protection measures.
- ❖ Use in-channel structures and restore natural meanders, where feasible, to stop stream downcutting and subsequent headcutting into wetlands.
- ❖ Implement planned grazing and prescribed fire on privately-owned saline wetlands.
- ❖ Develop and implement plans to control reed canary grass and narrow-leaved cattail in saline wetlands, especially those on protected areas.
- ❖ Intensify management (e.g. prescribed fire, grazing) on protected areas to improve the quality of saline wetlands.
- ❖ Work with developers to increase use of cluster development in areas surrounding saline wetlands.
- ❖ Develop and implement methods to restore saline wetlands.
- ❖ Work with the City of Lincoln and developers to reduce light pollution near saline wetlands.

## **Tier 1 At-risk Species:**

### **Plants:**

Saltwort

### **Animals:**

Salt Creek tiger beetle

### **Aquatic Communities:**

Headwater, Warm Water Stream

### **Terrestrial Communities**

Eastern Saline Marsh\*

Freshwater Marsh

Eastern Saline Meadow\*

Spring Seep

Wet-mesic Prairie

Tallgrass Prairie

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## **Landscape Name: Sandstone Prairies**

### **Landscape Description**

This landscape includes the bluffs and breaks along the Little Blue River and Rose Creek in Jefferson and Thayer counties. The soils in some parts of the area are shallow and derived from sandstone, which has limited agricultural development in many areas. Large blocks of native tallgrass prairie still remain. These prairies are often interspersed with cropland. Most of the prairies have been overgrazed and invaded by eastern red cedar and invasive deciduous trees. Bur oak woodlands occur in many of the drainage bottoms. Prairie fens occur occasionally in canyon bottoms and on side slopes.

The landscape contains some of the last remaining populations of the massasauga and timber rattlesnakes in the state. Even though many of the prairies are degraded, the large size of prairie remnants makes this area unique and provides an opportunity for landscape scale tallgrass prairie conservation. The largest protected areas in the landscape include Rock Glen WMA, Rose Creek WMA, and Rock Creek Station State Historical Park.

### **Stresses Affecting Species and Habitats**

- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Conversion of native prairies to cropland and other uses.
- ❖ Invasive tree encroachment in prairies and woodlands (e.g. honey locust, eastern red cedar).



- ❖ Exotic herbaceous plant invasion of prairies, primarily smooth brome and sericea lespedeza, and woodlands, primarily garlic mustard. In prairies, overgrazing and annual mid-summer haying promotes exotic invasion.
- ❖ Housing development.
- ❖ Agricultural runoff into streams.

### **Conservation Strategies**

- ❖ Support voluntary implementation of planned grazing and haying systems on private and public lands in combination with prescribed fire and rest.
- ❖ Implement tree clearing programs on private and public lands in combination with the prescribed fire and planned grazing.
- ❖ Conduct annual surveys for garlic mustard and sericea lespedeza and other invasive plants in woodlands and prairies, especially on public lands.
- ❖ Develop and implement, especially on protected areas, control programs for garlic mustard, sericea lespedeza, and other invasive exotic species.
- ❖ Protect priority streams from siltation and contaminants using methods such as stream buffers and grass waterways.
- ❖ Use conservation easements or voluntary fee title acquisition to protect high-quality prairies.

### **Tier 1 At-risk Species:**

#### **Plants:**

None

#### **Animals:**

Iowa skipper

Ottoe skipper

Massasauga

Timber rattlesnake

Bell's vireo

Henslow's sparrow

Greater prairie chicken

Plains pocket mouse

Plains harvest mouse

#### **Aquatic Communities:**

Headwater, Warm Water Stream

Mid-order, Warm Water River

#### **Terrestrial Communities:**

Eastern Cottonwood-Dogwood Riparian Woodland

Bur Oak Woodland\*

Sandbar Willow Shrubland

Sumac Dogwood Shrubland

Freshwater Marsh

Spring Seep

Prairie Fen\*  
 Tallgrass Prairie\*  
 Wet-mesic Tallgrass Prairie  
 Sandbar/Mudflat

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## **Landscape Name: Southeast Prairies**

### **Landscape Description**

This landscape includes the rolling hills of western Richardson, Pawnee, southern Johnson, and southern Gage counties. The landcover is primarily cropland, but there are also many tallgrass prairie remnants dominated by big bluestem and Indiangrass and reseeded native and exotic grasslands. The native prairies are of two types: hay meadows and grazed pastures. The hay meadows are generally in better ecological condition. The Big Nemaha River drains the eastern portion of the region while the Big Blue River drains the western portion of the region. Eastern deciduous woodlands are found along the bluffs and floodplains of these streams and their tributaries. The larger streams in the area have highly incised stream channels, though several smaller higher quality streams, including Wildcat, Turkey, Rock, and Yankee creeks, still remain.

The abundance of native and restored grasslands in the regions support a stable population of greater prairie chickens and other grassland birds. Burchard Lake WMA and Pawnee Prairie WMA areas are the largest protected areas in the landscape. These areas are strongholds for the largest remaining massasauga populations in Nebraska. The Barneston Bluff area in Gage County on the Big Blue River contains rocky woodlands, which support populations of timber rattlesnakes and copperheads.

### **Stresses Affecting Species and Habitats**

- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Conversion of native prairies to cropland.
- ❖ Invasive tree encroachment in prairies and woodlands, primarily Osage orange, honey locust, and eastern red cedar.
- ❖ Exotic herbaceous plant invasion, primarily sericea lespedeza, crown vetch, and smooth brome in prairies and garlic mustard in woodlands.
- ❖ Agricultural chemical and sediment runoff into streams.

### **Conservation Strategies**

- ❖ Support voluntary implementation of planned grazing and haying systems on private and public lands in combination with prescribed fire and rest.
- ❖ Implement invasive tree clearing programs on private and public lands in combination with the prescribed fire and planned grazing.

- ❖ Conduct annual surveys for garlic mustard and sericea lespedeza and other invasive plants in woodlands and prairies, especially on protected areas.
- ❖ Develop and implement control programs for garlic mustard, sericea lespedeza, and other invasive exotic species, especially on protected areas.
- ❖ Protect priority streams from siltation and contaminants.
- ❖ Use conservation easements and voluntary fee title acquisition to protect high-quality prairies.
- ❖ Implement integrated public and private lands management. For example, work with private landowners with properties bordering WMAs to manage larger habitat blocks.

**Tier 1 At-risk Species:**

**Plants:**

None

**Animals:**

Pond mussel

Massasauga

Timber rattlesnake

Bald eagle

Regal fritillary

Bell's vireo

Henslow's sparrow

Greater prairie chicken

Plains pocket mouse

Plains harvest mouse

**Aquatic Communities:**

Headwater, Warm Water Stream\*

Mid-order, Warm Water Stream

**Terrestrial Communities:**

Eastern Riparian Forest

Oak-Hickory-Ironwood Forest

Red Oak-Basswood-Ironwood Forest

Upland Bur Oak Forest\*

Lowland Bur Oak Forest\*

Bur Oak Woodland\*

Sandbar Willow Shrubland

Sumac Dogwood Shrubland

Freshwater Marsh

Spring Seep

Prairie Fen

Eastern Cordgrass Wet Prairie\*

Eastern Sedge Wet Meadow\*

Tallgrass Prairie\*

Wet-mesic Tallgrass Prairie\*

## Sandbar/Mudflat

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**Landscape Name: Thurston-Dakota Bluffs****Landscape Description**

This landscape includes the steep bluffs and floodplain of the Missouri River in Thurston and Burt counties in north central Nebraska. The majority of the bluffs support eastern deciduous forest of bur oak, basswood and ironwood. The Missouri River floodplain contains some of the last remnants of cottonwood-dominated floodplain forest and wet meadows, though the meadows are somewhat degraded. The majority of the landscape lies within the Omaha and Winnebago Indian reservations. It is the largest intact deciduous forest in the state. There are primitive roads through the forest on the reservations and many scattered houses. Much of the forest on the reservations is divided into small ownership tracts with multiple owners making conservation delivery difficult.

**Stresses Affecting Species and Habitats**

- ❖ Invasion of garlic mustard, common buckthorn and other exotic plants in woodlands.
- ❖ Logging on private and reservation lands.
- ❖ Housing development.

**Conservation Strategies**

- ❖ Conduct annual surveys for garlic mustard and other invasive plants in woodlands.
- ❖ Develop and implement control programs for garlic mustard and other exotic programs.
- ❖ Use conservation easements or voluntary fee title acquisition to protect key habitats from development and commercial logging of mature forests.
- ❖ Develop and implement conservation planning in conjunction with the Indian tribes for reservation lands.
- ❖ Offer financial incentives to private landowners to implement prescribed fire in the forests to set back to control unwanted tree species and to promote native plants.

**Tier 1 At-risk Species:****Plants:**

None

**Animals:**

Cerulean warbler

Bell's vireo

**Aquatic Communities:**

Headwater, Warm Water Stream

Large, Warm Water River

**Terrestrial Communities:**

Eastern Riparian Forest\*  
Oak-Hickory-Ironwood Forest\*  
Bur Oak-Basswood-Ironwood Forest\*  
Red Oak-Basswood-Ironwood Forest\*  
Lowland Hackberry-Black Walnut Forest\*  
Eastern Cottonwood-Dogwood Riparian Woodland\*  
Oak Woodland\*  
Sumac-Dogwood Shrubland  
Tallgrass Prairie  
Freshwater Marsh  
Marsh Seep  
Spring Seep  
Eastern Sedge Wet Meadow\*

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**Landscape Name: Willow Creek Prairies**

**Landscape Description**

This landscape includes the Willow Creek valley and surrounding uplands in Pierce County and small portions of neighboring Madison and Antelope counties. Willow Creek is a meandering prairie stream. Its floodplain contains many wet meadows dominated by big bluestem and prairie cordgrass. Cropland is also common in the valley. The majority of the meadows are hayed. These meadows are significant in that they contain one of the state's largest remaining populations of the federally and state threatened western prairie fringed orchid.

Sand dunes, supporting dry-mesic sand prairie, occupy much of the upland bordering the stream valley. Many of these prairies are hayed and in good condition, while some are grazed and more degraded. Cropland is also common on the dunes. There are currently no protected areas in this landscape.

**Stresses Affecting Species and Habitats**

- ❖ Conversion of native prairies to cropland.
- ❖ Housing development.
- ❖ Exotic plant invasion in native prairies, primarily leafy spurge, but also smooth brome, reed canary grass, timothy, and redtop.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Annual mid-summer haying of wet meadows, which impacts populations of the western prairie fringed orchid and native plant species diversity.
- ❖ Center pivot development and wetland drainage, which could lower groundwater levels and degrade native prairies.

## **Conservation Strategies**

- ❖ Support voluntary implementation of planned grazing and haying systems on private and public lands in combination with prescribed fire and rest.
- ❖ Protect orchid meadows and other key high-quality prairies through conservation easements or voluntary fee title acquisition.
- ❖ Develop and implement cooperative leafy spurge control methods, potentially using bio-control agents, in orchid meadows and other native grasslands.
- ❖ Restore ditched or otherwise degraded wetlands.
- ❖ Implement research projects to determine best management practices for the western prairie fringed orchid.

## **Tier 1 At-risk Species:**

### **Plants:**

Western prairie fringed orchid

### **Animals:**

Plains topminnow

Regal fritillary

### **Aquatic Communities:**

Headwater Warm Water Stream

### **Terrestrial Communities:**

Freshwater Marsh

Spring Seep

Eastern Sedge Wet Meadow\*

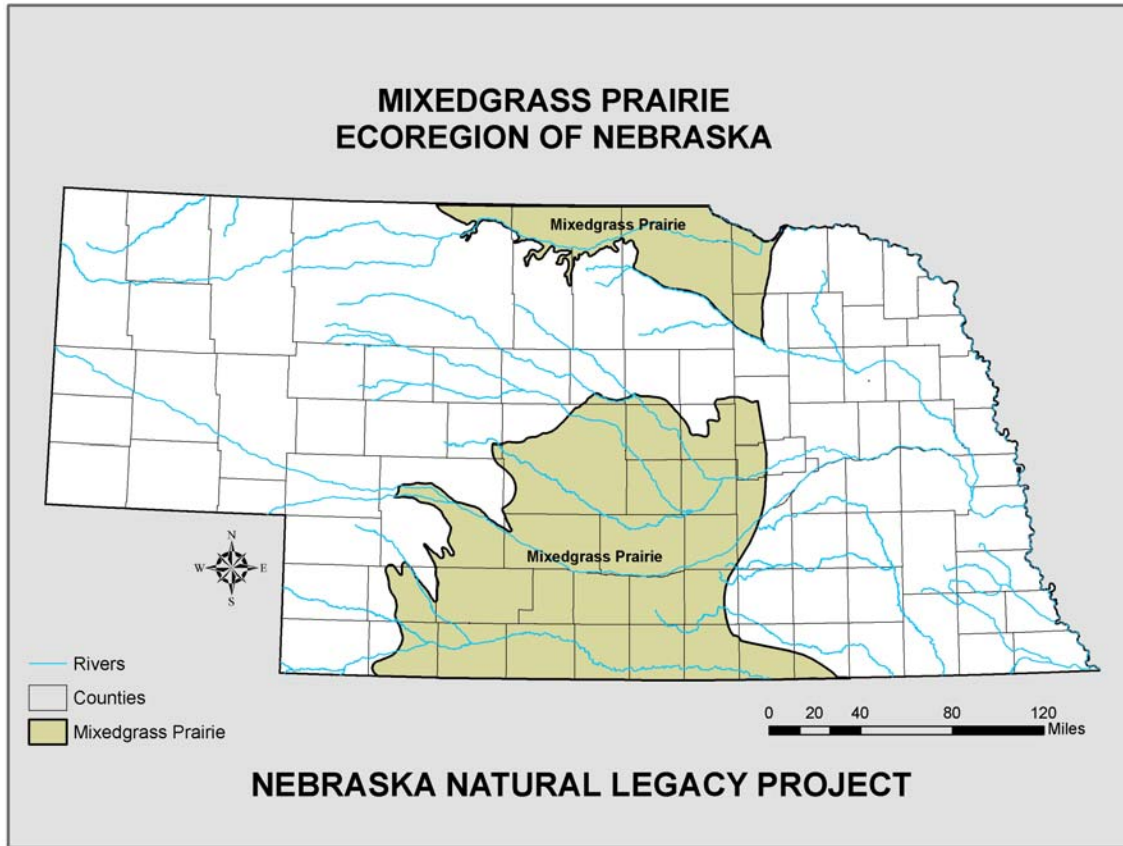
Northern Cordgrass Wet Prairie\*

Wet-mesic Tallgrass Prairie\*

Sandhills Dune Prairie

Dry-mesic Sand Prairie\*

## CHAPTER 6: MIXEDGRASS PRAIRIE ECOREGION



### INTRODUCTION

The Mixedgrass Prairie Ecoregion lies between the Tallgrass Prairie to the east and the Shortgrass Prairie to the west. As its name implies, the region is a transition zone where the Tallgrass and Shortgrass Prairie merge, taking on characteristics of both. Historically, the Mixedgrass Prairie expanded eastward into the Tallgrass Prairie region during prolonged drought, and westward into the Shortgrass Prairie region during wetter periods. Plant composition varies considerably depending on soil type, topography, weather influences, and land use. Its highly diverse flora and fauna includes a mix of species found also in the Tallgrass and Shortgrass Ecoregions.

Elevation increases gradually from east to west and ranges from 1,650 feet to 3,000 feet above sea level. Topography consists of nearly level broad plains in much of the Rainwater Basin area and along river drainages, gently rolling hills in the north-central part of the region, and steep slopes with deeply incised drainages in the southwest. Most of the region is covered by loess, wind-blown silt that settled over the area during the last several thousand years. Perennial and intermittent streams transect most of the region, serving as tributaries to the Platte, Republican, Loup, Niobrara and Blue rivers. Stream and river valleys contain alluvial deposits of sand, silt,

and/or loess. Bands of wind-deposited sand parallel parts of the Platte and Loup rivers, mimicking many of the characteristics of the larger Sandhills Ecoregion to the north.

The region's climate is semiarid with annual average precipitation ranging from 28 inches in the east to 20 inches in the west. Most precipitation occurs during the spring and early summer, often as the result of thunderstorms. The deep loess soils are fertile, but moderate precipitation and high evapotranspiration rates limit grassland development. The average annual temperature ranges from 52 to 57 degrees Fahrenheit and the frost-free period ranges from 150 to 190 days annually.

The Ogallala aquifer underlies a large portion of the ecoregion. Groundwater stored under the ecoregion ranges in depth and exceeds over 500 feet in places. Alluvial aquifers are present along rivers and streams and are recharged during high flows and contribute water to streams and rivers during lower hydroperiods. Artificial groundwater mounds have developed near the surface alongside irrigation delivery canals and downstream of irrigation reservoirs. The largest groundwater mound parallels the Tri-County Canal and is estimated to contain 6 to 8 million acre-feet of water.

The region contains hundreds of miles of rivers and streams which drain eastward into the Missouri River. The Platte River, originating in Colorado and Wyoming is the ecoregion's longest river. Spring snowmelt from mountain headwaters historically caused flood pulses that recharged alluvial aquifers, saturated floodplain wet-meadows, and scoured sandbars along the Platte. The Republican River begins in eastern Colorado and exits the state near Superior, NE. The South Loup, Middle Loup, and North Loup Rivers derive their flow from groundwater discharge out of the southern Sandhills and provide a significant source of summer flow to the Platte River. The Big Blue and Little Blue Rivers draw their water from runoff and cross the southeastern part of the ecoregion before departing the state into Kansas.

The mixedgrass prairie region contains an abundance of wetlands, including playas, wet meadows, and floodplain and sandhill wetlands. Playa wetlands are wind-formed, nearly circular depressions whose underlying clay pan holds water from rainfall and runoff. The Rainwater Basins in south-central Nebraska are of national importance for spring migrating waterfowl and once contained more than 4,000 major wetlands. Central Table Playa wetlands are found on the plains north of the Platte River, principally in Custer County. These basins are often perched on hilltops and resemble wetlands found in the Rainwater Basins. The broad floodplain of the Platte and Loup Rivers contain extensive subirrigated wet meadows. Former river channels, swales and sloughs are often found juxtaposed within wet meadows providing for much plant and animal diversity. Riverine wetlands include oxbows and other semi-permanent wetlands that are found adjacent to rivers in the region. These floodplain wetlands provide important habitat for amphibians and reptiles and serve as spawning and nursery habitat for many types of fish. Sandhills wetlands are found in sandy areas in close proximity to the Platte and Loup Rivers. These shallow wetlands formed where groundwater reaches the surface.



## Vegetation

The mixedgrass prairie ecoregion includes a variety of native plant communities. Tallgrass prairie species tend to dominate in the east and along river floodplains and shortgrass species dominate in the western part of the ecoregion. Most high quality grasslands contain a mix of tallgrass and shortgrass prairie species. Prairie hilltops may be dominated by drought resistant shortgrass species such as blue grama and buffalograss, side slopes by medium-statured grasses such as side-oats grama, little bluestem, western wheatgrass, and sand dropseed, and lower slopes and valleys by tallgrass prairie species such as big bluestem, Indiangrass, switchgrass, and Canada wildrye. A few dozen perennial grasses are typically found but often hundreds of forb species on good quality sites including prairie clovers, Illinois bundle flower, wild alfalfa, deer vetch, leadplant, prairie coneflower, stiff sunflower, and blazing star. Because of broadcast spraying for noxious weeds and intensive grazing, plant diversity on most prairies is much lower today.

Historically, less than one percent of the ecoregion was covered with woodlands. Today most watercourses are lined with riparian forests. Taller trees include eastern cottonwood, green ash, hackberry, and red cedar. Shrubs such as roughleaf dogwood, false indigo, and sandbar willow dominate the understory. Native stands of bur oak and black walnut can still be found on some steeper slopes, particularly in the eastern part of the ecoregion. Eastern red cedar has become more prominent during the last half century and now dominates many prairies in the western part of the ecoregion and some wet meadows along rivers. Planted woodlands and shelterbelts are common throughout the region, particularly in the more intensively farmed portions of the ecoregion.

Wet meadows and wet prairies along river courses include a variety of plants such as woolly sedge, spike rush, and prairie cordgrass. The federally endangered prairie white-fringed orchid is found in high quality meadows and the state endangered saltwort is known from one lowland site along the Platte River. Playa wetlands found in the Rainwater Basin and the Central Tables area often contains dense stands of river bulrush, common cattail, or nodding smartweed on seasonally flooded sites and spikerush, flatsedge, and forbs such as plains coreopsis in more temporarily flooded wetlands. Deeper, more permanent wetlands in the Rainwater Basins and in former river channels can also include submersed or floating plant communities consisting of bladderwort, pondweed, and duckweed. Riparian wetlands usually contain an understory of herbaceous plants such as switchgrass, scouring rush, and bedstraw. Sandhill wetlands typically include cattail, bulrush, and smartweed.

## Animals

More than 350 species of resident and migratory birds have been documented in the mixed-grass prairie ecoregion. Common grassland birds include grasshopper sparrow, dickcissel, western meadowlark, bobolink, northern bobwhite, ring-necked pheasant, field sparrow, northern harrier, and greater prairie chicken. The Platte River serves as an important stopover site for the endangered whooping crane and provides critical spring staging habitat to over 80% of the world's sandhill cranes. In total, over 300 bird species have been observed along the Platte River and 141 species are known to nest there. More than a dozen species of waterfowl regularly use

the Rainwater Basins during migration, including more than one-third of northern pintails, fifty percent of the continent's mallards, and over ninety percent of the mid-continent's white-fronted geese. Approximately 300,000 shorebirds comprising more than thirty species use the Rainwater Basin's including Baird's sandpiper, stilt sandpiper, lesser yellowlegs, and some of the largest concentrations of buff-breasted sandpipers observed anywhere. Thousands of Swainson's hawks migrate through the ecoregion each fall and large bodies of water such as Harlan County and Sherman Reservoir provide rest areas for thousands of white pelicans and Franklin's gulls. The region is home to many species of mammals. Most are widespread with no distinct affiliation to the mixed-grass prairie. Small mammals include the plains pocket gopher, prairie vole, least shrew, and eastern cottontail. Small populations of Ord's Kangaroo rat, white-tailed jackrabbit, eastern woodrat, and black-tailed prairie dog can be found in suitable habitat. Both white-tailed and mule deer are found in the ecoregion, with the latter mostly restricted to native grasslands in the western half of the ecoregion. A small and growing herd of elk are found in the loess canyons south of North Platte. Beaver, river otter, muskrat, and mink are associated with the region's watercourses. The most abundant large predator of the region is the coyote. Other common species include badger, red fox, raccoon, and striped skunk. The most frequently encountered bats are the eastern red bat, big brown bat, and silver haired bat.

The region's streams and reservoirs are home to a diverse range of fish species. River generalists that can tolerate wide environmental extremes are most common. Channel catfish, short-nosed gar, flathead chub and river carpsucker are found in most larger rivers. Game fish including walleye, northern pike, largemouth bass, white bass and bluegill, have been successfully introduced to reservoirs in the ecoregion. Most of the region's native fish species include the smaller minnows and chubs that are adapted to variable prairie stream environments. These include speckled chub, blacknose shiner, Topeka shiner, common shiner, pearl dace, finescale dace, plains topminnow, and brook stickleback.

Several reptiles and amphibians are found in the ecoregion. Aquatic environments host smooth and spiny softshell turtles, western painted turtles, and snapping turtles. Ornate box turtles can be found on native grassland sites. The northern water snake is the region's only aquatic snake and can be found near permanent bodies of water. The prairie rattlesnake is the only poisonous snake found in the mixed-grass prairie and is most common on dry upland sites in the western part of the ecoregion. Bullsnares, eastern yellowbelly racers, western and red-sided garter snakes, are all fairly common in the region in a variety of habitats. Western hog-nosed snakes may be found in dry and sandy prairies. Smooth green snakes and red-bellied snakes are two of the more rare snakes in the region, both may be found in open riparian areas and in wet meadows and prairies.

Three lizards are common in the ecoregion. The northern earless lizard prefers open sandy soil with little or sparse vegetation, the prairie racerunner can be found in a variety of habitats on both lowland and upland sites, and the northern prairie lizard prefers sandy sites with weeds, brush, or mammal burrows. The only common salamander in the region is the tiger salamander. The plains spadefoot toad is found in the dry grasslands of the region, rarely using river bottoms or wetlands, while Woodhouse's toad, Great Plains toad, Blanchard's cricket frog, western chorus frog, bullfrog, and plains leopard frog are common in wet areas.

Relatively little is known about the ecoregion's invertebrates. Perhaps the rarest insect is the Platte River caddisfly, which is only known to exist in a few channels of the Platte River near Grand Island. The regal fritillary butterfly, although rare over much of its range, appears to be relatively common throughout much of the ecoregion. The mixed-grass prairie ecoregion hosts one of the largest known populations of the federally endangered American burying beetle. The white heel-splitter is one of the more common freshwater mussels and is found in many permanent bodies of water.

## **DOMINANT LAND USE AND HISTORY**

Archeological evidence indicates that the first nomadic hunting and gathering groups arrived in the Platte River Valley between 10,000 and 25,000 years ago. Pawnee Indians made the first known settlements in the late 13<sup>th</sup> and 14<sup>th</sup> centuries. They resided along the Platte and Loup rivers where they raised corn, squash, beans, and sunflowers and gathered wild turnips, grapes, plums, and nuts. Most of their meat was derived from buffalo, elk, pronghorn, deer, rabbits, waterfowl, and game birds.

Although hundreds of thousands of immigrants traveled through the area on the Oregon and Mormon trails during the mid 1800's, European settlement was sparse until the transcontinental railroad was completed in the late 1860's. The region's population saw episodes of growth and decline that corresponded to periods of ample precipitation and drought. Land speculators bolstered by erroneous scientific claims promised that if more sod were broken then "rain would follow the plow." By 1900 there were many settlers in the ecoregion and corn, alfalfa and wheat were important crops. By the 1920's most readily farmable land was in dry land farm production.

World War I brought increased demand for agricultural products and a rapid expansion of agriculture into the western part of the ecoregion. A nationwide depression in the early 1930's coupled with a devastating drought brought wide-scale hardship to the area. Since most farms were not irrigated, corn yields dropped from 24 bushels per acre to just two or three. The dry conditions resulted in an eruption of grasshoppers that further reduced rangeland forage. Frequent dust storms added to the misery of the region's settlers. The population in the region dropped by nearly 20% during the mid 1930's.

The severe drought of the 1930's led to the construction of Kingsley Dam on the North Platte River. The reservoir was completed in 1943 and at the time was the second largest earthen dam in the world. It was designed to hold two million acre-feet of water and provide a source of irrigation for 200,000 acres of farmland in the ecoregion. The construction of other large reservoirs in the region followed, providing a source of irrigation, flood control, and recreation for the region.

The 1940's and 1950's saw an increase in agricultural efficiency and an increase in population for the region. From 1940-1970 the amount of land under irrigation increased in the ecoregion. The advent of commercially available fertilizers, more efficient farm machinery, and the use of herbicides and insecticides led to increases in corn production. During this time, government policies were put in place to subsidize and facilitate conversion of marginal land such as playa

wetlands to cropland. By the early 1970's the population in the ecoregion rose but the number of individual farms dropped. The trend for fewer and larger farms continues today.

Center pivot irrigation began to be put into widespread use in the 1970's and facilitated cultivation of steeper slopes and lands isolated from surface irrigation sources. Currently about two thirds of the land in the ecoregion is in cropland production with most of the remaining lands in grasslands for livestock grazing. There has been a recent trend for the ecoregion's largest cities to gain population at the expense of smaller towns. The ecoregion's four largest cities (Grand Island, Kearney, Hastings, and North Platte) make up a majority of the total population. In addition to the principal crops of corn, soybeans and wheat—alfalfa and grain sorghum are important crops in the ecoregion.

## **NATURE-BASED RECREATION**

The mixedgrass prairie ecoregion offers a plethora of outdoor and nature-oriented recreation. The ecoregion is recognized worldwide as the site of one of the premier wildlife viewing spectacles in the country. Each spring more than 500,000 sandhill cranes stage in south central Nebraska on their way to breeding grounds as far away as Siberia. An estimated 80,000 nature enthusiasts visit the area each spring to view sandhill cranes. National Audubon's Rowe Sanctuary and Crane Meadows Nature Center provide blind tours, visitor services, and educational programming to more than 25,000 visitors annually. Roadside viewing sites constructed by Central Platte Natural Resources District provide additional crane viewing sites.

Although less known, spring waterfowl viewing in the Rainwater Basin region is also top caliber. Between seven and nine million waterfowl and over three million geese stage here each spring. Concentrations of more than one million snow and Ross' geese congregate at times on larger waterfowl production areas. More than two-dozen species of waterfowl can be observed in the Rainwater Basin region. Many acres of public lands are available for viewing, although viewing infrastructure is limited to a few sites. A waterfowl observation tower at Massie Waterfowl Production Area near Clay Center and handicapped accessible blinds at Funk Waterfowl Production Area and Sacramento-Wilcox Wildlife Management Area are notable exceptions.

Bald eagle viewing is available at Central Nebraska Public Power and Irrigation District's J-2 power return near Lexington, at Harlan County Reservoir, Sherman Reservoir, and Rowe Sanctuary. More than 200 bald eagles have been observed at one time at Harlan County Reservoir. A large number of bald eagles winter in the ecoregion. Other unique opportunities include viewing of prairie chickens, prairie dogs, piping plover, least terns, and shorebirds.

There is a strong tradition of hunting and fishing in the ecoregion. More than one hundred thousand Canada geese winter along the ecoregion's portion of the Platte River making it one of the top goose hunting sites in the country. The Rainwater Basins provide quality waterfowl hunting in the fall with their ample free public hunting sites and their diversity of waterfowl. In recent years large numbers of hunters have come to the Rainwater Basins in the late winter and early spring to participate in the snow goose conservation hunt.

The ecoregion is known as a place where deer hunters can routinely take both white-tailed and mule deer. White-tailed deer numbers are high along riparian corridors such as the Platte, Republican, and Loup Rivers. Mule deer are plentiful in areas with extensive grasslands in the Loess Hills regions. The ecoregion remains one of the top locations for pheasant hunting in the Midwest, and offers excellent hunting for quail, turkey, prairie chickens, and cottontail rabbits. Although underutilized, the region's river systems provide quality canoeing and kayaking. The Republican River below Harlan County Dam, Cedar River, and Platte River are most used by canoeists, but the Loup also offers good canoeing opportunities. Undeveloped prairie and riverine habitats offer scenic vistas and relatively low use helps ensure a quality experience. The major limitations for canoeists are a lack of outfitters, access sites, and seasonally unreliable water.

Anglers take to the region's reservoirs in search of walleye, largemouth bass, catfish, white bass, and bluegill. Harlan County, Sherman County, Johnson Lake, and Swanson Reservoirs are the most highly visited bodies of water. Harlan County Reservoir is known for its trophy-sized wipers and for ranking amongst the top in master angler awards each year. There are many publicly owned sandpits in the region that provide quality fishing by shore, boat, and float tube. The region's rivers and streams provide opportunities for catching catfish.

Nature-based trails in the ecoregion are limited, but with potential for more development. Crane Meadows Nature Center offers the most extensive interpretive trail system in the ecoregion with miles of trails through a Platte River meadow/prairie community. Rowe Sanctuary has many miles of developed trails along the Platte River and Harlan County Reservoir also has an extensive nature trail. There are walking trails at Funk, Harvard, and Massie Waterfowl Production Areas and the city-owned Lake Seldom near Holdrege in the Rainwater Basins. The hike-bike trail at Ft. Kearny State Recreation Area will soon be connected to an existing trail system in Kearney. Most of the region's larger cities have trails associated with city parks that offer access to natural environments.

The principal challenge to expanding and conserving nature-based recreational resources in the ecoregion is involving a larger and more diverse cross-section of the region's residents in nature-based recreation activities. Key individuals from the business, economic development, and agricultural sectors should be involved in planning, promotion, and development of the ecotourism trade. There is no centralized clearinghouse of wildlife viewing-related information and a significant lack of wildlife viewing infrastructure in the ecoregion. Although there are many quality opportunities for nature-based recreation, access points are limited or obscured, interpretive information is lacking, and promotion of viewing opportunities is limited. A greater number of individuals who are knowledgeable about wildlife viewing are needed to help inform community leaders and the public about the ecoregion's wildlife viewing potential.

## **EDUCATION**

There is a strong interest by conservation groups, agencies, schools, and others to better meet the large demand for biodiversity education in the ecoregion. There are many groups already invested in and contributing to conservation education in the ecoregion. Prairie Plains Resource

Institute developed the successful “Summer Orientation About Rivers” program to introduce students to the biodiversity of the Platte River. Rowe Sanctuary and Crane Meadows Nature Center engage thousands of children annually in activities designed to stimulate interest in and raise literacy about the natural environment. Imperial Middle School uses a local lake for inquiry-based science education. Most of the ecoregion’s Natural Resource Districts sponsor environmental festivals like the Earth Jamboree organized by Little Blue Natural Resource District and the eight grade conservation day held by Tri-Basin Natural Resource District each spring. The Children’s Groundwater Festival held annually in Grand Island has educated thousands of children about the importance of conserving scarce water resources.

In addition to students, there is a need for increased education for the general adult population and professional conservationist community. Currently, a relatively small proportion of interested adults have access to or take part in natural history education. The demand for educational resources is demonstrated by the large numbers of individuals who seek information about sandhill crane and waterfowl during the spring migration period.

Local efforts such as the Clay Center Wing Ding offer tours and seminars to the public during a two-day celebration to foster a greater understanding of the importance of the Rainwater Basins to wildlife. The Rainwater Basin Joint Venture hosts an informational seminar each spring that provides natural resource professionals and landowners with opportunities to learn about wetlands. An elder hostel program sponsored by the University of Nebraska-Kearney has instructed hundreds of adults in natural history study.

The demand for education will likely always far exceed educators’ ability to provide it in the ecoregion. However, the important role of education in furthering biodiversity conservation is becoming better understood and more widely accepted. The current capacity for quality education in the ecoregion is too low and the lack of integration of biodiversity concepts into existing educational programs needs to be addressed. Major hurdles such as curriculum constraints in schools, a lack of trained educators, and insufficient teaching resources need to be overcome. Farmers and ranchers have much to contribute to the public’s understanding of wildlife and the role agriculture plays in sustaining habitats.

## **PARTNERSHIPS**

The mixedgrass prairie ecoregion is characterized by a diversity of partnerships, coalitions, and grass roots efforts that have been formed to conserve the region’s wildlife. These include, but are not limited to, the following groups.

- ❖ **The Rainwater Basin Joint Venture (RWBJV)** is one of the longest standing and effective partnerships in the ecoregion and state. The RWBJV coordinates wetland restoration, research, and management activities in a 4,200 square mile region in south-central Nebraska. It was formed in 1991 to help meet the objectives of the North American Waterfowl Management Plan. The RWBJV has three principle objectives: 1) Protect, restore, and create 50,000 acres of wetland and upland habitat 2) Provide reliable water for 1/3 of protected wetlands, and 3) Develop and implement wetland enhancement strategies. The activities undertaken by the RWBJV are directed by an implementation plan, best management

practices handbook, water options handbook, and a research needs document. The partnership is using state-of-the-art geographical information system technologies to guide wetland conservation. Support for wetland conservation in the region by landowners has risen substantially due to outreach efforts and through innovative means such as the annual informational seminar held each spring. Major partners include the US Fish and Wildlife Service, Natural Resources Conservation Service, Nebraska Game and Parks Commission, local Natural Resource Districts, Ducks Unlimited, The Nature Conservancy, Pheasants Forever, Nebraska Environmental Trust, and private landowners. More information can be found at [www.rwbjv.org](http://www.rwbjv.org).

There are a number of Central Platte River Initiatives that are related but unique. These initiatives and partnerships share a common vision of improving habitat for the region's unique fish and wildlife species. These include but are not limited to the following:

- ❖ **The Platte River Whooping Crane Maintenance Trust (PRWCMT)** was formed in 1978 as part of a court-approved settlement over the Gray Rocks Dam on a tributary of the Platte River in Wyoming. The organization is directed by a board consisting of representatives from the National Wildlife Federation, Missouri Basin Power Project, and the state of Nebraska. A \$7.5 million endowment provides funding to the PRWCMT to protect and manage habitat along the central Platte River. The non-profit organization has acquired over 10,000 acres of habitat to benefit whooping cranes and other wildlife. Each year staff conduct maintenance activities (e.g. disking and tree clearing) on numerous acres of sandbars and accretion lands on private lands. The organization also serves as a research center for biologists conducting research and monitoring on cranes, grassland birds, and other species. Partners include the US Fish and Wildlife Service, US Geological Service, Nebraska Game and Parks Commission, Prairie Plains Resource Institute, The Nature Conservancy, Nebraska Wildlife Federation, and Audubon Nebraska. More information is available at [www.whoopingcrane.org](http://www.whoopingcrane.org)
- ❖ **The Platte River Habitat Partnership (PRHP)** was formed in 2001 by the Nebraska Game and Parks Commission and The Nature Conservancy with funding support from the US Fish and Wildlife Service. The purpose of the partnership is to restore native grasslands and wet meadows along the central Platte River to benefit wildlife and the grazing community. The partnership covers a broad area bounded by Gothenburg to the west and Columbus to the east. To date, more than 200 landowners have been contacted and a large number of projects completed with benefits to habitat. The partnership is helping to identify and overcome barriers to prescribed burning in the region. Additional partners include the Natural Resources Conservation Service, Central Platte Natural Resources District, Audubon Nebraska, and Platte River Crane Trust. more information is available at [www.plattehabitat.org](http://www.plattehabitat.org)
- ❖ **The Platte River Corridor Initiative (PCI)** uses a process-based approach to watershed management with a focal geography of the Central Platte River, bluff to bluff from Gothenburg to Columbus. It is volunteer-driven, group focused, and idea-centered with an emphasis on promoting the sustainable balance of social, economic and environmental concerns in the valley. PCI places a focus on people and the processes by which they learn,

prioritize and act on conservation programs/practices based on their definitions and desires. PCI participants define their own geographic scope, issues, and interest and participation level. PCI is people focused and places priority on process over content with the following foci: 1) How do participants construct and prioritize the conservation issues before them, 2) How to develop networks of people with similar interests and objectives and enable them to make content based decisions about conservation and natural resource management based on mutual interests. The Prairie Plains Resource Institute and The Nature Conservancy are the principal partners in the Platte Corridor. More information is available at <http://www.prairieplains.org/>.

- ❖ The Platte River Endangered Species Partnership is a partnership between the states of Nebraska, Wyoming, Colorado, and the US Fish and Wildlife Service and seeks a basin-wide approach to management of water resources and four targeted endangered species. The goals of the cooperative initiative are to implement a program that will 1) secure improvements to Platte River habitat for the target species so current and future water use in the Platte will not likely jeopardize the species; 2) Provide compliance with Endangered Species Act for existing and new water uses; 3) Help prevent additional species in the Platte River from becoming threatened or endangered; and 4) Ensure that any impacts on the central Platte River habitat from future water development in each state are prevented or offset within that state. More information is available at [www.platteriver.org](http://www.platteriver.org)

## ECOREGION-SPECIFIC STRESSES AND CONSERVATION ACTIONS

### Key Stresses

Stresses and conservation actions in the mixed-grass prairie ecoregion are identified in chapter three and in descriptions of biologically unique landscapes. The following stresses were identified by conservation practitioners as the top stresses in the ecoregion.

- ❖ Altered hydrology and channel degradation of rivers and streams: Historically, the Platte and Republican Rivers experienced spikes in flows during the spring and early summer. These spikes caused large-scale sediment movement and prevented the establishment of perennial vegetation on sandbars, islands, and accretion ground. Groundwater and surface water withdrawals and storage in upstream reservoirs have significantly reduced flow peaks and caused water tables adjacent to rivers to decline, affecting animal and plant diversity and abundance. Many of the region's streams now go dry because of reduced inflows and stream channelization and bank stabilization projects have altered natural geomorphic and hydrologic processes.
- ❖ Spread of invasive species: Hundreds of nonnative plant and animal species are known to occur in the ecoregion. Some species such as smooth brome, Kentucky bluegrass, leafy spurge, and musk thistle have caused significant declines in plant diversity in native prairies. Many of the region's playa wetlands, wet meadows, and riparian habitats have become dominated by exotic plants such as reed canary grass, hybrid cattail, Russian olive, purple loosestrife, tall wheatgrass, phragmites, etc. The introduction of carp, mosquitofish, European starlings, etc. has impacted the region's biological diversity directly through competition and indirectly through habitat alterations.



- ❖ Conversion and fragmentation of natural habitats: Most of the ecoregion's lands that contain relatively flat productive soils have already been converted to agricultural fields. However, center pivots have made conversion of steeper prairie sites more feasible resulting in the conversion of thousands of additional acres of native prairie during the last several decades. The expansion of urban areas into surrounding rural communities and second home development is accelerating conversion of prairies and fragmenting riverine habitats in many parts of the ecoregion.
- ❖ Alteration of natural grazing and burning regimes: Most of the mixed-grass prairie that remains in the ecoregion has a reduced flora and faunal diversity. Season-long intensive grazing has reduced or eliminated many sensitive species that are intolerant of prolonged grazing and has favored the spread of a limited number of species tolerant of prolonged grazing. Fire occurs much less frequently today than it did historically. This has led to a decrease in grassland vigor and the invasion of fire intolerant species such as red cedar. Historically, grazing patterns likely were driven in part by fire occurrences (ungulates likely grazed on recently burned patches). Today the synergistic affects of burning and grazing are rarely seen.
- ❖ Lack of awareness and knowledge about the region's biological diversity and ecological processes: Although the region's native grasslands, rivers, and wetlands are unique and of high value, most of the ecoregion's residents lack an awareness of the importance of these habitats to biological diversity. Citizens have limited knowledge and opportunities to learn about the ecoregion's natural communities biological diversity. Many private landowners have a desire to increase their knowledge and understanding of ecological processes and management that can help maintain biological diversity, but educational resources are often not available.
- ❖ Loss of lands enrolled in conservation programs: Lands enrolled in programs such as the Conservation Reserve Program provide significant benefits to some species. Changing economic conditions and reduced support for these programs may result in large tracts of conservation lands being converted to agricultural cropland in the coming years. The loss of even a modest percentage of these lands will result in impacts to aquatic and other species.
- ❖ Wetland Drainage: Past drainage of many of the ecoregion's playa wetlands, wet meadows, and Riverine wetlands continues to impact wetland dependent species. Temporary and seasonal wetlands were perhaps the most common wetland types historically but proportionally fewer have been restored.
- ❖ Lack of trust and collaboration between the agricultural and conservation communities: Past conflicts between the agriculture and conservation communities on issues related to water and threatened and endangered species have left deep divisions. Although there is often common ground on many issues related to conserving biological diversity, there is a lack of trust and resolve to collaborate on issues important to all stakeholders.
- ❖ Sedimentation of rivers, streams, and wetlands: The close proximity of agricultural fields to rivers, streams, and wetlands has resulted in large volumes of sediment entering the ecoregion's bodies of water. Sedimentation increases stream turbidity and changes bottom substrates degrading habitat for fish and other aquatic species. Sedimentation of wetlands alters storage capacity and changes plant composition, reducing habitat available to waterfowl and other species.

## **Biologically Unique Landscapes of the Mixedgrass Prairie Ecoregion**

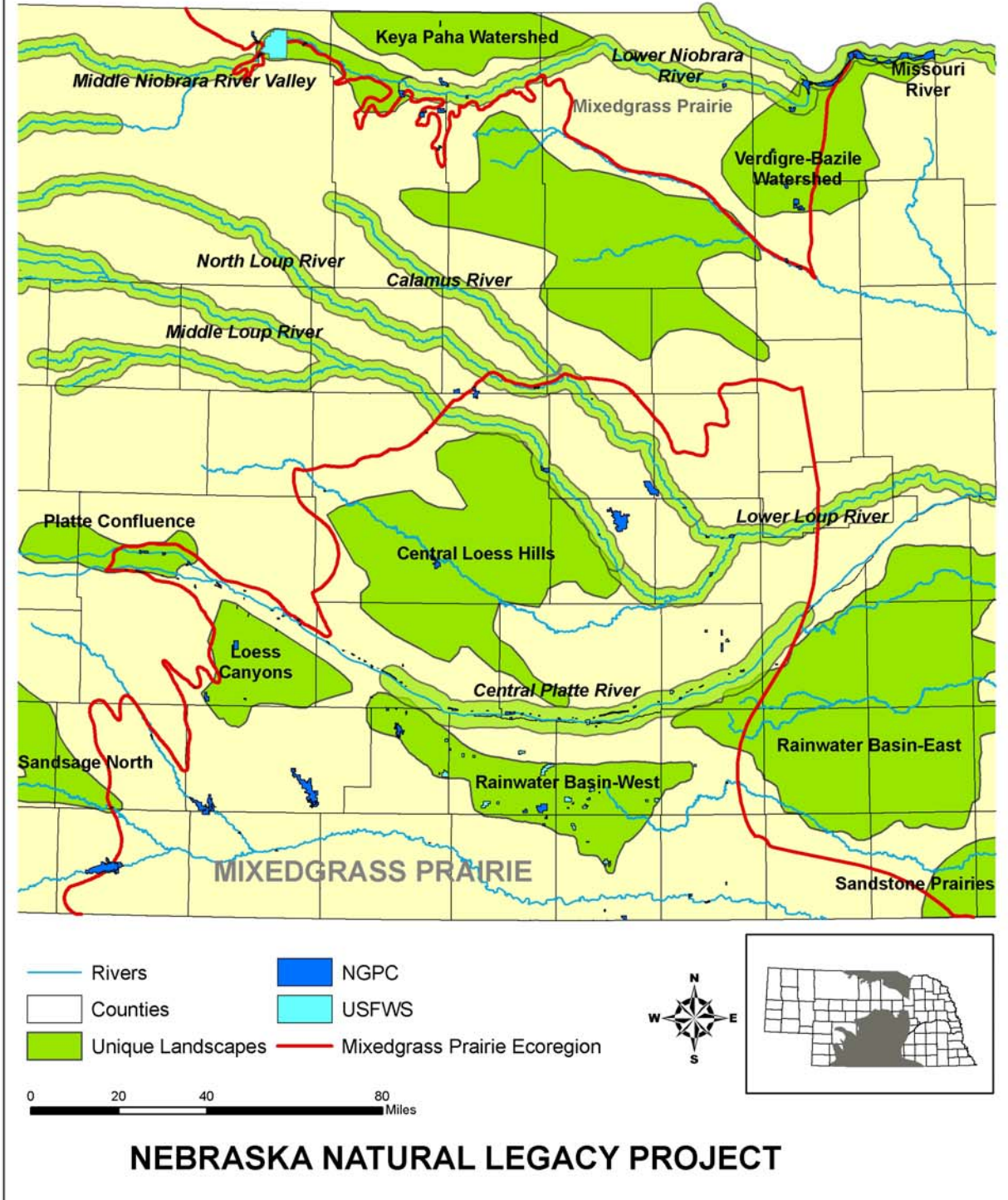
One of the goals of the Legacy Project is to identify a set of priority landscapes that, if properly managed, would conserve the majority of Nebraska's biological diversity. These landscapes, which we are calling Biologically Unique Landscapes, were selected based on the occurrences of at-risk species and ecological communities. See Chapter 3 for a description of the methods used to select the landscapes.

The map on following page shows the biologically unique landscapes for the Mixedgrass Prairie Ecoregion. Following the map are brief descriptions of each landscape including stresses affecting species and habitats, proposed conservation actions, and lists of Tier I at-risk species and ecological communities found in the landscape. An asterisk next to a community name indicates that it is a priority for conservation in that landscape.

### **Mixedgrass Landscapes**

Central Loess Hills  
Central Platte River  
Keya Paha Watershed  
Loess Canyons  
Lower Loup River  
Lower Niobrara River  
Middle Niobrara River Valley (see Sandhills Ecoregion for description)  
Platte Confluence  
Rainwater Basin West  
Verdigre-Bazile Watershed

# BIOLOGICALLY UNIQUE LANDSCAPES MIXEDGRASS PRAIRIE ECOREGION



## NEBRASKA NATURAL LEGACY PROJECT

## **Landscape Name: Central Loess Hills**

### **Landscape Description**

This landscape occupies the loess hills of central Nebraska from the Sandhills south to the Platte River valley. The landscape consists of rolling to steep loess hills dissected by the valleys of the Loup rivers. The hills are now a mosaic of mixedgrass prairie and cropland. Lack of grazing managed for biological diversity values, exotic plant invasion, and herbicide spraying have degraded the prairies. The flatter tablelands of this landscape contain playa wetlands that are used by whooping cranes during migration. The largest protected areas in the landscape are Sherman Reservoir WMA and Davis Creek WMA.

### **Stresses Affecting Species and Habitats**

- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Eastern red cedar encroachment of prairies.
- ❖ Exotic herbaceous plant invasion of prairies, primary species of concern are smooth brome, cheatgrass, Kentucky bluegrass, and musk thistle.
- ❖ Herbicide spraying of prairie.
- ❖ Sedimentation and drainage of the playa wetlands.

### **Conservation Strategies**

- ❖ Increase use of prescribed fire and tree cutting on private lands to reduce cedar abundance.
- ❖ Implement planned grazing systems on private lands to reduce exotic cool-season grasses and improve native plant diversity and vigor. Spring burning and spring grazing, sometimes used in combination, should be implemented as initial management practices to reduce exotic grass dominance. When exotics are under control rotational grazing can be implemented. Pheasants Forever's grazing deferment program can be utilized as an incentive to landowners who want to implement prescribed fire. Seek and implement methods of musk thistle control that do not require broadcast spraying of pastures.
- ❖ Restore the hydrology of playa wetlands.

### **Tier 1 At-risk Species:**

#### **Plants:**

None

#### **Animals:**

Ferruginous hawk

Bald eagle

Burrowing owl

Greater prairie chicken

Short-eared owl

Long-billed curlew  
Bell's vireo  
Whooping crane  
Regal Fritillary

**Aquatic Communities:**

Headwater, Warm Water Stream  
Mid-order, Warm Water River

**Terrestrial Communities:**

Loess Mixedgrass Prairie\*  
Tallgrass Prairie

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**Landscape Name: Central Platte River**

**Landscape Description**

This landscape includes the Platte River channel and the floodplain from central Dawson County eastward to central Hamilton. The central Platte River is a large, shallow stream with a braided channel. Sandbars and wooded islands are common within the channel. Much of the stream bank is wooded with the dominant species being cottonwood and eastern red cedar. Sand pits are common along the river, many with housing developments. Most of the river floodplain is in cropland, though there are scattered wet meadows in areas. Sand dune grasslands occur on the south side of the river in areas.

The staging of sandhill cranes during spring migration on the Platte River is a unique world-wide ecological phenomena. It is also a critical element in the life cycle of the mid-continental population of sandhill crane. Each spring between 300,000- 400,000 cranes concentrate on the central valley of the Platte River. Roosts numbering in the tens of thousands are scattered throughout the Platte River. Cranes leave the roosts to forage in adjacent corn fields and loaf in grasslands. Each sandhill crane spends between 1 and 4 weeks foraging and accumulating energy reserves in the form of fat. This accumulated energy is critical, as it provides the necessary fuel for the continued migration to nesting areas and the energetic reserves required for successful breeding. The elimination or significant alteration of spring staging areas on the Platte River are considered the most significant potential threat to the mid-continental population of sandhill cranes at the present time. The IUCN considers the protection of the Platte River as migratory habitat for sandhill cranes as a priority for conservation.

This stretch of the River has had extensive water depletion and in recent summers has gone dry over much of the area. It is a key spring migration stopover point on the central flyway. In addition to sandhill cranes, thousands of geese, waterfowl, and a variety of shorebirds use this stretch of the river. Five federal and/or state listed species occur along the Central Platte: whooping crane, interior least tern, piping plover, bald eagle and river otter. This portion of the Platte is designated as critical habitat for whooping cranes and piping plovers. The Platte River

Whooping Crane Maintenance Trust, the Audubon Society, The Nature Conservancy, and the Nebraska Game and Parks Commission own and manage a number of protected areas within this reach of the River.

### **Stresses Affecting Species and Habitats**

- ❖ Altered hydrologic regime, particularly lack of high spring flows, low summer flows, and reduced sediment transport to maintain sandbars and fish habitat
- ❖ Water depletions.
- ❖ Continued home development.
- ❖ Recreational use of river (e.g. air boats and 4-wheelers), which disturbs tern and plover nesting and other wildlife.
- ❖ Eastern red cedar, and other invasive shrub and tree encroachment of river sandbars, woodlands and meadows
- ❖ Sandpit development, which eliminates native meadows, woodlands, and river channel.
- ❖ Conversion of wet meadows to cropland.
- ❖ Exotic plant invasion of sandbars, meadows and woodlands, species of primary concern include reed canary grass, salt cedar, phragmites, purple loosestrife, tall wheatgrass, smooth brome, and garlic mustard.
- ❖ Drainage of wetlands.

### **Conservation Strategies**

- ❖ Restore and/or maintain the natural hydrologic regime necessary to sustain biological diversity and ecosystem function.
- ❖ Place conservation easements or acquire through voluntary fee title acquisition undeveloped reaches of the river, wet meadows, and woodlands to protect them from development.
- ❖ Undertake eastern red cedar and other tree clearing to maintain open meadow habitat for sandhill cranes, whooping cranes, and grassland birds. Initiate programs to control other invasive exotic species.
- ❖ Restore additional grassland habitat in the valley on private and public lands through high-diversity, local ecotype restorations.
- ❖ Work with sand and gravel companies to site gravel pits away from ecological sensitive areas of the floodplain and to restore sandpits to wetland communities once mining is completed.
- ❖ Expand island clearing efforts on the river for water bird use.
- ❖ Develop and implement best management practices to control and manage invasive plant communities.
- ❖ Restore wetland hydrology.

### **Tier 1 At-risk Species**

#### **Plants:**

Western prairie fringed orchid

#### **Animals:**

Platte River caddisfly

Regal fritillary  
Plains topminnow  
Bald eagle  
Interior least tern  
Piping plover  
Sandhill crane  
Whooping crane  
River otter

**Aquatic Communities:**

Mid-order, Warm Water River

**Terrestrial Communities:**

Eastern Cottonwood-Dogwood Riparian Woodland  
Eastern Cottonwood-Willow Riparian Woodland  
Sandbar Willow Shrubland  
Riparian Dogwood-False Indigo Shrubland  
Sumac-Dogwood Shrubland  
Freshwater Marsh  
Spring Seep  
Perennial Sandbar\*  
Northern Cordgrass Wet Prairie\*  
Northern Sedge Wet Meadow \*  
Wet-mesic Tallgrass Prairie\*  
Tallgrass Prairie  
Sandbar Mudflat\*

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**Landscape Name: Keya Paha Watershed**

**Landscape Description**

This landscape occupies the watershed of the Keya Paha River in Holt, Rock and Brown counties. The watershed is a mosaic of cropland and mixedgrass prairie. The Keya Paha River is a smaller river whose flows are unmodified. Meadows, woodlands and cropland occupy its floodplain. Numerous small streams are tributaries to the Keya Paha and their floodplains support large expanses of wet meadows. These streams have significant assemblages of rare fish species including the pearl dace and the state listed blacknose shiner, finescale dace, and northern redbelly dace. A population of the federally and state endangered American burying beetle occurs in the landscape. The prairies and meadows support a diversity of butterflies. Currently there are no protected areas within this landscape.

### **Stresses Affecting Species and Habitats**

- ❖ Modification of smaller streams and their headwaters in wet meadows through ditching or channelization.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Exotic species invasion of meadows, upland prairies and woodlands.

### **Conservation Strategies**

- ❖ Place conservation easements on critical streams reaches.
- ❖ Implement innovative grazing and haying regimes on native prairies.
- ❖ Restore specific key areas of cropland to grassland.
- ❖ Restore the natural hydrology to key wet meadows.

### **Tier 1 At-risk Species**

#### **Plants:**

None

#### **Animals:**

American burying beetle  
Plains topminnow  
Pearl dace  
Blacknose shiner  
Northern redbelly dace  
Finescale dace  
Iowa skipper  
Regal fritillary

#### **Aquatic Communities:**

Headwater, Cold Water Stream\*  
Headwater, Warm Water Stream\*  
Mid-order, warm water river\*

#### **Terrestrial Communities:**

Eastern Cottonwood-Willow Riparian Woodland\*  
Oak woodland\*  
Sandbar Willow Shrubland  
Riparian Dogwood-False Indigobush Shrubland  
Sumac-Dogwood Shrubland



Spring Seep  
 Freshwater Marsh  
 Northern Sedge Wet Meadow  
 Northern Cordgrass Wet Prairie  
 Dry-mesic Sand Prairie  
 Wet-mesic Tallgrass Prairie  
 Loess Mixedgrass Prairie  
 Northern Sand/Gravel Prairie\*  
 Sandbar/Mudflat

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## **Landscape Name: Loess Canyons**

### **Landscape Description**

This landscape consists of steep loess hills and canyons south of the Platte River in Lincoln, Dawson, and northern Frontier counties. These hills support mixedgrass prairie and are used primarily as rangeland though scattered crop fields occur. The mixedgrass prairies have been heavily invaded by eastern red cedars in recent decades. Most grasslands have been overgrazed in the past and are now heavily infested with cheatgrass and Japanese brome. The area is significant because it contains one of the largest known populations of the federally and state endangered American burying beetle. This landscape contains few protected areas, the largest being the Wapiti WMA.

### **Stresses Affecting Species and Habitats**

- ❖ Eastern red cedar encroachment.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Exotic cool-season grass invasion.
- ❖ Light pollution from acreage developments which impacts the American burying beetle.

### **Conservation Strategies**

- ❖ Increase use of prescribed fire and tree cutting on private lands to reduce cedar abundance.
- ❖ Implement planned grazing systems on private lands to reduce exotic cool-season grasses and improve native plant diversity and vigor. Spring burning and spring grazing, sometimes used in combination, should be implemented as initial management practices to reduce exotic grass dominance. When exotics are in control rotational grazing can be implemented.
- ❖ Promote use of appropriate lighting sources.

### **Tier 1 At-risk Species**

**Plants:**  
 None

**Animals:**

Regal fritillary  
American burying beetle  
Bell's vireo  
Burrowing owl  
Ferruginous hawk  
Greater prairie chicken  
Plains harvest mouse  
Plains pocket mouse

**Aquatic Communities:**

Headwater, Warm Water Stream

**Terrestrial Communities:**

Juniper Woodland  
Loess Mixedgrass Prairie\*

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**Landscape Name: Lower Loup Rivers**

**Landscape Description**

This landscape includes the lower reaches of the Middle Loup River (north-central Custer County southeastward), North Loup River (southwest Garfield County southeastward), and the Loup River from its origin to the Nance/Platte county line. The landscape includes the river channels and a two-mile buffer on each side of the rivers. The Loup rivers in these reaches are medium-sized rivers with broad braided, somewhat shallow channels. The river channels have many open sandbars and wooded islands. The flows on the North Loup River have been modified by the upstream Taylor Dam and irrigation diversions. The flows on the Middle Loup and Loup Rivers have been modified by several diversions. Though somewhat modified, the Loup rivers maintain a fairly constant year-around flow of water because of the spring-fed nature of the streams in their upper reaches in the Sandhills.

Much of the valley floodplains are cropland, though some areas support cottonwood woodlands, wet meadows and marshes. The valley bluffs are for the most part shallow sloped and covered by mixedgrass prairie with oak woodlands in areas.

Sandbars on the lower reaches of the Loup River support nesting colonies of the federally and state listed interior least tern and piping plover. The federally and state endangered whooping crane uses sandbars and wet meadows in the Loup river floodplains as migratory stopover habitat. Bald eagles are also known to nest along the Loup rivers. Nebraska's most extensive populations of the state threatened small white lady's-slipper occur in wet meadows in the Middle Loup River floodplain.

### **Stresses Affecting Species and Habitats**

- ❖ Additional water diversions.
- ❖ Point and non-point source pollution.
- ❖ Shoreline stabilization.
- ❖ Eastern red cedar and Russian olive encroachment in valley prairies and woodlands.
- ❖ Herbaceous plant invasion of the river channel, prairies, and woodlands, species of primary concern include phragmites, purple loosestrife, smooth brome, and reed canary grass.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Drainage and sedimentation of wetlands.

### **Conservation Strategies**

- ❖ Implement measures to site dairy and hog confinements away from sensitive habitats and watersheds.
- ❖ Protect key stretches of the Loup rivers through conservation easements.
- ❖ Implement invasive tree clearing projects on privately owned prairies and woodlands.
- ❖ Implement planned grazing and prescribed fire on native prairies and woodlands.
- ❖ Restore wetland hydrology.
- ❖ Maintain existing stream flows and hydrologic regime.

### **Tier 1 At-risk Species**

#### **Plants:**

Small white lady's-slipper

#### **Animals:**

Ottoe skipper  
Regal fritillary  
Plains topminnow  
Whooping crane  
Bald eagle  
Interior least tern  
Piping Plover  
Bell's vireo

#### **Aquatic Communities:**

Mid-order, Warm Water Stream\*

#### **Terrestrial Communities:**

Eastern Cottonwood-Willow Riparian Woodland\*  
Eastern Cottonwood-Dogwood Riparian Woodland\*

Diamond Willow Woodland\*  
Oak Woodland\*  
Sandbar Willow Shrubland\*  
Riparian Dogwood-False Indigobush Shrubland\*  
Sumac-Dogwood Shrubland  
Spring Seep  
Freshwater Marsh\*  
Northern Sedge Wet Meadow\*  
Northern Cordgrass Wet Prairie\*  
Wet-mesic Tallgrass Prairie\*  
Tallgrass Prairie  
Dry-mesic Sand Prairie  
Loess Mixedgrass Prairie\*  
Sandbar/Mudflat\*

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## **Landscape Name: Lower Niobrara River**

### **Landscape Description**

This landscape includes the Niobrara River channel and a two-mile buffer on each side of the river from central Brown County eastward to its confluence with the Missouri River in Knox County. The River in this reach has a broad braided, somewhat shallow channel. The channel has many open sandbars and wooded islands. This reach of the Niobrara River has fairly natural flows, the only obstruction on the river is the low Spencer Dam in Boyd County. Much of the valley bottom is in cropland, though some areas support cottonwood woodlands and bur oak woodlands. Some wet meadows and marshes still remain in the floodplain. The bluff slopes are mainly mixedgrass prairie with some oak woodlands in the east and ponderosa pine woodlands in the west.

Sandbars on the lower stretch of the Niobrara River from western Holt County eastward support numerous colonies of the federally and state listed interior least tern and piping plover. Bald eagles are also known to nest along this reach of the Niobrara River. Protected areas within the landscape include Red Bird, Bohemia Prairie and Greenvale WMA's and Niobrara State Park.

### **Stresses Affecting Species and Habitats**

- ❖ House and cabin development along the River.
- ❖ Eastern red cedar invasion of valley grasslands and woodlands.
- ❖ Spencer Dam blocking fish movement on the river.
- ❖ Exotic plant invasion of the stream channel, meadows and woodlands, primary species of concern include purple loosestrife, reed canary grass, leafy spurge, and smooth brome.

## **Conservation Strategies**

- ❖ Implement eastern red cedar clearing on private lands.
- ❖ Build a fish bypass on Spencer Dam.
- ❖ Implement planned grazing and prescribed fire on private lands.
- ❖ Implement control of invasive species in native habitats.
- ❖ Maintain existing stream flows and hydrologic regime.

## **Tier 1 At-risk Species**

### **Plants:**

None

### **Animals:**

Lake sturgeon  
Bald Eagle  
Piping Plover  
Interior Least Tern  
Bell's Vireo

### **Aquatic Communities:**

Headwater, Cold Water Stream\*  
Headwater, Warm Water Stream\*  
Mid-order, Warm Water River\*

### **Terrestrial Communities:**

Eastern Cottonwood-Willow Riparian Woodland\*  
Bur Oak-Basswood-Ironwood Forest\*  
Oak Woodland \*  
Sandbar Willow Shrubland\*  
Riparian Dogwood-False Indigobush Shrubland  
Sumac-Dogwood Shrubland  
Spring Seep\*  
Freshwater Marsh\*  
Northern Sedge Wet Meadow  
Northern Cordgrass Wet Prairie\*  
Wet-mesic Tallgrass Prairie\*  
Tallgrass Prairie  
Dry-mesic Sand Prairie  
Loess Mixedgrass Prairie  
Northern Sand/Gravel Prairie\*  
Sandbar/Mudflat\*

**Landscape Name: Platte Confluence****Landscape Description**

This landscape includes the South Platte River valley and the North Platte River valley and the land between them in Keith and Lincoln counties. It also includes a small area of Sandhills to the north of the North Platte valley through which Whitetail Creek, Birdwood Creek, and White Horse Creek flow.

Both the North Platte and South Platte rivers in this reach are shallow streams, with braided, mostly wooded channels. However, open sandbars and wet meadows are more common in the floodplain than in other reaches of the Platte rivers in western Nebraska. Sandhill cranes still use these open habitats for spring staging. River flows have been greatly depleted from upstream diversion and Russian olive and eastern red cedar have become invasive in the floodplain woodlands and meadows. Cropland is common in the valley.

Whitetail Creek, Birdwood Creek, and White Horse Creek headwater in the Sandhills, their flows derived from the extensive aquifer below the dunes, and flow southward into the North Platte River. In their upper reaches, they are fairly pristine, coldwater streams with wet meadows in their floodplains. These streams are unique in that they support several species of rare, cold-water fish, including the northern redbelly dace and finsecale dace. The streams also support submergent wetland plants that feed over-wintering trumpeter swans. There are few protected lands within this landscape.

**Stresses affecting Species and Habitats**

- ❖ Lack of spring high flows and reduced sediment transport in the Platte rivers to maintain and create open sandbars and variable depths of aquatic habitat within the river channel and adjacent riparian areas.
- ❖ Water depletions from the Platte rivers and underlying aquifers.
- ❖ Conversion of floodplain meadows to cropland.
- ❖ Eastern red cedar and Russian olive encroachment of floodplain woodlands and meadows.
- ❖ Exotic plant invasion of meadows, woodlands and the river channel, primarily reed canary grass, smooth brome, Canada thistle, salt cedar, phragmites (European variety), and purple loosestrife.
- ❖ Livestock grazing and haying practices that reduce native plant diversity and promote uniform habitat structure (e.g. season-long grazing, annual mid-summer haying).
- ❖ Alteration of wetland hydrology by drainage ditches.

**Conservation Strategies**

- ❖ Restore and maintain the natural hydrologic regime necessary to sustain biological diversity and ecosystem function.

- ❖ Undertake eastern red cedar and Russian olive clearing projects on private lands to maintain open habitats for Sandhill cranes and other migratory water birds. Implement programs to control other invasive exotic species.
- ❖ Implement innovative grazing and haying regimes on private land meadows in the Platte valleys and along the Sandhill streams to reduce exotics and promote native plants.
- ❖ Use conservation easements to protect important stretches of the Whitetail, Birdwood, and White Horse creeks.
- ❖ Restore the hydrology to the wet meadows and other wetlands.

### **Tier 1 At-risk Species**

#### **Plants:**

None

#### **Animals:**

Iowa skipper

Plains topminnow

Finescale dace

Northern redbelly dace

Bell's vireo

Greater prairie chicken

Sandhill crane

Whooping crane

Short-eared owl

Bald eagle

Long-billed curlew

#### **Aquatic Communities:**

Headwater, Cold Water Stream\*

Mid-order, Warm Water River\*

#### **Terrestrial Communities:**

Western Riparian Woodland

Sandbar Willow Shrubland\*

Riparian Dogwood-False Indigo Shrubland

Freshwater Marsh\*

Spring Seep

Perennial sandbar\*

Northern Cordgrass Wet Prairie\*

Northern Sedge Wet Meadow\*

Wet-mesic Tallgrass Prairie\*

Sandbar Mudflat\*

## **Landscape Name: Rainwater Basins**

### **Landscape Description**

The Rainwater Basin landscape occupies parts of 17 counties in south-central Nebraska. The topography is flat to gently rolling loess plain. The surface water drainage system is poorly developed and many watersheds drain into low-lying wetlands. Soil survey maps from the early 1900s indicate that approximately 4,000 larger wetlands totaling nearly 100,000 acres occurred in the area prior to Euroamerican settlement. By the beginning of the 20<sup>th</sup> Century most uplands in the landscape had been converted to cropland. A 1983 survey indicated that only 10 percent of the original wetlands had not been drained or filled. Nearly all remaining Rainwater Basin wetlands have been farmed at some time in the last century.

The Rainwater Basin wetlands have been identified by the North American Waterfowl Management Plan as a waterfowl habitat area of major concern in North America. The Basins are a focal point of a spring migration corridor used annually by millions of duck, geese, and shorebirds. In addition, the wetlands provide important migration habitat for whooping cranes, bald eagles, and other bird species. It is estimated that nearly the entire North American population of buff-breasted sandpipers stage in the eastern Rainwater Basins during their spring migration. These wetlands are also important breeding sites for amphibians.

### **Stresses affecting Species and Habitats**

- ❖ Drainage or filling of wetlands for conversion to cropland
- ❖ Sedimentation and chemical runoff from adjacent cropland.
- ❖ Exotic plant invasion of wetlands, primarily reed canary grass, river bulrush, and cattails.

### **Conservation Strategies**

- ❖ Conservation objectives and strategies for the Rainwater Basin are listed in *Looking to the future – an implementation plan for the Rainwater Basin Joint Venture* published by the Nebraska Game and Parks Commission. Strategies 1 and 2 below are taken from that document.
- ❖ Protect, restore, and create an additional 25,000 wetland acres and 25,000 acres of adjacent upland habitat.
- ❖ Provide a reliable water source for a minimum of 1/3 of all protected wetland acres to assure sufficient water quantity, quality, and distribution to migratory waterfowl and water bird needs.
- ❖ Develop and implement methods to effectively control invasive plant species in basins.
- ❖ Find conservation groups to hold conservation easements in the basins
- ❖ Work with private landowners to develop an efficient system to conduct cattle grazing in the basins.
- ❖ Create grassland buffers around basins to reduce sedimentation and chemical runoff.



## **Tier 1 At-risk Species**

### **Plants:**

None

### **Animals:**

Buff-breasted Sandpiper

King Rail

Whooping Crane

### **Aquatic Communities:**

Headwater, Warm Water Stream

### **Terrestrial Communities:**

Pond Marsh\*

Playa Wetland

Wheatgrass Playa Grassland\*

Tallgrass Prairie

Loess Mixedgrass Prairie

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## **Landscape Name: Verdigre and Bazile Creek Watersheds**

### **Landscape Description**

This landscape occupies the watersheds of Verdigre Creek and Bazile Creek in Cedar, Knox, Holt, and Antelope counties. The streams are spring-fed coldwater streams that have unique fish assemblages. The watersheds are a mosaic of cropland, restored native and exotic grasslands, and native tallgrass and mixedgrass prairie. Most of the prairies has been somewhat degraded by use of livestock grazing regimes that reduce native species diversity and exotic plant invasion. Oak woodlands are common along the streams and in ravines.

The northern portion of the landscape includes the Missouri River bluffs and breaks. These areas support loess bluff mixedgrass prairie, tallgrass prairie, and deciduous woodlands. The Santee Indian Reservation is located within this portion of the landscape. Protected areas within the landscape include Bazile Creek and Grove Lake WMAs and the Lewis and Clark SRA.

### **Stresses Affecting Species and Habitats**

- ❖ Potential waste runoff from dairy and hog confinements built within the watershed.
- ❖ Conversion of grasslands to cropland.
- ❖ Eastern red cedar and other invasive tree encroachment in woodlands and prairies.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.

## **Conservation Strategies**

- ❖ Implement measures to site dairy and hog confinements away from sensitive habitats and watersheds.
- ❖ Protect key stretches of Verdigre Creek and Bazile Creek through conservation easements.
- ❖ Implement invasive tree clearing projects on privately owned prairies and woodlands.
- ❖ Implement innovative grazing systems on private lands.
- ❖ Restore selected cropland to grassland, including expansion of stream buffer programs.

## **Tier 1 At-risk Species**

### **Plants:**

None

### **Animals:**

Plains Topminnow

Greater prairie chicken

### **Aquatic Communities:**

Headwater, Cold Water Stream\*

Headwater, Warm Water Stream\*

### **Terrestrial Communities:**

Bur Oak-Basswood-Ironwood Forest\*

Oak Woodland\*

Sumac-Dogwood Shrubland

Freshwater Marsh

Spring Seep

Eastern Cordgrass Wet Prairie

Wet-mesic Tallgrass Prairie

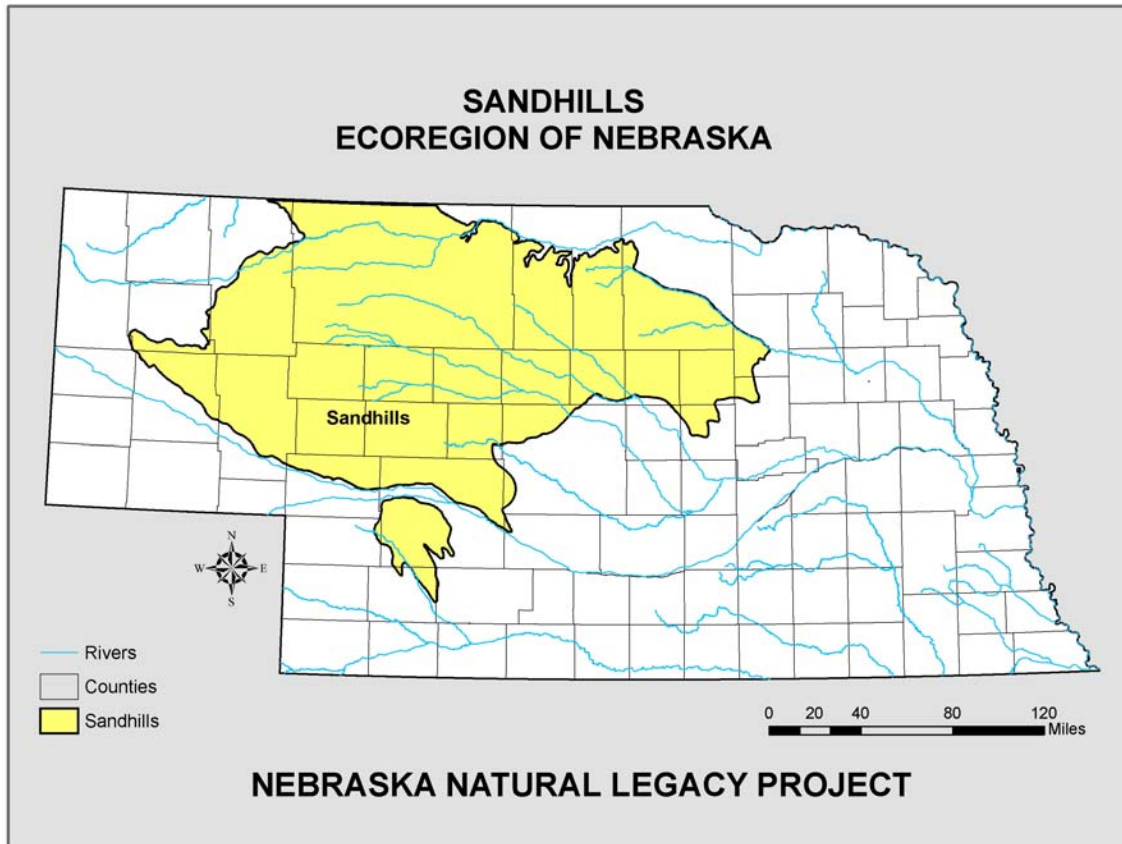
Tallgrass Prairie\*

Loess Bluff Prairie\*

Northern Sand/Gravel Prairie\*

Dry Cliff

## CHAPTER 7: SANDHILLS ECOREGION



### INTRODUCTION

It's difficult not to be awestruck by the sheer magnitude of the Sandhills and its unspoiled natural condition. Covering 19,300 square miles in north-central Nebraska, the Sandhills Ecoregion includes the largest dune system in the western hemisphere and one of the largest grass-stabilized dune regions in the world. A majority of the ecoregion remains in a relatively natural state. The Sandhills remain as one of the last vestiges of the great American plains.

Geologically, the Sandhills are young. Several major episodes of dune formation have occurred over the last 13,000 years and several periods of drought-induced wind erosion occurred during the last 1,000 years. Scientists speculate that, at times in its history, the Sandhills were a sea of blowing sand, not unlike today's Sahara desert. Dunes are aligned primarily in a northwesterly to southeasterly direction in accordance with prevailing winds and some reach over 400 feet in height.

The Sandhills climate is semiarid with precipitation ranging from 23 inches per year in the east to less than 17 inches per year in the west. The sandy dune soils are poorly developed with a thin layer of topsoil containing little organic matter. The lack of organic matter may result from the dry nature of the soils, or from the recent formation of the dunes providing little time for soil

development. High infiltration rates, up to 10 feet per day, allow rainwater and snowmelt to percolate rapidly downward. Extensive aquifers, up to 900 feet thick, have formed below the Sandhills in gravel deposits. The underground reservoir is part of the Ogallala aquifer and contains an estimated 700-800 million acre-feet of groundwater, nearly double the amount of water stored in Lake Erie.

The high water table has allowed nearly 2,000 shallow lakes and over a million acres of wetlands to form. Most lakes and wetlands are clustered near stream headwaters and in the western Sandhills where surface drainage is poor. Sandhill lakes and marshes are generally small, with only a few being over 1,000 acres in size, and shallow with the greatest depth less than fourteen feet. Scientists speculate that Sandhill wetlands cycle water from the underlying aquifer back to the atmosphere through evapotranspiration. This moisture later falls as rainfall, creating an environment conducive to grassland establishment and maintenance.

Most Sandhill lakes, marshes, and wet meadows are near neutral pH, but alkaline wetlands and lakes are common in the west where salts and carbonates have accumulated in wetland soils. The Sandhills contains some of the Great Plains' largest fens, groundwater-fed wetlands with peat or muck soils. They are often found at the headwaters of streams and the upper end of Sandhill lakes and marshes where groundwater discharge is abundant. Their organic soils can be up to 21 feet thick which resulted from the buildup of undecomposed plant material over thousands of years.

Southeasterly flowing streams, such as the North Loup, Middle Loup, Calamus, Cedar, and Dismal rivers, drain much of the central and eastern Sandhills. Their flows are derived almost entirely from groundwater discharge and little from overland flow. The flow of these rivers is remarkably consistent throughout the year and rarely results in floods or dries out from drought. The Niobrara River is the only Sandhills river that originates outside the ecoregion. Its headwaters are in eastern Wyoming and flows easterly through the northern Sandhills before entering the Missouri River in northeastern Nebraska. The Sandhills contains many smaller streams including the Minnechaduza, Pine, Boardman, and Birdwood creeks.

## **Vegetation**

The Sandhills contain a variety of native plant communities ranging from wetlands to dry upland prairie. Nearly 700 native plant species have been documented in the Sandhills, including several at-risk species. Two principal terrestrial community types are found in the Sandhills ecoregion.

The Sandhills dune prairie community consists of a mixture of sand-adapted grasses including sand bluestem, prairie sandreed, little bluestem, and hairy grama. Typical forbs are stiff sunflower, bush morning glory, and Plains gayfeather. Common shrubs include sand cherry, leadplant, prairie rose, and yucca. The Sandhills dry valley prairie community is found between dunes and has taller prairie grasses including big bluestem, Indiangrass, and switchgrass. Forbs include western ragweed, white sage, and prairie coneflower. Shrubs are generally small (less than one meter tall) and include leadplant, Arkansas rose, and western wild rose.

Sparsely vegetated blowouts occur in both community types. These are wind-excavated depressions that have a unique plant community. The federal and state threatened blowout penstemon is confined to blowouts. Fewer blowouts exist today because of wide-scale efforts to vegetate these sites because of fears of erosion.

Native woodlands are uncommon in the Sandhills and are found only in fire-protected river valleys and bluffs. Eastern cottonwood, peachleaf willow, and coyote willow dominate riparian woodlands along many Sandhill streams. Native shrub thickets of chokecherry, wild plum and snowberry are key habitats for native avian species and typically occur as distinct inclusions in the Sandhills dune prairie, with most individual thickets being less than an acre in size. The middle Niobrara River valley contains the largest concentration of woodlands in the Sandhills. Eastern deciduous woodlands containing bur oak, basswood, black walnut, and green ash grow on south-facing bluffs. Cool, moist, spring-fed canyons along the south bluff contain glacial relict woodlands dominated by paper birch and quaking aspen-trees characteristic of more northern environments. The steep, rocky, north river bluff supports ponderosa pine dominated woodlands characteristic of the Rocky Mountains. Both Sandhills prairie and northern mixed grass prairie are also found along the bluffs. The Middle Niobrara River Valley has been referred to as a biological crossroads because of the diverse mixture of plant and animal species that are found here.

Wet meadows occur in Sandhill valleys where the water table remains near the surface throughout the year. The sandy to fine sandy loam soils of freshwater meadows supports lush vegetation dominated by sedges, spikerushes, prairie cordgrass, and switchgrass. Shrubs, such as sandbar willow and false indigobush, are also found in this community. Alkaline wet meadows are dominated by inland saltgrass, foxtail barley, alkali sacaton, meadow bluegrass, and scratchgrass. Sandhill fens also have meadow-like vegetation dominated by grasses, sedges and shrubs. Saturated organic fen soils support a unique flora containing twenty at-risk plant species including bog bean, cottongrass, and marsh marigold.

Freshwater marshes have shallow standing water most of the year and occur in isolation, as zones around lakes, or as borders to streams. Common plants include ripgut sedge, common reed, smartweeds, hardstem bulrush, broad-leaf cattail, duckweeds, and coontail. Sandhill alkaline marshes have a sparser vegetative cover of Nevada bulrush, saltmarsh bulrush and other alkaline-tolerant plants.

## **Animals**

More than 300 species of resident and migratory birds have been documented in the Sandhills. The region is a stronghold for sharp-tailed grouse and greater prairie chicken and is considered to be an important breeding site for the world's largest sandpiper, the long-billed curlew. The Sandhills contain substantial breeding populations of upland sandpiper, vesper sparrow, lark bunting, grasshopper sparrow, and western meadowlark. The American Bird Conservancy has described the Nebraska Sandhills as the "best grassland bird place in the United States". The sandhills host the highest concentrations of northern harriers in the state and ferruginous hawks are common breeders in the western sandhills. Over a quarter million waterfowl have been recorded during May surveys and the area is the most important breeding area for mallards, blue-

winged teal, and pintails south of the prairie pothole region. Other waterbirds that are common breeders in the Sandhills include Wilson's phalarope, American avocet, western grebe, and black tern. Although woodlands are mostly confined to stream corridors woodland species such as black-billed magpie, Bell's vireo, black-and-white-warbler, and rose-breasted grosbeak are known to nest in the Sandhills.

The Sandhills are home to 55 species of mammals. Many mammals found in the Sandhills ecoregion are widespread with no distinct affiliation to the region. Small mammals include upland species such as the plains pocket gopher, white-tailed jackrabbit, Ord's kangaroo rat, and prairie voles. Species such as the masked shrew, jumping mouse, and meadow vole can be found associated with wet meadows and other wetlands. The most abundant large mammals include mule deer and white-tailed deer. Relatively small numbers of pronghorn can be found particularly in the western sandhills and elk occasionally can be found. Although free roaming bison no longer occur in the Sandhills, The Nature Conservancy's Niobrara Valley Preserve maintains two pseudo-natural herds on their 56,000-acre preserve along the Niobrara River. Coyotes are common throughout the ecoregion and bobcats can be found in many riparian areas. In recent years several confirmed sightings of mountain lions have been made. One of the rarest mammals of the Sandhills is the Bailey's eastern woodrat, a subspecies found only in middle Niobrara River valley woodlands.

Sandhill streams and lakes are home to 75 species of fish. Many common species are big river generalists, which can withstand a wide variation of environmental extremes. Among these are the channel catfish, flathead chub and river carpsucker. Most rare Sandhills fish species, including the blacknose shiner, pearl dace, northern redbelly dace, and finescale dace are northern species with their Sandhills populations being disjunct from their principal range. These species are less tolerant of habitat change and are now restricted to the fairly stable headwaters of Sandhill streams. Game fish, primarily yellow perch, northern pike, largemouth bass, bluegill, and carp, have been introduced to many Sandhill lakes and trout have been introduced to several coldwater streams.

Twenty-seven species of amphibians and reptiles are found in the Sandhills, including one salamander, three toads, four frogs, six turtles, four lizards, and nine snakes. The Great Plains toad, spade foot toad, and Rocky Mountain toad use Sandhills wetlands for breeding while spending most of their adult life in the uplands. The ornate box turtle is probably the most well known Sandhills reptile and can often be seen crossing roads. Blanding's turtle, a northern species whose range extends to New England is rare over much of its range but appears to be fairly abundant in Sandhill lake and marshes. Three small lizards are common on the sand dunes. The six-lined race runner seems to prefer denser vegetation while the lesser earless lizard prefers more sparsely vegetated open sand. The northern prairie lizard commonly forages in blowouts. The bullsnake and western hognose snake are probably the Sandhills' most common snakes. The prairie rattlesnake is the region's only venomous snake and lives primarily in areas with rock outcrops and prairie dog towns.

Insects are the most diverse, abundant, and least studied animal group in the Sandhills. They may also be the most important group ecologically and economically playing vital roles as pollinators, decomposers, grazers, and food for other wildlife. Insect diversity is enormous in the

Sandhills. Seventy species of scarab beetles have been documented for Thomas County alone, and numerous species of butterflies are known to inhabit the Sandhills. Possibly, the rarest insect in the Sandhills is the federally and state endangered American burying beetle. The Sandhills are one of the last known strongholds for this species that once ranged over much of the eastern United States.

Rich in flora and fauna, the Nebraska Sandhills remain as one of the best examples of a functioning prairie landscape in the country. Although the region has not completely escaped the impacts of the modern world, it will likely continue as a center of Great Plains biological diversity well into the future.

## **DOMINANT LAND USE AND HISTORY**

Less is known about native American use of the Sandhills than in any other ecoregion in Nebraska. Fewer cultural resource surveys have been conducted and its extensive undisturbed grasslands have limited archeological discovery. Human use of the sandhills likely dates back at least 10,000 years. The first human inhabitants were probably nomadic and used primitive weapons to hunt mammoth, horse, camel, and other now extinct species. The first year-round settlements likely occurred along lakes and streams beginning 1,000-2,000 years ago. Like most native plains people, they subsisted using a mixed economy of agriculture (corn, beans, squash), hunting, and gathering. Nearly a dozen tribes are known to have occupied the Sandhills including but not limited to the Plains Apache, Pawnee, Commanche, Ponca, Omaha, Teton Sioux, Oglala and Cheyenne.

The first Euro-American visitors to the Sandhills are believed to be trappers and hunters who traveled along streams in search of game. James Mackay was one of the first known non-indigenous visitors to the Sandhills' interior. He led an expedition in 1795 and remarked that the current southeastern Cherry county was "a great desert of drifting sand...without animals of any kind excepting some little varicolored turtles, of which there are vast numbers." In 1855 an Army Lieutenant traveled through the Sandhills and commented that permanent settlement was not possible because of unfavorable climate and lack of soil fertility.

It was not until the 1870's that cattle producers began discovering the Sandhills potential as rangeland. One of the first Sandhill ranches was organized in 1877 by E.S. Newman on the Niobrara River to provide cattle to Native Americans living on the Pine Ridge reservation. Cattle were kept from grazing the more rugged sandhills south of the river until a spring blizzard in 1879 scattered more than 6,000 cattle into the adjacent sand hills. Hoping to salvage a small portion of the lost stock, cowboys not only found the lost cattle but also large herds of well-fattened and watered cattle which had been thriving on sandhill grasses. By the late 1880s the Sandhills had become an important cattle-raising region.

Most early ranches were large and cattle were left unfenced to graze freely. In the early 1900's, Moses Kinkaid, a Congressman from O'Neill secured passage of the Kinkaid Act. This act encouraged settlement in the Sandhills by increasing the maximum land claim from 160 acres to 640 acres. Between 1910 and 1917 nearly nine million acres were claimed by "Kinkaiders." Most attempts at farming failed, but ranching succeeded and the population in the Sandhills grew

from about 67,000 in 1900 to over 95,000 by the 1930's. In the mid-1930's severe drought gripped the Great Plains. During this time, some ranchers discovered that the effects of drought could be partially mitigated by switching to a rotational grazing system. Innovations such as the windmill and barbed wire fence were important to the success of early Sandhill ranchers and allowed them to compete economically with the larger ranches that had previously dominated the region.

These early small ranches helped foster a close personal relationship between ranchers and the Sandhills, a relationship that still exists today. Early ranchers learned about the fragile nature of the Sandhills and the inextricable connection between conserving the region's grasslands and economic viability. Sandhill ranchers were one of the first groups to widely accept the use of planned rotational grazing systems, a technique that is widely accepted as being the most sustainable for grazing and compatible for biological diversity conservation. Sandhill ranchers are widely credited with helping to maintain the area's rich biological diversity through their commitment to sound stewardship.

Today, approximately 95 percent of the Sandhills are maintained as native grasslands primarily for livestock production. Average ranch size varies widely and cattle outnumber people in the Sandhills by 20:1. Overall over a half million head of cattle are supported in the Sandhills annually. It has remained an environmentally unique landscape because cattle ranchers have been good land stewards. Crop production peaked in the 1970's when center pivot irrigation tripled as native grassland was converted in an unsuccessful attempt to farm large portions of the Sandhills. Although many of these formerly cropped lands have now been reseeded to grass and put into the Conservation Reserve Program, many Sandhill ranchers still view this as one of the low points in the history of the Sandhills.

## **NATURE-BASED RECREATION**

The Nebraska Sandhills is ideally suited for natural amenities-based recreation. As one of the largest remaining grassland landscapes in the United States, the Sandhills have a unique allure to those wishing to gain a glimpse of America's prairie past. The Sandhills are well known to upland game hunters and birdwatchers alike. The region sports some of the nation's best sharp-tailed grouse and prairie chicken hunting in the fall and premier lek viewing in the spring. Many species of waterfowl and shorebirds can be seen in the spring including large concentrations of pintails, grebes, and phalaropes. Great Plains endemics like long-billed curlew, chestnut-collared longspur, Leconte's sparrow, and rare species like trumpeter swan can be seen. In all more than 300 species of birds have been recorded in the Sandhills.

Big game, upland game, and waterfowl hunting in the Sandhills offers an unparalleled experience of panoramic views of native landscapes and solitude made possible by low hunter density. Abundant populations of mule deer, white-tailed deer, wild turkey, and even an occasional pronghorn provide pleasure to nature enthusiasts. Sandhill lakes are well regarded for large bluegill, northern pike, and largemouth bass. Merritt and Calamus reservoirs provide excellent uncrowded fishing and spectacular views. The region's rivers although often overlooked can provide quality fishing for catfish and other game species.



There are thousands of acres of public land in the sandhills including three National Wildlife Refuges, two National Forests, state wildlife management areas, and state park areas. The 56,000 acre Niobrara Valley Preserve, owned by The Nature Conservancy is one of the organization's larger preserves and includes two bison herds. Seventy-six miles of the central Niobrara River are part of the National Wild and Scenic River system and is known as one of the top canoeing destinations in the country, attracting over 20,000 river users each year. There are over 10 outfitters in the Valentine area who provide canoe, kayak, and inner tube rental. Other rivers such as the Dismal, and Loup Rivers provide quality canoeing and kayaking but are relatively unused. The Dismal River is the most difficult river to canoe in Nebraska, and offers a challenge to thrill seekers. A growing number of private businesses cater to nature enthusiasts by providing lodging, canoe/kayak rentals, horseback riding, and access to large tracts of private lands for wildlife viewing, hunting, and fishing.

State highways and secondary roads provide easy access to the most popular nature-recreation sites in the region. The Sandhills Scenic Byway (State Highway 2) which cuts through the heart of the Sandhills is considered one of the top ten scenic byways in the country. Access to some areas requires driving on hard-packed sand roads. The sparsely populated sandhills offers one of the last accessible places in the continental US to observe celestial objects free from the light pollution of more populated areas. Once completed, the Cowboy Trail will be the nation's longest rails-to-trails conversion. It will provide hikers and bicyclists with an unparalleled experience of the Sandhills.

## **EDUCATION**

Because Sandhills residents have a close affiliation with the land, there is perhaps a greater appreciation and understanding of the region's unique ecology than is found in other parts of the state. Ranchers are often eager to share their knowledge of Sandhills wildlife and plants and the role ranching has played in their conservation. Currently there is no single organization or educational institution that is devoted specifically to natural history and environmental education in the Sandhills. Instead there are many distinct and loosely connected entities involved in wildlife education in the Sandhills.

The U.S. Fish and Wildlife Service operates a visitor center at the Fort Niobrara National Wildlife Refuge that explains Fort Niobrara history, local wildlife, and refuge management. The Nebraska Game and Parks Commission operates a visitor center at Smith Falls State Park that provides interpretation of the natural history of the Niobrara Valley and the Calamus Fish Hatchery includes a small visitor center that describes the area's fish and wildlife. The Gundmunson and Barta Brothers ranches provide learning opportunities about ranching in the Sandhills.

The Nebraska state 4-H camp located within the Nebraska National Forest provides a unique setting for educational activities in the Sandhills. The camp includes lodging and dining facilities, an auditorium, hiking trails, and access to canoeing. A summer youth camp, the annual Becoming an Outdoors Woman program, outdoor skills camps, and meetings of organizations such as the Nebraska Ornithologist Union take place at the camp each year exposing hundreds of individuals to the Sandhills.

A number of schools in the Sandhills ecoregion offer in-class study of the ecoregion and experiential educational opportunities. A weeklong Sandhills Academy is held annually each summer in Ainsworth and includes topics on ecology, political and social issues pertaining to the Sandhills. North of Taylor a local group of ranchers have created a roadside rest area with interpretive signage that provides information on native plants, sandhills ecology, and ranching.

## **PARTNERSHIPS**

The sandhills ecoregion is characterized by a diversity of partnerships, coalitions, and grass roots efforts that have been formed to conserve the region's wildlife. These include, but are not limited to, the following groups.

- ❖ The **Sandhills Task Force** was organized in 1991. It is a 16-member non-profit organization made up of local ranchers and representatives from Nebraska Game and Parks Commission, U.S. Fish and Wildlife Service, The Nature Conservancy, Natural Resources Conservation Service, and North Central Resource Conservation and Development program, and Nebraska Cattlemen. Its goal is to enhance the natural resources in the Sandhills by supporting wildlife and profitable private ranching. The Task Force has been successful in bringing landowners and conservation groups together to complete projects involving conservation easements, grassland enhancement, wetlands and stream restoration, research, technical assistance, education and outreach. Enhancing native grasslands is the core mission of the Task Force. The organization works with voluntary landowners and government agencies to develop conservation strategies that benefit both ranching and wildlife. Approximately 40,000 acres are positively impacted each year. More information is available at <http://www.sandhillstaskforce.org/>
- ❖ The **Niobrara Council** is a grassroots-driven organization formed in 1997 to assist the National Park Service in managing and protecting Niobrara National Scenic River resources. It was formed by local individuals who wished to have an active voice in Niobrara River management issues and to help preserve the rural characteristics, scenic qualities, and private ownership of land in the area. The council was originally formed by an inter-local agreement between Brown, Cherry, Keya Paha, and Rock Counties. In 2000, the Council was strengthened when legislation made it a state-recognized organization with river management responsibility, development coordination authority, and the ability to hold conservation easements and title to land. Currently the Council has 16 members consisting of representatives from local, state, and federal agencies, local landowners, county commissioners, business, and the environmental community. The diverse makeup of the Council provides a wealth of knowledge, experience, and new perspectives regarding river management issues. Although the "Niobrara Council" concept was a departure from conventional approaches to natural resource management, the cooperative experiment has proven to be extremely effective and now serves as a model for others throughout the nation.

- ❖ The **Middle Niobrara Weed Awareness Group** was formed in 2001 to better coordinate weed management activities along the Niobrara River corridor. The purpose of the organization is to help local landowners become aware of the potential threat of noxious weeds and to facilitate communication amongst agencies, organizations and the public. The group is involved in mapping occurrences of noxious weeds and identifying effective control measures. Members include The Nature Conservancy, National Park Service, Niobrara Council, Brown County Weed Control, Rock County Weed Control, Cherry County Weed Control, Keya Paha Weed Control, Nebraska Dept. of Agriculture, North Central Resource Conservation and Development, Nebraska Board of Education Land and Funds, U.S. Fish and Wildlife Service (Ft. Niobrara NWR, U.S. Geological Survey, and private landowners. More information can be found at <http://www.niobraraCouncil.org/>.

## ECOREGION-SPECIFIC STRESSES AND CONSERVATION ACTIONS

### Key Stresses

Stresses and conservation actions in the Sandhills ecoregion are identified in chapter three and in descriptions of biologically unique landscapes. The following stresses were identified by conservation practitioners as the top threats in the ecoregion.

- ❖ Alteration of natural grazing and burning regimes: Although the predominance of ranching in the Sandhills is responsible for sustaining a rich complement of biological diversity, grazing patterns do not exactly mirror grazing by native herbivores. Historically, grazing intensity varied seasonally and from year-to-year. As a result there is less structural and plant diversity today than what occurred historically resulting in reduced biological diversity. Fire frequency was much higher in the past and there were likely synergistic relationships between fire and grazing. Woody vegetation has increased along rivers and streams because of reduced fire frequency. Red cedar trees have invaded much of the Sandhills.
- ❖ Wetland and wet meadow drainage: Past ditching and drainage of wetlands has impacted aquatic resources in the sandhills. Wet meadows are biologically diverse communities but composition changes when the natural hydrology is changes. Unique wetlands such as fens are degraded when ditched.
- ❖ Spread of invasive species: Invasive species are a threat to biological diversity in the Sandhills. Purple loosestrife and reed canary grass threaten riparian areas and wetlands and musk thistle and leafy spurge are threats to prairie communities. The introduction of carp has degraded many lakes, wetlands and streams.
- ❖ Interbasin Water Transfer: Biological diversity in the Sandhills is driven in large part by a water table that is close to the surface. Large-scale export of groundwater outside the Sandhills would significantly alter the region's hydrology by lowering the water table and reducing flows in streams and rivers. Although inter-basin transfer of water is not currently being done in the Sandhills, it looms as a future threat to biological diversity.
- ❖ Lack of knowledge about the region's biological diversity: The Sandhills are unique biologically and ecologically. However, many of the ecoregion's residents have limited opportunities to learn about the plant and animal species that are found in the Sandhills.

Sandhills ranchers have much knowledge about the Sandhills but often do not have a chance to share this knowledge with others. A lack of understanding and appreciation of the Sandhills could negatively impact future conservation of the Sandhills.

- ❖ Ranching Economics: The ranching community in the Sandhills is driven by a high level of pride and personal responsibility for sustaining the region's unique natural resources. Economic hardships are changing ownership patterns (e.g. more nonresident owners), which could affect management decisions and ultimate stewardship of the land.
- ❖ Conversion and fragmentation of natural habitats: Although most of ecoregion's natural communities are intact, center pivot agricultural development on the eastern and southern border of the Sandhills is accelerating, resulting in a loss of native communities and a decline in biological diversity. Fragmentation of large unbroken tracts of sandhill prairie by tree plantings, home development, wind turbines, roads etc. represent both current and future stresses on the region's biological diversity.

## **Biologically Unique Landscapes of the Sandhills Ecoregion**

One of the goals of the Legacy Project is to identify a set of priority landscapes that, if properly managed, would conserve the majority of Nebraska's biological diversity. These landscapes, which we are calling Biologically Unique Landscapes, were selected based on the occurrences of at-risk species and ecological communities. See Chapter 3 for a description of the methods used to select the landscapes.

The map on following page shows the biologically unique landscapes for the Sandhills ecoregion. Following the map are brief descriptions of each landscape including stresses affecting species and habitats, proposed conservation actions, and lists of Tier I at-risk species and ecological communities found in the landscape. An asterisk next to a community name indicates that it is a priority for conservation in that landscape.

### **Sandhills landscapes**

Cherry County Wetlands

Dismal River Headwaters

Elkhorn River Headwaters

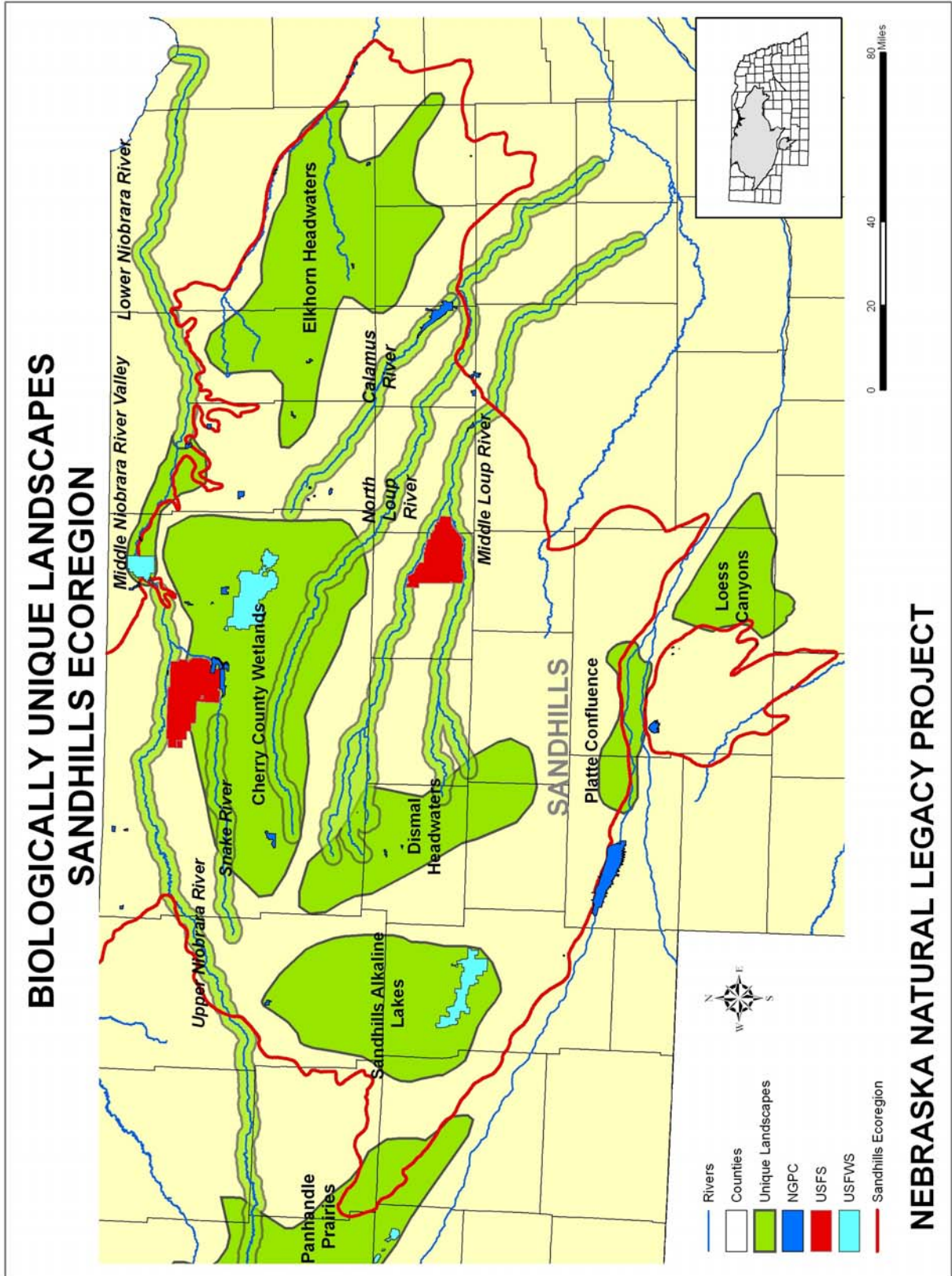
Middle Niobrara Valley

Platte Confluence (see Mixedgrass Ecoregion for description)

Sandhills Alkaline Lakes

Snake River

Upper Loup River and Tributaries (includes Calamus, Middle Loup and North Loup landscapes)



## **Landscape Name: Cherry County Wetlands**

### **Landscape Description**

This landscape occurs in Cherry County in the northern Sandhills. The area consists of high and often long linear dunes, with interdunal valleys. Many of the valleys have a high water table and contain numerous lakes, marshes, wet meadows, and fens. Cropland, primarily center pivot irrigated, occurs only occasionally in the valleys.

The North Loup River and its tributaries headwater in this region. The Snake River flows through the northern portion of the landscape. The landscape includes one of the Sandhill's largest wetland complexes. It is a prime area for nesting and migratory water birds and the wetlands support large populations of reptiles and amphibians. The area is unique in that its wet meadows support a large population of the federally and state threatened western prairie fringed orchid. The area is also habitat for several other federal and state listed species including the American burying beetle, bald eagle, and whooping crane. The area's numerous high quality streams support assemblages of rare fish including the pearl dace, the state and federally listed Topeka shiner and the state listed northern redbelly dace, blacknose shiner, and finescale dace. The Valentine National Wildlife Refuge and McKelvie National Forest are the largest protected areas in the landscape.

### **Stresses Affecting Species and Habitats**

- ❖ Wetland drainage, which can lead to lowered groundwater levels and stream channel downcutting.
- ❖ Exotic species invasion, primarily reed canary grass, smooth brome, phragmites, Garrison creeping foxtail, and purple loosestrife.
- ❖ Livestock grazing and haying practices that reduce native plant diversity and promote uniform habitat structure (e.g. season-long grazing, annual mid-summer haying).
- ❖ Lack of open sand habitats in upland dunes for the blowout penstemon due to lack of fire and present range management practices.
- ❖ Stream channelization and instream structures barring fish movement.
- ❖ Stocking of exotic and game fish in streams with rare fish species.

### **Conservation Strategies**

- ❖ Work with private landowners to develop and implement methods of forage utilization on wet meadows that don't require ditching of the meadows to facilitate haying.
- ❖ Restore the natural hydrology of wet meadows and other wetlands through ditch plugging and water control structures in wet meadows.
- ❖ Maintain the natural hydrology of Sandhills streams, which is necessary to sustain biological diversity and ecosystem function.

- ❖ Implement integrated noxious weed control strategies that do not negatively impact western prairie fringed orchid populations.
- ❖ Work with extension and agronomy groups to stop the promotion and planting of exotic forage grasses and forbs in Sandhill wet meadows.
- ❖ Implement ecologically friendly planned grazing systems on private lands.
- ❖ Improve implementation of biodiversity management, including increase use of prescribed fire and planned livestock grazing, on wildlife management areas in the landscape.
- ❖ Where feasible, create open sand habitats on public lands for the blowout penstemon through use of prescribed fire and heavy livestock grazing.
- ❖ Work with the USDA to promote moderate grazing of wetlands instead of fencing wetlands out from livestock grazing.
- ❖ Discontinue game fish stocking in streams with rare fish species.
- ❖ Ensure that stream structures allow for fish passage.

### **Tier 1 At-risk Species:**

#### **Plants:**

Wolf spikerush  
Blowout penstemon  
Western prairie fringed orchid

#### **Animals:**

American burying beetle  
Regal fritillary  
Plains topminnow  
Pearl dace  
Topeka shiner  
Northern redbelly dace  
Blacknose shiner  
Finescale dace  
Blanding's turtle  
Short-eared owl  
Burrowing owl  
Trumpeter swan  
Whooping crane  
Bald eagle  
Bell's vireo  
Long-billed curlew  
Greater prairie chicken

#### **Aquatic Communities:**

Alkaline Lake\*  
Freshwater Lake\*  
Headwater, Cold Water Stream\*  
Headwater, Warm Water Stream  
Mid-order, Warm Water Stream



Mid-order, Cold Water Stream

**Terrestrial Communities:**

Eastern Cottonwood-Willow Riparian Woodland  
 Sandbar Willow Shrubland  
 Riparian Dogwood-False Indigobush Shrubland  
 Spring Seep  
 Marsh Seep\*  
 Sandhills Fen\*  
 Sandhills Aquatic Wetland\*  
 Sandhills Freshwater Marsh\*  
 Perennial sandbar  
 Northern Sedge Wet Meadow\*  
 Northern Cordgrass Wet Prairie\*  
 Wet-mesic Tallgrass Prairie\*  
 Dry-mesic Sand Prairie\*  
 Sandhills Dune Prairie\*  
 Sandhills Dry Valley Prairie\*  
 Sandbar/Mudflat

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**Landscape Name: Dismal River Headwaters**

**Landscape Description**

This landscape occurs in Cherry, Grant, Arthur, McPherson, and Hooker counties in the west-central Sandhills. The area consists of high dunes with interdunal valleys. Many of the valleys have a high water table and support numerous lakes, marshes, wet meadows, and fens. Cropland, primarily center pivot irrigated, occurs only occasionally in the valleys and these are mainly center pivots.

The Middle Loup River and the North and South Forks of the Dismal rivers headwater in this region. The lakes and marshes of this landscape are a major nesting and migratory area for waterbirds. They also support large populations of reptiles and amphibians. This landscape includes populations of the federally and state endangered blowout penstemon. The only protected areas within the landscape are the Frye Lake and De Fair Lake WMAs.

**Stresses Affecting Species and Habitats**

- ❖ Wetland ditching, which can lead to lowered groundwater levels and stream channel downcutting.
- ❖ Exotic species invasion, primarily reed canary grass, smooth brome, phragmites, Garrison creeping foxtail, and purple loosestrife.
- ❖ Livestock grazing and haying practices that reduce native plant diversity and promote uniform habitat structure (e.g. season-long grazing, annual mid-summer haying).

- ❖ Lack of open sand habitats for the blowout penstemon due to lack of fire and present range management practices.

### **Conservation Strategies**

- ❖ Work with private landowners to develop and implement methods of forage utilization on wet meadows that don't require ditching of the meadows to facilitate haying.
- ❖ Restore the natural hydrology of wet meadows in the stream headwaters through ditch plugging and water control structures in wet meadows.
- ❖ Maintain the natural hydrology of Sandhills streams, which is necessary to sustain biological diversity and ecosystem function.
- ❖ Implement ecologically friendly planned grazing systems on private lands.
- ❖ Promote and implement diversified haying practices.
- ❖ Where feasible, create open sand habitats on public lands for the blowout penstemon through use of prescribed fire and heavy livestock grazing.
- ❖ Work with the USDA to promote moderate grazing of wetlands instead of fencing wetlands out from livestock grazing.
- ❖ Ensure that stream structures allow for fish passage.

### **Tier 1 At-risk Species:**

#### **Plants:**

Blowout penstemon

#### **Animals:**

Pearl dace

Northern redbelly dace

Finescale dace

Blanding's turtle

Trumpeter swan

Long-billed curlew

#### **Aquatic Communities:**

Freshwater Lake\*

Alkaline Lake\*

Headwater, Cold Water Stream\*

Headwater, Warm Water Stream

Mid-order, Warm Water River

Mid-order, Cold Water River

#### **Terrestrial Communities:**

Eastern Cottonwood-Willow Riparian Woodland

Sandbar Willow Shrubland

Riparian Dogwood-False Indigobush Shrubland

Spring Seep

Marsh Seep

Sandhills Fen\*  
 Sandhills Aquatic Wetland\*  
 Sandhills Freshwater Marsh\*  
 Perennial sandbar  
 Northern Sedge Wet Meadow\*  
 Northern Cordgrass Wet Prairie\*  
 Wet-mesic Tallgrass Prairie  
 Sandhills Dune Prairie  
 Sandhills Dry Valley Prairie  
 Sandbar/Mudflat

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## **Landscape Name: Elkhorn River Headwaters**

### **Landscape Description**

This landscape occurs in the northeastern Sandhills and includes large areas of Brown, Rock, Holt, Garfield, and Wheeler counties. The area consists mainly of level sand plain with a regionally high water table and occupied by wet meadows. Rolling sand dunes are found in areas and Sandhill marshes and lakes are scattered through the region. Center pivot cropfields are common in areas.

The South Fork and North Fork of the Elkhorn river headwater in this region. The landscape includes one of the Sandhills' largest wetland complexes. The area is unique in that its wet meadows support the states largest populations of the federally and state threatened western prairie fringed orchid. The area is also habitat for several other federal and state listed species including the small white lady's-slipper orchid, American burying beetle, bald eagle, and whooping crane. The area is also important for waterfowl and other waterbird production. Protected areas within the landscape include several wildlife management areas, including Goose Lake, South Pine Swan Lake and Dry Creek WMAs.

### **Stresses Affecting Species and Habitats**

- ❖ Center pivot irrigation development.
- ❖ Reduced groundwater levels from irrigation.
- ❖ Ditching of meadows and marshes which can lower groundwater levels and lead to stream channel downcutting.
- ❖ Exotic plant invasion, primary species of concern are reed canary grass, phragmites, smooth brome, Garrison creeping foxtail, and leafy spurge.
- ❖ Annual mid-summer haying of meadows.
- ❖ Herbicide application in meadows to control leafy spurge is a threat to western prairie fringed orchid population.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.

## **Conservation Strategies**

- ❖ Work with private landowners to seek methods of production on meadows that would not require ditching and stream channelization as methods to increase hay production.
- ❖ Restore the natural hydrology of wet meadows through ditch plugging and water control structures.
- ❖ Maintain the natural hydrology of Sandhills streams, which is necessary to sustain biological diversity and ecosystem function.
- ❖ Promote and implement conservation strategies that diversify management away from mid-summer annual haying of meadows.
- ❖ Implement integrated noxious weed control strategies that do not negatively impact western prairie fringed orchid populations.
- ❖ Work with extension and agronomy groups to stop the promotion and planting of exotic forage grasses in Sandhill wet meadows.
- ❖ Work with the USDA to promote moderate grazing of wetlands instead of fencing wetlands out from livestock grazing.
- ❖ Discontinue game fish stocking in streams with rare fish species.
- ❖ Ensure that stream structures allow for fish passage.

## **Tier 1 At-risk Species:**

### **Plants:**

Small white lady's-slipper  
Wolf spikerush  
Western prairie fringed orchid

### **Animals:**

American burying beetle  
Blanding's turtle  
Plains topminnow  
Trumpeter swan  
Whooping crane  
Bald eagle

### **Aquatic Communities:**

Freshwater Lake\*  
Headwater, Warm Water Stream  
Mid-order, Warm Water Stream

### **Terrestrial Communities:**

Eastern Cottonwood-Willow Riparian Woodland  
Sandbar Willow Shrubland  
Riparian Dogwood-False Indigobush Shrubland  
Spring Seep

Marsh Seep  
 Sandhills Aquatic Wetland\*  
 Sandhills Freshwater Marsh\*  
 Perennial sandbar  
 Northern Sedge Wet Meadow\*  
 Northern Cordgrass Wet Prairie\*  
 Wet-mesic Tallgrass Prairie\*  
 Dry-mesic Sand Prairie\*  
 Sandhills Dune Prairie  
 Sandhills Dry Valley Prairie  
 Sandbar/Mudflat

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## **Landscape Name: Middle Niobrara River Valley**

### **Landscape Description**

The middle Niobrara River valley is a 76-mile reach of the river in Cherry, Keya Paha, Rock, and Brown counties. This river reach has been designated as a National Wild and Scenic River and is often referred to as the biological crossroads of the Midwest. The middle Niobrara River valley is deeply incised, and is the intersection of five diverse plant communities: northern mixed-grass prairie, Sandhills prairie, Rocky Mountain pine woodland, northern paper birch woodland, and eastern deciduous woodland. The valley, with its diverse mix of plant communities, is home to an incredible diversity of native animal and plant species, including many glacial relict species. The Nature Conservancy's 56,000 acre Niobrara Valley Preserve alone contains 581 species of plants, 213 birds, 86 lichens, 44 mammals, 25 fish, 17 reptiles, and 8 amphibians. The middle Niobrara River valley also provides habitat for many at-risk species including whooping crane, bald eagle, piping plover, interior least tern, and Bailey's eastern woodrat, a subspecies endemic to the valley. The primary protected areas within the landscape include The Nature Conservancy's Niobrara Valley Preserve, Ft. Niobrara National Wildlife Refuge and several state wildlife management areas and state recreation areas.

### **Stresses Affecting Species and Habitats**

- ❖ Development including homes, cabins, ranchettes, roads, and recreational facilities.
- ❖ Interruption of the natural fire regime leading to increase tree densities, primarily eastern red cedar and ponderosa pine, excess litter accumulation and exotic plant invasion in the valley.
- ❖ Invasive plants in stream channel, wetlands, woodlands, and grasslands, primary species of concern include reed canary grass, purple loosestrife, leafy spurge, and smooth brome.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Upstream dams and water diversion.

## **Conservation Strategies**

- ❖ Increase tree thinning and use of prescribed fire in the valley on private and public lands.
- ❖ Use of conservation easements or voluntary fee title acquisition to protect key habitats within the valley from development
- ❖ Work with local government agencies to implement zoning in the valley to limit development.
- ❖ Promote the use of conservation buyers in the valley.
- ❖ Conduct integrated weed control efforts to control invasive species.
- ❖ Implement appropriate grazing strategies on private lands.
- ❖ Educate the public regarding methods to reduce impacts to wildlife.

## **Tier 1 At-risk Species:**

### **Plants:**

Small white lady's-slipper orchid

### **Animals:**

Iowa skipper  
Regal fritillary  
Ottoe Skipper  
Piping plover  
Interior least tern  
Whooping crane  
Bell's vireo  
Bald eagle

### **Aquatic Communities:**

Headwater, Cold Water Stream\*  
Headwater, Warm Water Stream  
Mid-order, Warm Water River\*

### **Terrestrial Communities:**

Ponderosa Pine Forest  
Bur Oak-Basswood-Ironwood Forest\*  
Paper Birch Springbranch Canyon Forest\*  
Western Riparian Woodland  
Oak Woodland\*  
Ponderosa Pine Woodland\*  
Sandbar Willow Shrubland  
Riparian Dogwood-False Indigobush Shrubland  
Sumac-Dogwood Shrubland  
Spring Seep\*  
Freshwater Marsh\*  
Northern Sedge Wet Meadow  
Northern Cordgrass Wet Prairie

Perennial Sandbar\*  
Sandhills Dune Prairie  
Sandhills Dry Valley Prairie  
Dry-mesic Sand Prairie  
Wet-mesic Tallgrass Prairie  
Tallgrass Prairie  
Western Mixedgrass Prairie  
Northern Sand/Gravel Prairie\*  
Sandbar/Mudflat\*

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## **Landscape Name: Sandhills Alkaline Lakes**

### **Landscape Description**

This landscape occurs in Sheridan, Morrill, and Garden counties in the western Sandhills. The area consists of high dunes with interdunal valleys. Many of the valleys have a high water table and contain numerous lakes, marshes, and wet meadows. The area has a poorly developed drainage system and many of wetlands and lakes in the region are alkaline.

This area is unique in that the largest concentration of alkaline wetlands and lakes in the state occur here. The wetlands are important nesting and migratory habitat for shorebirds and other water birds, including avocets and black-necked stilts. This landscape includes the largest populations of the federally and state endangered blowout penstemon in the state. The Crescent Lake National Wildlife Refuge occurs in this landscape, as well as, The Nature Conservancy's Graves Ranch Preserve.

### **Stresses Affecting Species and Habitats**

- ❖ Wetland ditching, which can lead to reduced groundwater levels and stream channel downcutting.
- ❖ Exotic species invasion, primarily reed canary grass, smooth brome, phragmites, Garrison creeping foxtail, and purple loosestrife.
- ❖ Annual mid-summer haying of meadows.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Lack of open sand habitats for the blowout penstemon due to lack of fire and grazing methods.
- ❖ Lack of fire.
- ❖ Conversion of prairie to cropland.

### **Conservation Strategies**

- ❖ Work with private landowners to develop and implement methods of forage utilization on wet meadows that don't require ditching of the meadows to facilitate haying.

- ❖ Work with extension and agronomy groups to stop the promotion and planting exotic forage grasses in Sandhill wet meadows.
- ❖ Implement ecologically friendly planned grazing systems on private lands.
- ❖ Where feasible, create open sand habitats on protected lands for the blowout penstemon through use of prescribed fire and heavy livestock grazing.
- ❖ Increase management of wetlands as shorebird habitat.
- ❖ Restore the natural hydrology of wet meadows through ditch plugging and water control structures.
- ❖ Maintain the natural hydrology of Sandhills streams, which is necessary to sustain biological diversity and ecosystem function.
- ❖ Promote and implement conservation strategies that diversify management away from mid-summer annual haying of meadows.

### **Tier 1 At-risk Species:**

#### **Plants:**

Blowout penstemon

#### **Animals:**

Short-eared owl

Burrowing owl

Trumpeter swan

Bald eagle

Bell's vireo

Long-billed curlew

Swift Fox

Blanding's turtle

#### **Aquatic Communities:**

Alkaline Lake\*

Freshwater Lake\*

Headwater, warm water stream

Mid-order, warm water river

#### **Terrestrial Communities:**

Spring Seep\*

Sandhills Aquatic Wetland\*

Sandhills Freshwater Marsh\*

Western Alkaline Marsh\*

Northern Sedge Wet Meadow

Northern Cordgrass Wet Prairie

Western Alkaline Meadow\*

Wet-mesic Tallgrass Prairie

Sandhills Dune Prairie\*

Sandhills Dry Valley Prairie\*

Sandsage Prairie\*



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## **Landscape Name: Snake River**

### **Landscape Description**

This landscape includes the upper reaches of the Snake River from the western end of Merritt Reservoir westward to the stream's headwaters. The landscape includes the river channel and a two-mile buffer on each side of the river. The Snake River begins as a small spring-fed stream flowing through Sandhills meadows. As the stream gains flow its valley becomes deeply incised. The upper Snake River is a coldwater stream with a narrow channel that maintains a near constant flow rate throughout the year due to its spring-fed nature.

The valley is open and occupied by wet meadows in the upper reaches. The valley sides in the lower reaches are occupied by ponderosa pine woodland and Sandhills dune prairie. There are also some streamside marshes.

The upper reach of the Snake River is one of the most pristine coldwater streams in Nebraska. It supports an important assemblage of rare fish including the plains topminnow, pearl dace, northern redbelly dace, and finescale dace. Merritt Dam on the lower Snake River blocks fish movement into the upper reaches. There are no protected areas in this landscape.

### **Stresses Affecting Species and Habitats**

- ❖ Ditching and channel straightening in the upper reaches that lead to stream downcutting and lowered groundwater levels.
- ❖ Stocking trout and other game fish into streams with rare fish species.
- ❖ Golf course and housing development.
- ❖ Invasive species invasion in the stream channels, marshes, and meadows. Primary species of concern are reed canary grass, purple loosestrife, phragmites, smooth brome, and Garrison creeping foxtail.
- ❖ Grazing and haying practices that reduce native plant diversity and promote uniform habitat structure.

### **Conservation Strategies**

- ❖ Work with private landowners to seek methods of production on meadows that would not require ditching and stream channelization as methods to increase hay production.
- ❖ Restore the natural hydrology of wet meadows through ditch plugging and water control structures.
- ❖ Maintain the natural hydrology of Sandhills streams that is necessary to sustain biological diversity and ecosystem function.
- ❖ Protect key stretches of the Snake River through conservation easements.
- ❖ Implement innovative grazing and haying systems on private lands.
- ❖ Discontinue game fish stocking in streams with rare fish species.

**Tier 1 At-risk Species:**

**Plants:**

None

**Animals:**

Plains topminnow

Pearl dace

Finescale dace

Northern redbelly dace

Trumpeter swan

**Aquatic Communities:**

Headwater, Cold Water Stream\*

**Terrestrial Communities:**

Juniper Woodland

Sandbar Willow Shrubland

Spring Seep

Sandhills Freshwater Marsh

Northern Sedge Wet Meadow\*

Northern Cordgrass Wet Prairie\*

Wet-mesic Tallgrass Prairie

Dry-mesic Sand Prairie

Sandhills Dune Prairie

Sandhills Dry Valley Prairie

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**Landscape Name: Upper Loup Rivers and Tributaries**

**Landscape Description**

This landscape includes the upper reaches of the Middle Loup, Dismal, North Loup and Calamus rivers from their headwaters in the central Sandhills southeastward to where the rivers enter the loess hills. The landscape includes the river channels and a two-mile buffer on each side of the channels. These rivers start as spring-fed streams in Sandhills meadows. They gain flow throughout their journey and most are meandering streams that have cut deep valleys beyond their headwaters. In their upper reaches the stream have a narrow channel, but they become more braided in their lower reaches. The valley bottoms are occupied by wet meadows with some cottonwood woodlands, marshes and isolated cropland. The bluffs are mainly covered with Sandhills dune prairie. The steep bluffs of the North Fork and the South Fork of the Dismals rivers support eastern red cedar woodland in areas.

The flows of these streams are nearly constant throughout the year due to consistent groundwater seepage. The dam on the Calamus River, which forms the Calamus Reservoir, is the only mainstem dam on the rivers in this region. Downstream diversions on the Loup rivers within the loess hills block fish movement upstream. The rivers have been fairly extensively ditched in their upper reaches where they flow through Sandhill meadows. Many small, colder-water tributary streams flow into these rivers.

The upper reaches of these rivers and some of their tributaries are significant in that they support assemblages of rare fish, including the Topeka shiner, blacknose shiner, and finescale dace. The federally and state endangered whooping cranes uses wider, braided reaches of the stream channels and associated meadows as migratory stopover habitat. The federally and state threatened western prairie fringed orchid occurs in wet meadows within the valleys. The American burying beetle is found within this landscape. Protected areas within the landscape include portions of the Nebraska National Forest and a few smaller wildlife management areas.

### **Stresses Affecting Species and Habitats**

- ❖ Ditching and channel straightening in the upper stream reaches that often lead to channel degradation and reduced groundwater levels.
- ❖ Dam building and water diversion on the rivers.
- ❖ Groundwater depletion from irrigation resulting in reduced stream flows.
- ❖ Golf course and housing development in areas.
- ❖ Invasive species encroachment in the stream channels, marshes, meadows and woodlands. Primary species of concern are reed canary grass, purple loosestrife, phragmites, smooth brome, Garrison creeping foxtail, eastern red cedar, and Russian olive.
- ❖ Grazing and haying practices that reduce native plant diversity and promote uniform habitat structure.

### **Conservation Strategies**

- ❖ Work with private landowners to seek methods of production on meadows that would not require ditching and stream channelization to drain the meadows for haying.
- ❖ Restore the natural hydrology of wet meadows, fens, and smaller streams through ditch plugging and water control structures.
- ❖ Maintain the natural hydrology of Sandhills streams, which is necessary to sustain biological diversity and ecosystem function.
- ❖ Use conservation easements to protect key stretches of the rivers.
- ❖ Implement innovative grazing and haying systems on private lands.
- ❖ Implement invasive tree cutting programs on private lands.
- ❖ Prevent stocking of exotic and game fish into streams with rare fish species.
- ❖ Ensure that stream structures allow for fish passage.
- ❖ Removal of human-made, in-stream structures that are no longer used and that form barriers to species movement (e.g. water diversion structures).

## **Tier 1 At-risk Species**

### **Plants:**

Blowout penstemon  
Western prairie fringed orchid  
Wolf spikerush

### **Animals:**

Regal fritillary  
American burying beetle  
Blanding's turtle  
Plains topminnow  
Topeka shiner  
Blacknose shiner  
Pearl dace  
Finescale dace  
Northern redbelly dace  
River otter  
Whooping crane  
Bald eagle  
Long-billed curlew  
Bell's vireo  
Piping plover  
Trumpeter swan  
Long-billed curlew

### **Aquatic Communities:**

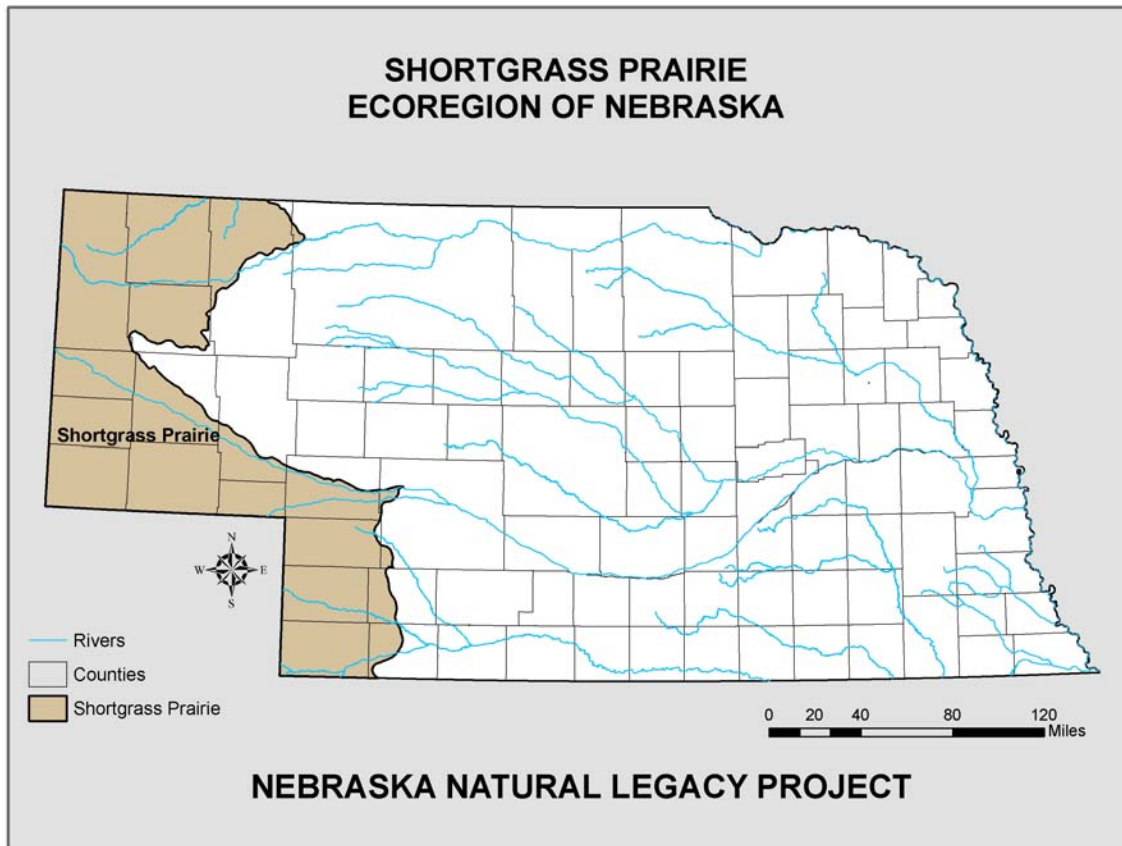
Headwater, cold water stream  
Headwater, warm water stream\*  
Mid-order, warm water river\*

### **Terrestrial Communities:**

Eastern Cottonwood-Willow Riparian Woodland\*  
Diamond Willow Woodland\*  
Juniper Woodland\*  
Sandbar Willow Shrubland  
Riparian Dogwood-False Indigobush Shrubland  
Sumac-Dogwood Shrubland  
Spring Seep  
Marsh Seep\*  
Sandhills Fen\*  
Sandhills Aquatic Wetland  
Sandhills Freshwater Marsh  
Perennial Sandbar\*  
Northern Sedge Wet Meadow\*  
Northern Cordgrass Wet Prairie\*

Wet-mesic Tallgrass Prairie  
Dry-mesic Sand Prairie  
Sandhills Dune Prairie  
Sandhills Dry Valley Prairie  
Sandbar/Mudflat\*

## CHAPTER 8: SHORTGRASS PRAIRIE ECOREGION



### INTRODUCTION

Western Nebraska is generally referred to as the shortgrass prairie ecoregion of the state and contains a surprisingly high diversity of habitats. This ecoregion includes shortgrass, mixedgrass, and sandsage prairie types, sparsely vegetated badlands, western coniferous forest, and playa wetlands. The region features dramatic changes in elevation and topography over relatively short distances, with soils ranging from sandy to clay-loam, to hard sandstone. The region contains a greater variety of exposed soil types than any other area of the state, with older paleo-soils that have not experienced any recent disturbance from glaciation. Annual rainfall ranges from 12-17 inches and the annual average temperature ranges from 47-50 degrees Fahrenheit. Humidity is generally low in the ecoregion.

Shortgrass prairie in its truest form is most common in the southern panhandle in Banner, Cheyenne, Deuel, and Kimball counties. Mixedgrass prairie finds its way into the ecoregion in the southeast and includes a distinct shortgrass prairie type known as sandsage prairie. Scottsbluff and Morrill Counties include the Wildcat Hills bluff formation that is dominated by mixedgrass prairie and Ponderosa Pine woodlands.

The North Platte River bisects the ecoregion and includes many tributaries, wet meadows, and deciduous woodlands. Relic Sandhill prairie extends through Morrill and Sioux Counties,

complete with the rolling topography and mixedgrass vegetation typical of interior Sandhills. Farther north a mosaic of shortgrass and mixedgrass prairies merge until it meets the Pine Ridge in northern Dawes, Sheridan and Sioux Counties. North of this rocky ridge of Ponderosa Pine, shale mixedgrass and badlands prairies extend to the border of South Dakota.

In addition to the North Platte, other small river systems in the panhandle include Lodgepole Creek in the southern panhandle and the Upper Niobrara and White Rivers in the north. Five large reservoirs and a number of smaller artificial lakes provide habitat for fish, amphibians, invertebrates, and birds. Naturally occurring playas found throughout the ecoregion (particularly the south), are generally only wet during periods of heavy or sustained rains and provide significant habitat when conditions are favorable. Similarly, the region contains a number of small creeks, which may or may not be wet year-round, with associated wet meadows and springs.

## **Vegetation**

Two distinct prairie types occur in the ecoregion: shortgrass and mixed grass. Shortgrass prairie communities are dominated by short statured grasses such as buffalograss, blue grama, side-oats grama, and purple threeawn. More than 100 species of forbs including milkvetches, scarlet guara, cutleaf ironplant, spine-fruit prickly pear, purple locoweed, slender-flower scurfpea, prairie coneflower, and scarlet globe mallow can be found interspersed with grasses. The low precipitation in the shortgrass prairie ecoregion, in conjunction with grazing causes, most shortgrass vegetation to rarely exceed 10 inches in height.

Mixedgrass prairie in the ecoregion is typically dominated by blue grama, prairie sandreed, threadleaf sedge, needle-and-thread grass, little bluestem, and western wheatgrass. Grass height can reach 18-24 inches in height but is often shorter in this ecoregion due to local management and precipitation. Shrubs found in mixedgrass prairies include skunkbush sumac, winterfat, fringed sage, snowberry, yucca, and broom snakeweed. More than 100 species of forbs can be found including scarlet guara, dotted gayfeather, skeletonplant, cutleaf ironplant, lemon scurfpea, and scarlet globe mallow.

Within the mixedgrass prairie type there are two unique communities. The northwestern mixedgrass prairie tends to be dominated by western wheatgrass and blue grama, and may include big sagebrush, silver sagebrush, rubber rabbitbrush, greasewood, and yucca. The (western) loess mixedgrass prairie is dominated by typical shortgrass prairie species if grazed intensely, but on slopes or lightly grazed areas taller grasses like little and big bluestem, switchgrass, and sideoats grama become more common. Leadplant and sandsage are the most common shrubs, where eastern red cedar has not invaded. Common forbs include western ragweed, fringed sage, prairie coneflower, scarlet globe mallow, scarlet guara, broom snakeweed, and others.

The sandhills dune prairie and sandsage prairie (Sandhills borders prairie) is recognized mainly by the high proportion of sandsage but also includes sand bluestem, blue grama, prairie sandreed, needle-and-thread, and yucca. Forbs in this community include sand-lily, desert goosefoot, plains sunflower, bush morning-glory, and showy ipomopsis. Sandhills prairie is dominated by prairie sandreed, hairy grama, and sunsedge, and shrubs include leadplant, dwarf prairie rose, western poison ivy, and yucca. Forbs include stiff sunflower, bush morning glory, plains

gayfeather, brittle prickly pear, hairy puccoon, desert goosefoot, winged pigweed, field snake cotton, etc. Sandage prairie in the southern part of the ecoregion is dominated by prairie sandreed and needle-and-thread, shrubs such as sandsage and yucca, and forbs that are similar to those found in the sandhills community.

Western alkaline meadows along the North Platte are characterized by inland saltgrass, alkali sacaton, clustered field sedge, foxtail barley, and meadow bluegrass. Forbs include spearscale, alkali aster, viscid camphor-daisy, and thelypod. Ponderosa pine woodlands are dominated by ponderosa pine, but may have inclusions of quaking aspen and a green ash subcanopy. Saskatoon serviceberry, chokecherry, dwarf juniper, fragrant sumac, mountain mahogany, and wolfberry are common shrubs. Kentucky bluegrass and littleseed ricegrass may be found in the sparse herbaceous layer.

Riparian woodlands are dominated by an open canopy of tall cottonwoods and shorter peachleaf willows. The subcanopy may include green ash, box-elder, Russian olive, and junipers. Sandbar willow is a common shrub, but wild plum, chokecherry and buffaloberry are also present on higher terraces and banks. The herbaceous layer is sparse and may include field horsetail, Emory's sedge, woolly sedge, marsh muhly, and prairie cordgrass.

Badlands are mainly unvegetated eroded areas sparsely covered by low shrubs such as saltbush and rubber rabbitbrush and a scant cover of forbs such as silver orache, poverty weed, and Russian thistle. Occasionally mixedgrass prairie grasses may also be found. Similar to badlands are the interspersed rock outcrops across the rugged terrain of the panhandle. Here the dominant shrub is typically skunkbush sumac, with herbaceous vegetation made up of blue grama and thickspike wheatgrass or few-flower buckwheat and Hood's phlox.

## **Animals**

More than 300 species of resident and migratory birds have been recorded in the shortgrass prairie ecoregion. Common shortgrass prairie species include McCown's and Chestnut-collared longspurs, Brewer's sparrow, horned lark, burrowing owl and the state threatened mountain plover. Species commonly found in the mixedgrass prairie community include western meadowlark, grasshopper sparrow, and lark bunting. The pine ridge region includes many forest species such as Lewis' woodpecker, pygmy nuthatch, ovenbird, and mountain bluebird. The region's wetlands support many species of waterfowl including Canada goose, mallard, and northern pintail, and shorebirds such as western sandpiper, and greater yellowlegs.

A variety of mammals are known to occur in the ecoregion. Ungulates include both white-tailed and mule deer, elk, pronghorn, and bighorn sheep. Coyotes and bobcats are the most common large predator but in recent years mountain lions have also been recorded in the panhandle. The ecoregion serves as one of the remaining strongholds for the diminutive swift fox, a state endangered species. Prairie dogs are locally abundant and the federally endangered black-footed ferret was once present in the ecoregion. Other mammals include the river otter, black-tailed jackrabbit, badger, plains pocket gopher, and grasshopper mouse.

The aquatic habitats of Nebraska's Panhandle support numerous species of fish. The region's lakes and reservoirs have been stocked with gamefish such as walleye, largemouth bass, white bass and bluegill. River-associated species include channel catfish, river carpsucker, the state-



threatened finescale dace, state-endangered blacknose shiner, shovelnose sturgeon, western silvery minnow, plains minnow, suckermouth minnow, flathead chub, blacknose dace, plains topminnow, and Iowa, Johnny, and orange-throat darters. Brown trout and rainbow trout have been stocked in cold water streams in the ecoregion.

Many species of amphibians and reptiles are known to occur in the shortgrass prairie ecoregion. Amphibians include western striped chorus frog and Woodhouse's toad. Reptiles include bullsnake, prairie rattlesnake, lesser earless lizard, short horned lizard, ornate box turtle, and painted turtle.

## **DOMINANT LAND USE AND HISTORY**

The first known use of the shortgrass ecoregion by humans was by Pawnee and Otoe Indians who built earth lodges in the North Platte River Valley. Later, nomadic tribes of Pawnee, Sioux and Northern Cheyenne traversed the region hunting the great herds of bison and other game. The earliest Europeans in the region were likely explorers who ventured into the southeastern corner of the ecoregion with Coronado in the 1500's. The Oregon and Mormon Trails, which crossed the region, carried thousands of settlers westward during the western expansion of the 1840's and 1850's. Relatively few individuals settled in the ecoregion during this time.

The Homestead Act of 1864 spurred settlement by providing 160 acres to homesteaders who could improve their land claim within five years. An additional 160 acres could be acquired if a sufficient number of trees were planted on the claim site. Completion of the transcontinental railroad brought an increasing number of settlers to this part of Nebraska in the late 1860s. Tracts of grassland as far as the eye could see were very enticing to cattlemen. Vast ranches were established, primarily on public land. Cattle thrived on the short, warm-season grasses such as buffalo grass and blue grama which were rich in protein even after dormancy. The Kincaid Act of 1904 allowed homesteaders to increase their land claim to 640 acres, making farming the dry prairies less risky. Section-sized farms started springing up and large ranchers who formerly ran cattle freely across the open plains, faced new difficulties.

The Reclamation Act of 1902 proved to be the impetus for irrigating the arid lands and encouraging crop production in the ecoregion. A few farmers along the Owl and Winter Creeks dug canals by hand to bring river water to their crops in 1887. Canal associations soon followed allowing accelerated development of irrigation systems. By 1909 enough sugar beets were being produced to support the first sugar factory. At the height of sugar beet production there were five factories in the Scottsbluff area.

Land that was located too far from irrigation canals started growing winter wheat. This crop did very well with limited rainfall, especially under a summer fallowing rotation (resting the land every other year and cultivating vegetation to preserve subsoil moisture). Another prominent crop of the region was dry beans. The first 100 acres of dry beans was planted in 1927. In subsequent years the area became one of the major dry edible bean producing regions of the nation.

During the 1920's the short grass prairie region saw dramatic changes as large areas of prairie were converted to crop fields. Nineteen twenty-nine marked the first year of a seven year drought. Below average precipitation combined with high temperatures and driving winds

created the worst drought in the region's history. During the height of the dust bowl years, lights had to be used during the day in order to see. The drought coupled with the nation's economic depression left many farmers and ranchers in the region in economic ruin.

The 1940's saw a recovery for farming in the ecoregion and many farms and ranches once again prospered. Improvements in farming efficiency in the 1950's through 1960's lead to dramatic increases in crop production. The wide-scale use of center pivot irrigation systems in the 1970's and 1980's brought previously unirrigated land into crop production. In the late 1990's severe drought returned to the area and the amount of land under cultivation began to decline. Moratoriums on new groundwater development were put in place to help safeguard depleted water resources. No-till farming and dry land friendly crops like sunflowers received wider acceptance during the late 1990's.

Currently almost 87 % of the land in the northwest portion of the ecoregion is in grass and used for grazing and nearly 88 % of the land in the southeast part of the ecoregion is under crop production. Of the 5.6 million acres of land in the short-grass prairie region, 2.28 million acres is used as cropland, half of which is irrigated. Approximately 2.75 million acres are in grassland and used principally for grazing. A very small portion of the ecoregion is in native woodlands.

The Conservation Reserve Program (CRP) and the Conservation Reserve Enhancement Program (CREP) have taken tens of thousands of acres cropland out of production and returned it to grassland. Due to declining groundwater and surface water resources in the ecoregion, many CRP and CREP lands will likely remain in grassland even after contracts expire.

The current trend is towards fewer but larger farms and ranches in the ecoregion. This trend is being driven by economics and a loss of residents in rural areas to more populated towns and cities. Many landowners have concerns about future land acquisitions for public use and its impact on sustaining a ranching tradition. The northern portion of the panhandle has a much higher percentage of land area in public ownership than in other parts of the state. Recent efforts to promote agritourism in the region are being done in part to increase economic prosperity. Promoting the region's biological diversity and unique landscape could likewise lead to increased economic sustainability.

## **NATURE-BASED RECREATION**

The short-grass prairie ecoregion has a wealth of natural amenities. The region is a well-known destination for the natural history enthusiast, hunters and anglers, hikers, and the casual visitor interested in varied scenery. Six of the top ten tourist attractions in Nebraska are found in the shortgrass prairie ecoregion and all are at based at least in part on natural amenities. Tourism is the second largest industry in the panhandle, generating \$40 million in retail dollars in Scotts Bluff County alone.

The ecoregion is home to Lake McConaughy, the largest reservoir in the state and a well-known destination for anglers, bird watchers, hunters, and campers. The reservoir supports trophy sized striped bass and walleye and the adjacent Lake Ogallala is one of the best rainbow trout fisheries in the Great Plains. Over 340 species of birds have been observed at Lake McConaughy, more than any other site in Nebraska. Several hundred eagles can be seen during the winter from a heated eagle viewing facility below the dam.

Nebraska's pine ridge region offers some of the most scenic vistas in the state. The 22,000-acre Fort Robinson State Park provides opportunities to observe bighorn sheep and pronghorn. A small but growing elk herd in the pine ridge entertains both hunters and wildlife viewers. Anglers can enjoy quality trout fishing in the area's coldwater springs and turkey and deer hunting opportunities abound. Fort Robinson offers different trail types, including equestrian trails. In addition to Fort Robinson and Chadron State Parks, numerous state wildlife management areas, the National Forest and Soldier Creek Wilderness also occur on Pine Ridge. Oglala National Grassland and Toadstool Geologic Park, both administered by the U.S. Forest Service are located north of Pine Ridge and provide their own unique habitats and outdoor recreation opportunities.

A second bighorn sheep herd was recently established in the wildcat hills. The Wildcat Hills Nature Center is the region's leading environmental education center. A variety of programs are offered to adults and children about the region's unique flora and fauna and a trail system accommodates wildlife viewers. The nearby Scotts Bluff National Monument has a three mile scenic trail that leads to the summit of the monument. There are currently plans for a 26 mile network of trails and greenways that generally follow the North Platte and plan to link Scottsbluff and Gering with Scotts Bluff National Monument.

Although the sandsage prairie is less well known for nature-based recreation, it provides quality hunting and birdwatching opportunities. The true mixedgrass prairie in the southwest corner of the Panhandle provides one of the most reliable opportunities to observe the state threatened mountain plover. Economic development in the ecoregion is becoming ever more entwined with the natural amenities of the area. Declining rural populations and diminished agricultural opportunities are changing the make-up of the ecoregion. Nature-based recreation is providing renewed hope and opportunities in the shortgrass prairie ecoregion.

The principal challenge to expanding and conserving nature-based recreational resources in the ecoregion is involving a larger and more diverse cross-section of the region's residents in nature-based recreation activities. Key individuals from the business, economic development, and agricultural sectors should be involved in planning, promotion, and development of the ecotourism trade. There is no centralized clearinghouse of wildlife viewing-related information and a significant lack of wildlife viewing infrastructure in the ecoregion. Although there are many quality opportunities for nature-based recreation, access points are limited or obscured, interpretive information is lacking, and promotion of viewing opportunities is limited. A greater number of individuals who are knowledgeable about wildlife viewing are needed to help inform community leaders and the public about the ecoregion's wildlife viewing potential.

## **EDUCATION**

Environmental education has long been viewed as a critical element of conservation in the shortgrass prairie ecoregion. Efforts to bring wildlife education into the classroom have been ongoing for several decades. Educational Service Unit #13 in Scotts Bluff has been a model for working collaboratively with agencies and private organizations to facilitate environmental education in the region's schools. The Wildcat Hills Nature Center in Gering was built to help students and adults learn about the natural history of the area. Nearly half of the Panhandle's 64 schools are class I elementary only districts (<10 students/grade). Small classroom size affords great opportunities for student-centered learning but often requires that a larger number of

individuals be trained in environmental education. Rural schools sometimes have more space available for outdoor classrooms or may even be located close to natural areas that can be used for field trips.

The region's larger schools are experiencing increases in enrollment and are becoming more ethnically diverse. Constraints on teachers to meet new and existing curriculum requirements sometimes leaves little additional time to devote to important disciplines such as environmental education. Understanding and addressing cultural differences in environmental education programming is also important. Schools surveyed in the ecoregion indicated that interest in wildlife education is high and nearly all schools incorporate wildlife themes in the classroom at least several times each year.

Currently, resource professionals are stretched too thin to adequately meet the demand for environmental education in the region. Although many teachers are interested in the environment, they often lack the training or resources to effectively teach about the region's biological diversity. Environmental educators in the ecoregion often are not able to travel to Lincoln, Omaha or other urban centers in eastern Nebraska to network with other professionals and participate in training.

There are a number of environmental education programs that take place in the ecoregion each year. These include but are not limited to "Since then Water Wonders", "Branch Out", "Zoo Quest", and "Environ-Art". The Riverside Zoo in Scotts Bluff reaches more than 10,000 children and adults each year and zoo staff conduct teacher training in environmental education. Rocky Mountain Bird Observatory conducts landowner workshops and participates in environmental education programs on birds. Chadron State College recently began offering course work in wildlife ecology for college-level students.

Despite the rich natural heritage of the ecoregion, there is often a lack of understanding and awareness of the ecoregion's biological diversity by its residents. In addition, ranchers and farmers often have a unique understanding and experiences about wildlife and are usually willing to share their knowledge. Increased collaboration amongst environmental educators, resource professionals, teachers, farmers and ranchers, and community leaders could lead to increased understanding of various viewpoints and increase education capacity.

## **PARTNERSHIPS**

- ❖ In 2001, **Nebraska Prairie Partners** was formed in cooperation with the Rocky Mountain Bird Observatory (RMBO) and Nebraska Game and Parks Commission (NGPC). They recognized a need for biological information and landowner outreach in western Nebraska in order to facilitate bird conservation in the region. RMBO had expertise on regional prairie bird conservation, field monitoring, and landowner outreach. NGPC had local infrastructure, funding, and a proven private lands incentive program. The purpose of this project was to implement grassland bird monitoring and research and provide outreach and technical expertise to private landowners. Monitoring currently takes place on 450 sections of land for common prairie birds, and another 450 sites for various species of special conservation concern. Target species include: Burrowing owl, Ferruginous Hawk, and Mountain Plover. Approximately 350 private landowners have been involved in the program thus far. The

Nebraska Shortgrass Prairie Partnership was started in 2003 and is designed to conserve and enhance shortgrass prairie habitat on private lands by offering technical assistance and financial incentives. Both projects are supported by grants from the Nebraska Game and Parks Commission, U.S. Fish and Wildlife Service, the Nebraska Environmental Trust, and Playa Lakes Joint Venture. For more information, visit: [www.rmbo.org](http://www.rmbo.org).

- ❖ The **Platte River Basin Environments, Inc. (PRBE)** was organized officially in 1991. This organization seeks to acquire and manage Platte River and other important habitats in the shortgrass prairie ecoregion. Led by avid sportsmen and conservation enthusiasts its members also have expertise in hydrology, geology, range management, and wildlife biology. Since its formation, PRBE board members have secured over \$3 million dollars in grants and donations. Major grants and gifts have come from the Nebraska Environmental Trust, North American Wetlands Conservation Act, Oregon Trail Community Foundation, Ducks Unlimited, Pheasants Forever, National Wild Turkey Federation, Peter Kiewit Foundation, and the Private Stewardship Grant Program. PRBE's efforts and partnerships with over 24 entities earned them the 2004 National Wetlands Conservation Award. Properties PRBE has helped acquire and protect include: Wildcat Hills Nature Center, Cedar Canyon Wildlife Management Area (WMA), Kiowa WMA, Faucus Springs WMA, Chadron Creek WMA, PRBE's Mitchell Valley Units, PRBE's Spotted Tail Units, PRBE's Horse Creek Units, PRBE's Bead Mountain Ranch Units, PRBE's dream is that similar groups across Nebraska will begin to conserve land for public use.
- ❖ The **Playa Lake Joint Venture** was formed in 1989 to help conserve playas and associated habitats for birds and other wildlife in parts of six states in the western Great Plains. Since its inception, the PLJV has raised close to \$50 million to conserve more than 100,000 acres of playas and other wetland and wildlife habitat in the High Plains. The activities of the PLJV are guided by a master plan that gives direction for conservation activities at the regional level. The Joint Venture is a regional partnership of federal and state wildlife agencies, conservation groups, industry and private landowners. Partners include: the U.S. Fish and Wildlife Service, U.S. Forest Service, Ducks Unlimited, The Nature Conservancy, Pheasants Forever, Conoco-Phillips, and state wildlife agencies of Colorado, Kansas, Nebraska, New Mexico, Oklahoma and Texas – and via these partners numerous landowners. For more information, visit: [www.pljv.org](http://www.pljv.org).

## ECOREGION-SPECIFIC STRESSES AND CONSERVATION ACTIONS

### Key Stresses

Stresses and conservation actions in the shortgrass prairie ecoregion are identified in chapter three and in descriptions of biologically unique landscapes. The following stresses were identified by conservation practitioners as the top stresses in the ecoregion.

- ❖ Alteration of natural disturbance regime: Shortgrass and mixed-grass prairies in the ecoregion historically were subject to intensive short duration grazing by native herbivores followed by periods of rest. Constant season-long grazing by cattle has changed plant and animal composition by favoring a relatively small proportion of species adapted to prolonged grazing. Periodic fires historically burned through

expansive areas of prairie and ponderosa pine forest. The lack of fire has altered species composition and structure of grasslands, forest, and wetlands.

- ❖ Altered hydrology and channel degradation of rivers and streams: Rivers, streams, and wetlands in the ecoregion are being stressed by surface water diversions and groundwater withdrawals. The loss of water to aquatic communities jeopardizes many species. A lowering of the water table along rivers and streams changes plant composition and often promotes the spread of invasive species. Reduced flows to the Platte and Republican Rivers have contributed to a shift from a grass/forb-dominated community to trees and shrubs, changing the species composition in the ecoregion.
- ❖ Spread of invasive species: Invasive species are severely threatening the ecoregion's biological diversity. Cheat grass, Russian olive, reed canary grass and other species have competitively excluded native plants and degraded habitat for fish and wildlife.
- ❖ Lack of knowledge about the region's biological diversity and ecological processes: The region's residents have limited opportunities to learn about the plant and animal species that are found in the ecoregion. Most school-aged children and adults are unaware of many of the species found in the ecoregion, key stresses, and the ecological processes that are important to sustaining biological diversity. Private landowners have limited access to information about management actions that can be taken to sustain natural communities and biological diversity on their land.
- ❖ Conversion and fragmentation of natural habitats: Although large areas of the ecoregion are still intact, sub-division of larger ranches into smaller units and acreages is resulting in loss and fragmentation of natural communities. Second home construction along rivers, native forests, and near recreational areas threatens to impact species. Some limited agricultural conversion of grassland continues throughout the ecoregion.

## **Biologically Unique Landscapes of the Shortgrass Prairie Ecoregion**

One of the goals of the Legacy Project is to identify a set of priority landscapes that, if properly managed, would conserve the majority of Nebraska's biological diversity. These landscapes, which we are calling Biologically Unique Landscapes, were selected based on the occurrences of at-risk species and ecological communities. Chapter 3 includes a description of the methods used to select the landscapes.

The map on the following page shows the biologically unique landscapes for the Shortgrass Prairie ecoregion. Following the map are brief descriptions of each landscape including stresses affecting species and habitats, proposed conservation actions, and lists of Tier I at-risk species and ecological communities found in the landscape. An asterisk next to a community name indicates that it is a priority for conservation in that landscape.

### **Shortgrass Landscapes**

Kimball Grasslands

North Platte River Wetlands

Oglala Grasslands

Panhandle Prairies

Pine Ridge

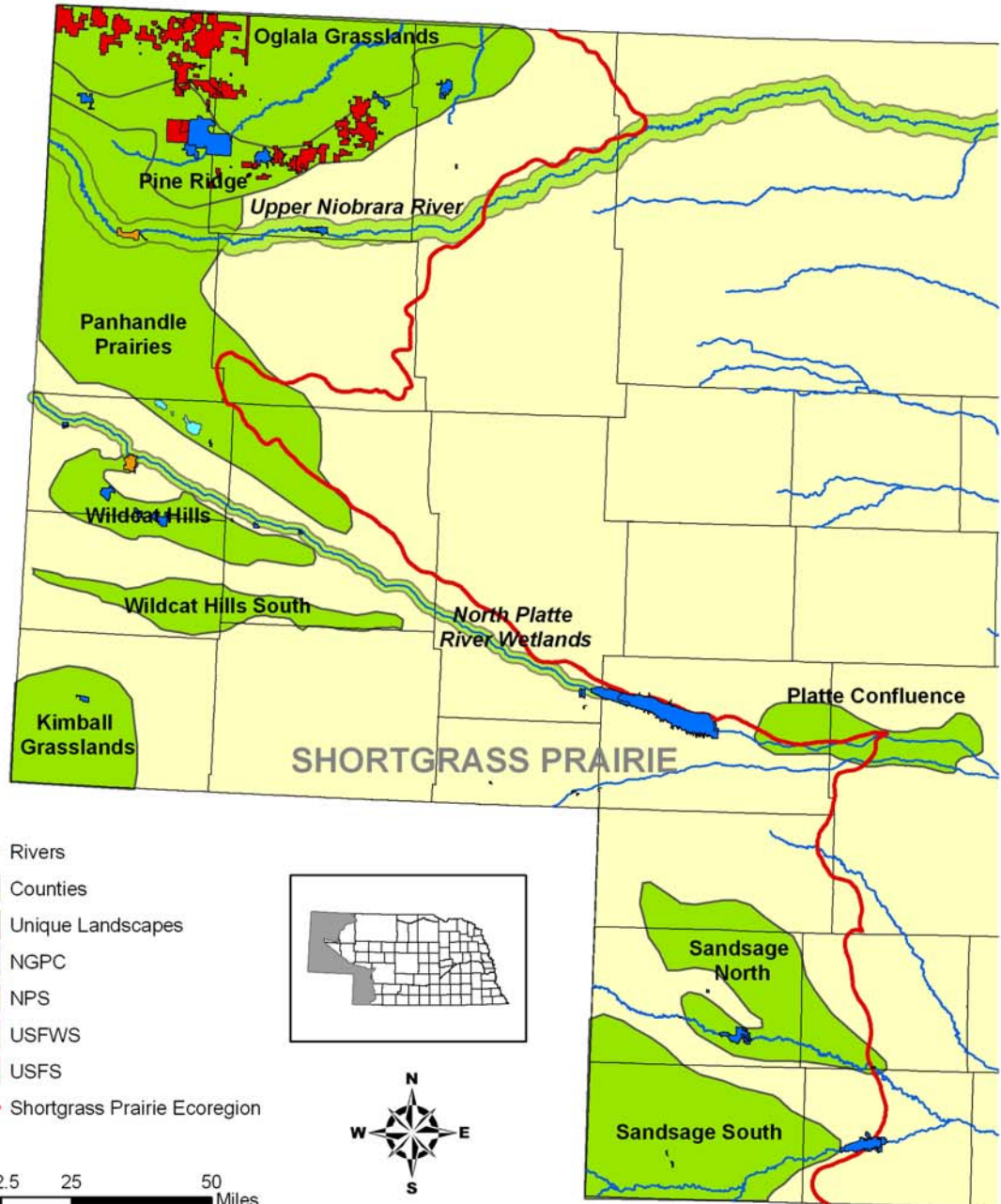
Platte Confluence (see Mixedgrass Ecoregion for description)

Sandsage (North and South combined)

Upper Niobrara River

Wildcat Hills (North and South combined)

## BIOLOGICALLY UNIQUE LANDSCAPES SHORTGRASS PRAIRIE ECOREGION



NEBRASKA NATURAL LEGACY PROJECT



## **Landscape Name: Kimball County Grasslands**

### **Landscape Description**

This landscape occupies the level to rolling hills and breaks of southwest Kimball County. Most of the more level ground is in dryland crops, primarily wheat. Native mixedgrass prairie still occupies the shallow-soiled breaks bordering Lodgepole Creek and other stream valleys.

The landscape is unique in that it supports the state's only population of the federally and state listed Colorado butterfly plant. In addition, nesting populations of the state-listed mountain plover occur in this landscape, where they utilize heavily grazed native grasslands and cropland such as wheat stubble. Playa wetlands are found on level sites in the northern portion of the landscape.

### **Stresses Affecting Species and Habitats**

- ❖ Canada thistle invasion of meadows where the Colorado butterfly plant occurs.
- ❖ Herbicide spraying, to control invasive species, in meadows where the Colorado butterfly plant occurs.
- ❖ Flow depletions in Lodgepole Creek that impact groundwater levels in adjacent meadows with the Colorado butterfly plant.
- ❖ Tillage in fallow wheat fields that destroys mountain plover nests.
- ❖ Sedimentation and hydrological alteration of playa wetlands.
- ❖ Conversion of native prairie to cropland.
- ❖ Exotic plant invasion of native grasslands, the primary species of concern is cheatgrass.

### **Conservation Strategies**

- ❖ Work with private landowners whose meadows contain the Colorado butterfly weed to develop and implement forms of Canada thistle control that do not damage populations of the butterfly plant.
- ❖ Restore and maintain the natural hydrology of Lodgepole Creek that is needed to sustain biological diversity and ecosystem function.
- ❖ Conduct voluntary nest clearing of crop fields to prevent damage to mountain plover nests.
- ❖ Restore selected crop fields and CRP lands to shortgrass prairie for mountain plover nesting habitat.
- ❖ Prevent sedimentation and restore the hydrology of the playa wetlands.
- ❖ Develop management agreements with landowners to implement grazing and burning regimes on native grasslands that favor mountain plover and native plant diversity.

### **Tier 1 At-risk Species:**

#### **Plants:**

Colorado butterfly plant

#### **Animals:**

Plains topminnow

Burrowing owl  
Ferruginous hawk  
McCown's longspur  
Mountain plover  
Swift fox

**Aquatic Communities:**

Headwater, Warm Water Stream

**Terrestrial Communities:**

Ponderosa Pine Woodland\*  
Sandbar Willow Shrubland  
Western Streamside Wet Meadow\*  
Western Mixedgrass Prairie\*  
Shortgrass Prairie\*  
Rock Outcrop\*

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**Landscape Name: North Platte River Wetlands**

**Landscape Description**

This landscape includes the North Platte River channel and the associated freshwater and alkaline wetland complexes within the river valley from the upper end of Lake McConaughy to the Wyoming/Nebraska border and also in the headwater reach of Pumpkin Creek. The North Platte River valley in this reach has a braided, mainly tree-lined channel. Cottonwood, eastern red cedar and Russian olive are the dominant floodplain trees. The majority of the river floodplain is farmed. However, both alkaline and freshwater wetland complexes remain. Many of the freshwater meadows are heavily invaded by exotic grasses. The alkaline meadows tend to be in better condition. This landscape is unique in that it contains one of two alkaline wetland complexes in the state. North Platte valley wetlands are an essential migratory stopover point for waterfowl and shorebirds. The alkaline meadows also support unique assemblages of insects including tiger beetles, dragonflies and butterflies. Major protected areas in this landscape include Kiowa WMA, Chet and Jane Fleisbach WMA, and lands owned by Platte River Basin Environments, Inc.

**Stresses Affecting Species and Habitats**

- ❖ Ditching and drainage of wetlands.
- ❖ Reduced river flows that impact groundwater levels in river valley wetlands.
- ❖ Reduced groundwater levels from irrigation water withdrawal.
- ❖ Exotic species invasion, the species of primary concern is tall wheatgrass, Russian olive, cheatgrass, phragmites, and Canada thistle.
- ❖ Livestock grazing and haying practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Conversion of native prairie to cropland.
- ❖ Reduction in ground water level and stream flow in Pumpkin Creek and other areas (e.g., University Lakes area).

## Conservation Strategies

- ❖ Use voluntary conservation easements or voluntary fee title acquisition to protect key high quality freshwater and alkaline wetlands and wet meadows.
- ❖ Work with private landowners to implement ecologically sensitive grazing and haying regimes.
- ❖ Work with agronomists to discontinue use of tall wheatgrass plantings.
- ❖ Use ditch plugging and water control structures to restore the natural hydrology to wetland complexes.
- ❖ Work with private landowners to implement integrated pest management systems and invasive species brush management.
- ❖ Restore and maintain the natural hydrology of key streams (e.g. Pumpkin Creek) that is needed to sustain biological diversity and ecosystem function.
- ❖ Conduct tree clearing on specific areas of the North Platte River channel.

## Tier 1 Species

### Plants:

None

### Animals:

Regal fritillary

River otter

Bald eagle

Burrowing owl

Whooping crane

### Aquatic Communities:

Headwater, Warm Water Stream

Mid-order, Warm Water River

### Terrestrial Communities:

Western Riparian Woodland

Sandbar Willow Shrubland\*

Freshwater Marsh\*

Western Alkaline Marsh\*

Western Alkaline Meadow\*

Western Streamside Wet Meadow\*

Northern Cordgrass Wet Prairie\*

Perennial Sandbar\*

Sandbar/Mudflat

**Landscape Name: Oglala Grasslands****Landscape Description**

This landscape occupies the plains and rolling hills in the northwestern Panhandle north of the Pine Ridge. Mixedgrass prairie covers most of the plains and hills, though there are numerous areas of badlands and several streams with partially wooded valleys. The soils are predominantly clays derived from Pierre Shale and support mixedgrass prairie dominated by blue grama, green needle grass, and western wheatgrass.

This landscape is unique in that it is one of the larger intact grasslands remaining in Nebraska, though many “go-back” fields occur in the area. This landscape includes the state’s most extensive badlands and the only occurrences of several plant communities including western floodplain terrace grassland, silver sagebrush shrub prairie, greasewood shrub prairie, and northwestern mixedgrass prairie. Scattered playas occur in the landscape. These grasslands support extensive prairie dog towns, swift fox populations, and extensive habitat for grassland birds. The Oglalla National Grasslands occupy a large portion of this landscape.

**Stresses Affecting Species and Habitats**

- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Exotic species invasion, primarily cheatgrass.

**Conservation Strategies**

- ❖ Work with private landowners and the U.S. Forest Service to implement ecological sensitive grazing systems that reduce cheatgrass and promote native plant diversity and a diverse vegetation structure.
- ❖ Restore sagebrush communities on selected sites.

**Tier 1 At-risk Species:****Plants:**

Wild buckwheat

**Animals:**

Burrowing owl  
 Ferruginous hawk  
 Long-billed curlew  
 Brewers sparrow  
 Bell’s vireo  
 Swift fox

**Aquatic Communities:**

Headwater, Warm Water Stream  
 Mid-order, Warm Water River\*

**Terrestrial Communities:**

Spring Seep  
 Western Streamside Wet Meadow\*  
 Western Floodplain Terrace Grassland\*  
 Silver Sagebrush Shrub Prairie\*  
 Greasewood Shrub Prairie\*  
 Shortgrass Prairie\*  
 Northwestern Mixedgrass Prairie\*  
 Western Mixedgrass Prairie  
 Western Sandy Slope Prairie  
 Rock Outcrop  
 Badlands\*

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**Landscape Name: Panhandle Mixedgrass Prairies****Landscape Description**

This landscape occupies the plains and rolling hills in the northern Panhandle from the Pine Ridge south to the North Platte River valley. It includes the rough breaks and rocky outcrops associated with the Niobrara River in central Sioux County and the North Platte River in Scotts Bluff and Morrill counties. The plains include isolated sand dunes in west-central Sioux County. These dunes support Sandhills dune prairie and sandsage prairie. The soils are loamy to loamy sands, except on the sand dunes. The landscape is occupied primarily by native prairie with only scattered cropland.

This landscape is unique in that it is one of the largest intact, higher quality grasslands remaining in Nebraska. These grasslands support prairie dog towns, the state's largest swift fox populations, and extensive habitat for grassland birds. Alkaline wetlands occur along Snake Creek in the far east-central portion of this landscape. The North Platte National Wildlife Refuge is the only protected land in this landscape.

**Stresses Affecting Species and Habitats**

- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure.
- ❖ Exotic species invasion, primarily cheatgrass.
- ❖ Conversion of prairie to cropland (e.g. in the Niobrara River valley)

**Conservation Strategies**

- ❖ Work with private landowners to implement ecological sensitive grazing systems. These systems should strive to reduce cheatgrass abundance and promote native plant diversity and diverse vegetative structure.
- ❖ Protect key high-quality sites through conservation easements or voluntary fee title acquisition.

**Tier 1 At-risk Species:**

**Plants:**

Wild buckwheat

**Animals:**

Plains topminnow  
Burrowing owl  
Ferruginous hawk  
McCown's longspur  
Long-billed curlew  
Brewer's sparrow  
Swift fox

**Aquatic Communities:**

Headwater, Warm Water Stream

**Terrestrial Communities:**

Spring Seep  
Western Streamside Wet Meadow  
Sandsage Prairie\*  
Sandhills Dune Prairie\*  
Shortgrass Prairie\*  
Western Mixedgrass Prairie\*  
Loess mixedgrass Prairie  
Western Sandy Slope Prairie\*  
Dry Cliff  
Rock Outcrop\*  
Badlands

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**Landscape Name: Pine Ridge**

**Landscape Description**

The Pine Ridge is a rocky escarpment that rises several hundred feet from the surrounding plains in Sioux, Dawes, and Sheridan counties in northwest Nebraska. The escarpment is composed of sandstone, siltstones and volcanic ash. Ponderosa pine woodlands and forest occupy many of the north- and east-facing slopes, and bottoms. Pine woodlands and mixedgrass prairie occupy the south- and west-facing slopes. Several streams, including the White River, Hat Creek and Soldier Creek, headwater in the Pine Ridge. The valleys of these northward flowing streams support deciduous woodlands and meadows in their floodplains.

The Pine Ridge is a pine-dominated escarpment within the grassland dominated Great Plains. It supports many at-risk species at the edge of their range, including two of the state's three populations of the Rocky Mountain bighorn sheep. There are several large protected areas

within this landscape including the Nebraska National Forest, Fort Robinson State Park and several wildlife management areas.

### **Stresses Affecting Species and Habitats**

- ❖ Housing and ranchette development.
- ❖ Increased densities of ponderosa pine and to a lesser extent eastern red cedar, due to lack of fire.
- ❖ Logging practices with a high degree of groundcover and soil disturbance.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure. This, along with other factors such as logging, has led to exotic plant invasion, primarily cheatgrass, smooth brome, Kentucky bluegrass, eastern red cedar, leafy spurge, and Canada thistle.
- ❖ Catastrophic wildlife fire (crown fires) due to excess fuel accumulation.
- ❖ Lack of grazing and prescribed fire on some public lands.

### **Conservation Strategies**

- ❖ Use conservation easements to protect key areas from development.
- ❖ Work with public and private landowners to implement planned grazing systems.
- ❖ Work with public and private landowners to implement prescribed, low-intensity surface fires to control exotic plants, reduce ponderosa pine and eastern red cedar densities, and reduce threat of crown fires. Dense stands of trees may require mechanical thinning prior to burning to reduce fuel loads.
- ❖ Conduct ecologically sensitive tree thinning on private and public land.
- ❖ Implement biodiversity management on public lands, including increased use of prescribed, low-intensity surface fire and planned grazing systems. A fire return interval of 5-10 years should be appropriate for public lands within the Pine Ridge.

### **Tier 1 At-risk Species:**

#### **Plants:**

None

#### **Animals:**

Tawny crescent

Lewis' woodpecker

Bell's vireo

Long-legged myotis

Fringe-tailed myotis

Townsend's big-eared bat

Swift fox

Rocky Mountain bighorn sheep

#### **Aquatic communities:**

Headwater, Coldwater Stream\*

Headwater, Warmwater Stream\*

**Terrestrial Communities:**

Ponderosa Pine Forest\*  
 Ponderosa Pine Woodland\*  
 Mixed Conifer Woodland\*  
 Green Ash-Elm Canyon Bottom Woodland\*  
 Mountain Mohogany Shrubland  
 Buckbrush Shrubland  
 Spring Seep  
 Western Mixedgrass Prairie\*  
 Pine Ridge Sandy Slope Prairie\*  
 Dry Cliff\*  
 Rock Outcrop\*  
 Badlands

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**Landscape Name: Sandsage Prairie****Landscape Description**

This landscape is composed of low rolling sand dunes and stream breaks in a four county area in far southwest Nebraska. Loess mixedgrass prairie and western mixedgrass prairie occur on the breaks and bluffs of the Republican and Frenchman rivers while sandsage prairie occurs on rolling sand dunes. The mixedgrass prairies are partially fragmented by cropland and degraded in some areas due to livestock grazing practices that reduce plant species diversity. The sandsage prairies have been highly fragmented by center pivot development. The landscape is significant because it contains some of the last remnants of sandsage prairie and some of the highest quality loess mixedgrass prairies in the state. Historically, sandsage prairie contained lakes and wetlands, but these have disappeared in recent decades due to the lowering of the groundwater table. If the groundwater were restored, these wetland areas may reappear. Several higher quality small streams flow into the Republican River, including Buffalo Creek and Rock Creek. The stretch of the Republican River above Swanson Reservoir is not as degraded as lower reaches and still contains a braided channel and open sandbars. The largest protected areas in the landscape are Enders Reservoir WMA, Swanson Reservoir WMA, and Red Willow Reservoir WMA.

**Stresses Affecting Species and Habitats**

- ❖ Conversion of native grasslands to cropland, especially conversion of sandsage prairie to center pivot irrigation.
- ❖ Groundwater withdrawal for center pivot irrigation, which effect wetlands and stream flows.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure in prairies, which can lead to exotic plant invasion and over abundance of sandsage.
- ❖ Spraying of sandsage prairies to reduce sandsage abundance.
- ❖ Exotic plant invasion, primarily smooth brome and cheatgrass, in native prairies.



## **Conservation Strategies**

- ❖ Protect largest blocks of sandsage prairie from conversion to cropland through conservation easements or voluntary fee title acquisition.
- ❖ Work with landowners to restore groundwater levels and potentially restore wetlands in the sandsage prairie.
- ❖ Work with private landowners to implement planned grazing systems.
- ❖ Work with the Natural Resource Conservation Service to eliminate the practice of herbicide spraying on private lands as a method of reducing sandsage abundance.
- ❖ Implement prescribed burning on private lands as a method of reducing sandsage in sandsage prairies and controlling exotic cool-season grasses in mixedgrass prairies.
- ❖ Invasive woody species removal and grazing management within the Republican River valley upstream from Swanson Reservoir.
- ❖ Restore wetlands in the Republican River valley upstream from Swanson Reservoir.

### **Tier 1 At-risk Species:**

#### **Plants:**

Sandhills goosefoot  
Compact prairie clover

#### **Animals:**

Plains Topminnow  
Ferruginous hawk  
Bald eagle  
Burrowing owl  
Greater prairie chicken  
Short-eared owl  
Long-billed curlew  
Bell's vireo

#### **Aquatic Communities:**

Headwater, Cold Water Stream\*  
Headwater, Warm Water Stream\*  
Mid-order, Warm Water River

#### **Terrestrial Communities:**

Spring Seep  
Wet-mesic Tallgrass Prairie  
Sandsage Prairie\*  
Sandhills Dune Prairie  
Loess Mixedgrass Prairie\*  
Western Mixedgrass Prairie\*  
Rock outcrop\*

## **Landscape Name: Upper Niobrara River**

### **Landscape Description**

This landscape occupies the Niobrara River channel, and a two-mile wide buffer on each side of the river, from eastern Cherry County westward to the Nebraska/Wyoming border. In the far west the Niobrara River is a narrow, coldwater stream with an open, gently sloping valley with few trees. Rocky outcrops are also common along the valley bluffs and mixedgrass prairie occurs on most of the bluffs. Eastward as the river gains flows the valley becomes entrenched. Where the river enters the Sandhills in western Cherry County the valley is several hundred feet deep and ponderosa pine woodlands occupy portions of the bluff and cottonwood dominated-woodlands occupy portions of the floodplain. Portions of the valley bottom are in cropland.

The only dam on this reach of the Niobrara River is the one that forms Box Butte Reservoir in Dawes County, otherwise flows on the river are fairly natural. The upper Niobrara River supports a unique assemblage of cold-water fish including the pearl dace and the state-listed blacknose shiner and finescale dace. Wet meadows in the Niobrara River valley in western Sioux County support the state's only known population of Ute lady's-tresses orchid. Protected areas on the upper Niobrara include Agate Fossil Beds National Monument, The Nature Conservancy's Cherry Ranch and Prairie Plains Resource Institute's Guadalcanal Memorial Prairie.

### **Stresses Affecting Species and Habitats**

- ❖ Reduced river flows due to irrigation development. This threat is most prevalent in the western reaches of the river.
- ❖ Housing and ranchette development.
- ❖ Conversion of valley bottom meadows to cropland.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure in both uplands and riparian areas.

### **Conservation Strategies**

- ❖ Maintain the natural hydrology of the Niobrara River that is necessary to sustain biological diversity and ecosystem function.
- ❖ Utilize local rancher expertise when implementing management actions on protected sites
- ❖ Use conservation easements to protect key lands threatened by development.
- ❖ Work with private landowners to implement ecological sensitive grazing systems.
- ❖ In meadows containing the Ute lady's-tresses orchid, implement haying and grazing regimes that benefit the orchid.
- ❖ Restrict stocking of exotic fish when they threaten at-risk fish species.

### **Tier 1 At-risk Species:**

#### **Plants:**

Ute lady's-tresses orchid  
Blowout penstemon  
Wild buckwheat

**Animals:**

Regal fritillary  
Plains topminnow  
Pearl Dace  
Blacknose shiner  
Finescale dace  
Burrowing owl  
Ferruginous hawk  
Bell's vireo  
Long-billed curlew  
Brewer's sparrow  
Swift fox  
River otter

**Aquatic Communities:**

Headwater, Cold Water Stream\*  
Headwater, Warm Water Stream  
Mid-order Warm Water River\*

**Terrestrial Communities:**

Western Riparian Woodland  
Ponderosa Pine Woodland\*  
Sandbar Willow Shrubland\*  
Spring Seep\*  
Freshwater Marsh\*  
Northern Sedge Wet Meadow  
Northern Cordgrass Wet Prairie  
Western Streamside Wet Meadow\*  
Perennial Sandbar  
Sandhills Dune Prairie  
Shortgrass Prairie  
Western Mixedgrass Prairie  
Western Sandy Slope Prairie  
Sandbar/Mudflat  
Rock Outcrop\*

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**Landscape Name: Wildcat Hills**

**Landscape Description**

The Wildcat Hills is a rocky escarpment that rises several hundred feet on the south side of the North Platte River in Scotts Bluff, Banner, and Morrill counties. The escarpment is composed primarily of sandstone, siltstone and volcanic ash. The north bluff of the escarpment is steep and deep canyons cut into the bluff. The canyons support stands of mountain mahogany, eastern red cedar and Rocky Mountain juniper. The north-facing slopes of the escarpment support

ponderosa pine woodlands. Mixedgrass prairie, rock outcrops, and scattered patches of sandsage prairie occupy the remainder of the Wildcat Hills.

The Wildcat Hills are unique in that they are an intact mosaic of pine woodlands and mixedgrass prairie mosaic and support the largest stands of mountain mahogany shrubland in the state. The Wildcat Hills also support one of three Rocky Mountain bighorn sheep populations in the state. Protected lands within the Wildcat Hills include Wildcat Hills SRA and WMA, Buffalo Creek WMA, Cedar Canyon WMA, Platte River Basin Environ's Bead Mountain Ranch, and Scottsbluff National Monument.

### **Stresses Affecting Species and Habitats**

- ❖ Housing and ranchette development.
- ❖ Livestock grazing practices that reduce native plant diversity and promote uniform habitat structure in both uplands and riparian areas.
- ❖ Exotic plant invasion, primarily cheatgrass, smooth brome, Kentucky bluegrass and eastern red cedar.
- ❖ Lack of fire, leading to eastern red cedar encroachment in some areas.
- ❖ Lack of grazing and prescribed fire on some public lands.

### **Conservation Strategies**

- ❖ Use conservation easements to protect areas from development.
- ❖ Work with private landowners to implement planned grazing systems.
- ❖ Work with private landowners to implement prescribed fire to control exotic plants, and reduce eastern red cedar densities.
- ❖ Increase biodiversity management on public lands within the Wildcat Hills including increased use of prescribed fire and planned grazing.

### **Tier 1 At-risk Species:**

#### **Plants:**

Nuttall desert parsley

#### **Animals:**

Plains topminnow

Burrowing owl

Swift fox

Rocky Mountain bighorn sheep

#### **Aquatic communities:**

Headwater, Warm Water Stream

#### **Terrestrial Communities:**

Ponderosa Pine Woodland\*

Mixed Conifer Woodland\*

Green Ash-Elm Canyon Bottom Woodland\*

Juniper Woodland\*

Mountain Mohogany Shrubland\*

Buckbrush Shrubland  
Spring Seep  
Sandsage Prairie  
Western Mixedgrass Prairie\*  
Western Sandy Slope Prairie\*  
Dry Cliff\*  
Rock Outcrop\*

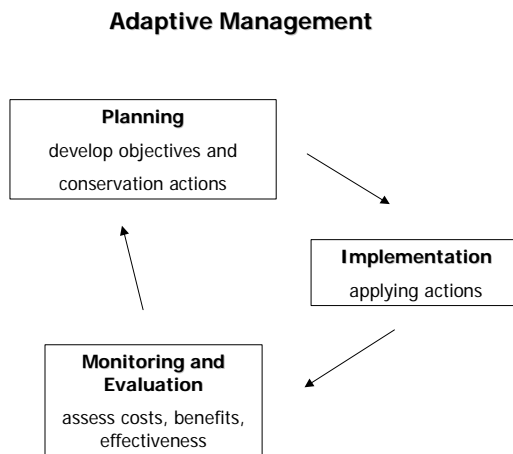
## Chapter 9 Adaptive Management, Monitoring, Inventory and Research

In this chapter we present a framework for adapting our conservation actions in response to new information and changing conditions. An integral component of adaptive management is monitoring to assess species and habitat responses to management actions. We present a number of components that should be included in a monitoring plan, the development of which is one of the priorities in implementing the Legacy Project. In addition we list priority inventory and research, identified during the development of the Legacy Project, which are needed to fill critical data gaps, provide baseline information for monitoring, and provide the knowledge needed to develop more effective conservation actions.

### Adaptive Management

Adaptive management is the process of continually improving management policies and practices by learning from the outcome of management actions. The basic steps in the adaptive management process are: 1) develop a management plan with objectives and proposed conservation actions, 2) implement the plan, 3) monitor and evaluate the results including assessing costs, benefits and effectiveness, and 4) revise the plan, if needed, utilizing the lessons learned from the evaluation.

Figure 1



In its simplest form, adaptive management can involve applying a conservation action at a site, observing the results and adjusting the action in the future if warranted. However, it has its widest applicability when components of experimental design are incorporated into the monitoring process including replication, random assignment of treatments (including controls) and sites, and statistical analysis of results. Monitoring and

evaluation provide the critical links between implementing conservation actions and revising management objectives and actions to be more effective.

## **Monitoring**

During the development of the Natural Legacy Project, we did not have the resources necessary to develop a detailed monitoring plan. Below we have identified a framework for developing such a plan, which will be a priority as we begin implementation. Due to limitations of human, financial and information resources, we must be strategic in selecting both what to monitor and how to monitor it. Monitoring of management actions is typically conducted at two levels: 1) response of individual species and 2) response of habitats or ecological communities. In addition to monitoring biotic responses, one can monitor whether proposed conservation actions were carried out (implementation monitoring), the public/stakeholder understanding, acceptance and support of conservation actions, or the abatement of key threats to species or communities. To be successful, a monitoring strategy needs to be affordable, provide credible information that assesses effectiveness and is usable by decision makers.

### Implementation Monitoring

An important component of the monitoring strategy will be to track the implementation of conservation actions that are proposed in the Legacy Project. These can be used to evaluate how well the goals set for conservation of ecological communities and species are being met. Information collected would include the location, types of conservation actions, agencies and organizations involved, species and communities affected, acres or miles of stream, cost of project, funding sources, etc. The use and effectiveness of tools such as incentives, easements, voluntary acquisitions, management agreements, and restorations should also be monitored and analyzed not only in terms of accomplishments but also cost effectiveness.

### Species Monitoring

Population monitoring is currently being conducted on a regular basis for a handful of at-risk species (e.g. bald eagle, piping plover, interior least tern, greater prairie chicken, pallid sturgeon, Salt Creek tiger beetle). This type of monitoring allows researchers to determine if populations are increasing, stable, or decreasing and can alert staff to the need for action in the case of declining populations. This type of monitoring is most effectively conducted prior to and following management actions to assess the impacts of these actions and modify the actions to maximize the desired effect on species of interest. Given the expense of detailed population monitoring, a careful evaluation will need to be conducted to determine which additional at-risk species should be monitored, as well as if the currently monitored species warrant continued monitoring.

Standardized monitoring protocols exist for some well-studied species and should be used in order to maintain the compatibility of data gathered here with that gathered in other states. If no established protocols exist, they should be developed from what is

known about the species. Monitoring protocols need to be specifically tailored to the species and management actions being evaluated. Monitoring should be designed to quantify population change and to understand the potential causes of the change.

Monitoring factors might include direct measurements of populations or indirect measures such as habitat. Direct measures might include population size, density, growth/condition, productivity, or survival. Habitat can be used as a surrogate for direct population measures if the relationship between habitat and population is well defined. In many cases, a combination of direct and indirect measures will be appropriate. In addition, habitat data are critical to the understanding of causes of population change.

The overall conservation status of species will also be monitored. The Tier I and Tier II at-risk species lists will be periodically reviewed and revised by taxon experts. This revision will occur on an ongoing basis as new information on abundance, distribution, and population trends becomes available, with an overall review at least every five years.

### Habitat Monitoring

Habitat monitoring can occur at two main levels: monitoring trends in abundance, distribution, and condition of individual community types and 2) monitoring the response of community examples to management action, including restoration.

Monitoring trends in abundance and distribution of different habitat types can be used to detect land use changes and can help direct conservation action toward those types that are showing the steepest decline. A map of historic vegetation (Kaul and Rolfsmeier 1993) can be used to evaluate the change in abundance since pre- Euroamerican settlement while more recent trends can be examined using current surveys. This type of monitoring over a large scale is best accomplished using remote sensing techniques. Unfortunately, the land cover maps that are currently available (National Land Cover Data, Nebraska GAP) are derived from satellite imagery and are at a fairly coarse scale (~ 20 vegetation types). These are inadequate for monitoring many of our communities that occur at small scales (e.g. small patch types). There is a need to develop a land cover map with better resolution and for ground-truthing of remotely sensed data. In addition, selected small patch communities may be better monitored using aerial photography or ground surveys.

There is a need to develop a set of best management practices for ecological communities that maintain and enhance their biodiversity value. Monitoring responses of individual community types to various management practices will be a key component in developing those guidelines. Both formal experimentation testing different management practices, as well as monitoring existing practices on managed lands, will be needed. Floristic quality assessment is one approach that may be used for evaluating responses to treatments. One could also monitor responses of indicator species or exotic species within the community.



## Databases

The Nebraska Natural Heritage Program maintains the most comprehensive, statewide database on at-risk species and ecological communities. Information on at-risk species from other NGPC databases (Fisheries, Nongame Bird Program, Nongame Mammal Program) has been added to this database. Currently there are more than 6,000 species records and 1,500 community records in the Heritage database. This database is updated annually with new survey information. The Heritage database is linked to the Biologically Unique Landscapes layer (see Chapter 3) and will automatically update information on the landscapes as new survey information becomes available.

All data added to the Heritage database is quality controlled and converted to a standard format. The quality control process ensures that the data are accurate and reliable while the standard format allows data from many sources to be easily queried, summarized, and distributed. In addition, because the same standard format is used by programs in the Natural Heritage network (all 50 states, most Canadian provinces and several Latin American countries), the data can be easily combined into large datasets that allow for analysis across state and national boundaries. These multi-jurisdictional datasets allow for effective broad-scale conservation planning. Data standards as well as multi-jurisdictional datasets are developed and maintained by NatureServe in conjunction with its member Heritage Programs and Conservation Data Centres.

There is a need to develop additional databases to help track progress towards meeting the goals of the Legacy Project. One database could track implementation of conservation actions on an annual basis. Information tracked could include conservation goals, type of action(s), species and habitats affected, location, number of acres or miles of stream affected, project cost, funding sources, etc. Another, spatially explicit database should be developed to track the conservation status of lands and waters. This would include lands under federal, state and local ownership as well as those lands with conservation easements or agreements in place. Information tracked would include management goals, management practices, habitats and species protected, etc.

## Inventory and Research

Development of the Legacy Project was hampered by lack of information in a variety of areas including species and ecological community data, appropriate conservation strategies, and best management practices. In addition to inventory and research that may be conducted as a part of monitoring, there is a need to fill critical information gaps on the distribution, abundance, conservation status, biology and ecology of at-risk species and ecological communities. Below is a list of priority inventory and research projects that are needed to fill critical data gaps, provide baseline information for monitoring, and provide the knowledge needed to develop more effective conservation actions.

### Biological Inventory

#### Species

- ❖ For 45 % of the Tier I species there were not enough documented occurrences of populations to fully meet the goals set for those species. Inventory of additional populations of these species should be a priority. There is also a strong need to assess the condition/viability of each population during inventory work. Appendix 8 identifies inventory and research needs for individual Tier I species.
- ❖ Conduct inventory work to better document the distribution and abundance of Tier II at-risk species. Inventory work should be prioritized based on gaps in knowledge and the imperilment status of the species. In general, our inventory needs are greatest for invertebrates (both terrestrial and aquatic) and non-vascular plants.
- ❖ Develop predictive models of species distribution for at-risk species to guide survey work and increase inventory efficiency.
- ❖ Inventory the distribution and spread of key invasive exotic species including garlic mustard, purple loosestrife, phragmites, Russian olive, salt cedar, and zebra mussel.
- ❖ Utilize data from inventory work to revise the Tier I and Tier II species lists.

#### Ecological Communities

- ❖ There were insufficient documented occurrences of 72% of the ecological community types to fully meet the goals set for those communities. Inventories identifying high-quality examples of each of these types should be a high priority.
- ❖ Develop a classification for aquatic systems (lakes, rivers, streams). Conduct inventories to identify high-quality examples of each type.

#### Landscapes

- ❖ Inventory priority landscapes for additional high-quality examples of Tier I species and ecological communities. Identifying other occurrences at these existing sites will increase the efficiency of the conservation effort.
- ❖ Develop a current landcover map of Nebraska to better assess landscape condition.

#### Biological Research

##### Species

- ❖ Conduct research to better understand the biology/ecology of at-risk species. Appendix 8 lists research needs for individual Tier I species.

- ❖ Evaluate the habitat requirements of at-risk species including the size, condition and landscape context of habitat(s) needed to sustain viable populations.
- ❖ Develop population viability assessments for selected at-risk species to better determine population conservation goals.
- ❖ Develop captive rearing techniques for highly imperiled species that will require re-introduction efforts to recover the species (e.g. Salt Creek tiger beetle).
- ❖ Conduct studies to evaluate the impact of exotic species on native flora and fauna.
- ❖ Develop control mechanisms for invasive exotic species that have a high impact on at-risk species and ecological communities.

#### Ecological Communities

- ❖ Increase understanding of ecological processes influencing communities; investigate grazing, fire, and hydrologic regimes, and the natural mosaic of disturbance and patch types in a landscape.
- ❖ Conduct studies to evaluate the effects of management practices (e.g. burning, grazing, haying, hydrologic regime manipulation) on the composition, structure and function of ecological communities.
- ❖ Develop best management practices to promote native species diversity and maintain ecological processes in different community types,
- ❖ Develop habitat restoration techniques for those community types for which there is the greatest need of restoration and the least known about restoration (e.g. saline wetlands, freshwater streams).
- ❖ Conduct studies to evaluate the success of habitat restoration projects.

#### Conservation and Environmental Education Research

- ❖ Determine the most critical and requested education materials and develop a priority listing for areas of needs.
- ❖ Determine the need for additional educators who are trained in nature education.
- ❖ Conduct an inventory of outdoor education and nature centers in Nebraska and identify areas of the state that would benefit from new centers.

### Nature-based Recreation Research

- ❖ Conduct statewide and regional economic impact studies of hunting, fishing, wildlife viewing, and other nature-based recreation to determine the economic benefits of these activities. Conduct a marketing assessment of current and potential nature-based tourism clients to identify user needs and wants.
- ❖ Conduct studies to determine the wants/needs/satisfaction level of constituents that participate in non-consumptive, wildlife-dependent recreation and determine the availability of sites/facilities to support that recreation.
- ❖ Inventory sites on public and private lands currently providing opportunities and access for wildlife viewing, nature and wildlife interpretation, and evaluate the potential and need for enhancing existing opportunities and access.
- ❖ Identify and inventory sites that would provide new opportunities and access for wildlife viewing and nature and wildlife interpretation.

### Economic Research

- ❖ Conduct studies to evaluate the economic importance of eco-tourism in Nebraska.
- ❖ Conduct research on trends in economic development and population demographics in the state and assess their potential impact on biodiversity conservation.

### Human Dimensions Research

- ❖ Conduct surveys to determine the public's attitudes towards biological diversity, conservation and management practices.
- ❖ Assess the success of methods of outreach to landowners and land managers in engaging them in wildlife-friendly practices and conservation programs.

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**APPENDIX 1: Membership of the teams** that are involved with the development of Nebraska's Natural Legacy Project. See Chapter 2 for descriptions of the role of each team.

## Nebraska's Natural Legacy Partnership Team

Vance	Appling	<i>Ponca Tribe of Nebraska</i>
Pete	Berthelsen	<i>Pheasants Forever, Inc.</i>
Kenny	Dinan	<i>USFWS-Partners for Fish and Wildlife</i>
Jim	Douglas	<i>Nebraska Game and Parks Commission</i>
Dean	Edson	<i>Nebraska Association of Resources Districts</i>
Gloria	Erickson	<i>Nebraska Partnership for All-Bird Conservation</i>
Craig	Head	<i>Nebraska Farm Bureau</i>
Ryan	Heiniger	<i>Ducks Unlimited</i>
Gary	Hergenrader	<i>Nebraska Forest Service, University Rep</i>
Duane	Hovorka	<i>Nebraska Wildlife Federation</i>
Scott	Josiah	<i>Nebraska Forest Service, University Rep</i>
Larry	Klimek	<i>USFWS De Soto Refuge</i>
Bobbie	Kriz-Wickham	<i>Nebraska Department of Agriculture</i>
Brooke	Levey	<i>Nebraska Alliance for Conservation and Environment Education</i>
John	McFadden	<i>Nebraska Farm Bureau</i>
Steve	Moran	<i>Rainwater Basin Joint Venture of Nebraska</i>
Ritch	Nelson	<i>Natural Resources Conservation Service</i>
Greg	Schenbeck	<i>US Forest Service</i>
Al	Steuter	<i>The Nature Conservancy</i>
Roy	Stoltenberg	<i>Farmers Union</i>
Tyler	Sutton	<i>Grassland Foundation</i>
Paul	Tebbel	<i>Nebraska Audubon</i>
Craig	Utter	<i>Nebraska Cattlemen</i>

## Nebraska's Natural Legacy Internal Support Team

Ted	Blume	<i>NGPC - Law Enforcement Division Administrator</i>
Jim	Douglas	<i>NGPC - Wildlife Division Administrator</i>
Bill	Grewcock	<i>Nebraska Game and Parks Commissioner</i>
Mace	Hack	<i>NGPC - Wildlife Research Section Assistant Division Administrator</i>
Rick	Holland	<i>NGPC - Fisheries Assistant Division Administrator</i>
Mark	Humpert	<i>NGPC - CWCS Co-Coordinator</i>
Larry	Hutchinson	<i>NGPC - Fisheries Fish and Wildlife Program Manager</i>
Kirk	Nelson	<i>NGPC - Assistant Director</i>
Mark	Pinkerton	<i>Nebraska Game and Parks Commissioner</i>
Phil	Richmond	<i>NGPC - Publications Editor</i>
Steve	Riley	<i>NGPC - Wildlife Habitat Partners Section Assistant Division Administrator</i>
Rick	Schneider	<i>NGPC - CWCS Co-Coordinator</i>
Kristal	Stoner	<i>NGPC - CWCS Planning Assistant</i>

## Nebraska's Natural Legacy Science Team

Richard	Bischof	<i>NGPC - Nongame Mammal Program Manager</i>
John	Dinan	<i>NGPC - Nongame Bird Program Manager</i>
Mike	Fritz	<i>NGPC - Heritage Zoologist</i>
Mace	Hack	<i>NGPC - Wildlife Research Section Assistant Division Administrator</i>
Rick	Holland	<i>NGPC - Fisheries Assistant Division Administrator</i>
Mark	Humpert	<i>NGPC - CWCS Co-Coordinator</i>
Aditya	Peri	<i>NGPC - GIS Specialist</i>
Steve	Riley	<i>NGPC - Wildlife Habitat Partners Section Assistant Division Administrator</i>
Steve	Schainost	<i>NGPC - Rivers and Streams Program Manager</i>
Rick	Schneider	<i>NGPC - CWCS Co-Coordinator</i>
Gerry	Steinauer	<i>NGPC - Heritage Botanist</i>
Kristal	Stoner	<i>NGPC - CWCS Planning Assistant</i>
Scott	Taylor	<i>NGPC - Upland Game Program Manager</i>
Andrew	Tyre	<i>University of Nebraska</i>
Dave	Wedin	<i>University of Nebraska</i>
Sam	Wilson	<i>NGPC - Nongame Mammal Program Manager</i>

## Nebraska's Natural Legacy Outreach Team

Rick	Eades	<i>Nebraska Game and Parks Commission</i>
Jane	Gustafson	<i>Nebraska Game and Parks Commission</i>
Mark	Humpert	<i>Nebraska Game and Parks Commission</i>
Joanna	Pope	<i>Natural Resources Conservation Service</i>
Phil	Richmond	<i>Nebraska Game and Parks Commission</i>
Kristal	Stoner	<i>Nebraska Game and Parks Commission</i>
Michelle	Stryker	<i>Nebraska Game and Parks Commission</i>
Chris	Thody	<i>Tern and Plover Conservation Partnership</i>
Neil	Watson	<i>Nebraska Environmental Trust</i>

## Nebraska's Natural Legacy Wildlife Education and Recreation Team

Andrea	Cade	<i>Nebraska Game and Parks Commission</i>
Mark	Humpert	<i>Nebraska Game and Parks Commission</i>
Sarah	Krug	<i>Fontenelle Nature Center</i>
Jeanine	Lackey	<i>Nebraska Game and Parks Commission</i>
Marian	Langan	<i>Audubon Spring Creek Prairie</i>
Brooke	Levey	<i>Project Wet and Project Learning Tree Coordinator</i>
Marie	Nielson	<i>Educator, ESO 10</i>
Jeff	Rawlinson	<i>Nebraska Game and Parks Commission</i>
Jim	Woodland	<i>Nebraska Department of Education</i>

## Nebraska's Natural Legacy Core Team

Mark	Humpert	<i>NGPC - CWCS Co-Coordinator</i>
Aditya	Peri	<i>NGPC - GIS Specialist</i>
Rick	Schneider	<i>NGPC - CWCS Co-Coordinator</i>
Tammy	Snyder	<i>NGPC - Heritage Data Technician</i>
Kristal	Stoner	<i>NGPC - CWCS Planning Assistant</i>

## Writing Teams

### Tallgrass Ecoregion Team

Bob	Barry	<i>DeSoto National Wildlife Refuge</i>
Bobbie	Kriz-Wickham	<i>Nebraska Department of Agriculture</i>
Marian	Langan	<i>Audubon Spring Creek Prairie</i>
Gerry	Steinauer	<i>Nebraska Game and Parks Commission</i>
Kristal	Stoner	<i>Nebraska Game and Parks Commission</i>
Scott	Wessel	<i>Nebraska Game and Parks Commission</i>

### Sandhills Ecoregion Team

Mark	Humpert	<i>Nebraska Game and Parks Commission</i>
Jeanine	Lackey	<i>Nebraska Game and Parks Commission</i>
Gene	Mack	<i>US Fish and Wildlife Service</i>
Rick	Schneider	<i>Nebraska Game and Parks Commission</i>
Gerry	Steinauer	<i>Nebraska Game and Parks Commission</i>
Craig	Utter	<i>Nebraska Cattlemen</i>
Bill	Vodehnal	<i>Nebraska Game and Parks Commission</i>

### Mixed-Grass Ecoregion Team

Bob	Bettger	<i>Congressmen Tom Osborne's Office</i>
Kenny	Dinan	<i>US Fish and Wildlife Service</i>
Chris	Helzer	<i>The Nature Conservancy</i>
Mark	Humpert	<i>Nebraska Game and Parks Commission</i>
Tim	McCoy	<i>Nebraska Game and Parks Commission</i>
Rich	Walters	<i>Nebraska Game and Parks Commission</i>
Bill	Whitney	<i>Prairie Plains Resource Institute</i>

### Shortgrass Ecoregion Team

Melody	Benjamin	<i>Nebraska Cattlemen</i>
Cris	Carnine	<i>Nebraska Prairie Partners</i>
Mike	Haphold	<i>US Fish and Wildlife Service</i>
Mark	Humpert	<i>Nebraska Game and Parks Commission</i>
Anne	James	<i>Nebraska Alliance for Conservation and Environment Education</i>
Ritch	Nelson	<i>Natural Resources Conservation Service</i>
Greg	Schenbeck	<i>US Forest Service</i>
Gary	Schlichtemeier	<i>Nebraska Game and Parks Commission</i>

## Participants in the Species Experts Workshops

### Reptiles and Amphibians

Dennis	Ferraro	<i>University of Nebraska - Omaha</i>
Dan	Fogell	<i>University of Nebraska - Omaha</i>
Mike	Fritz	<i>NGPC – Heritage Zoologist</i>

### Insects

Mike	Fritz	<i>NGPC – Heritage Zoologist</i>
Leon	Higley	<i>University of Nebraska - Lincoln</i>
Wyatt	Hoback	<i>University of Nebraska – Kearney</i>
Mary Liz	Jameson	<i>University of Nebraska - Lincoln</i>
Randy	Lawson	<i>Chadron State College</i>
Hal	Nagel	<i>University of Nebraska - Kearney</i>
Brett	Ratcliff	<i>University of Nebraska – Lincoln</i>
Steve	Spomer	<i>University of Nebraska - Lincoln</i>

### Mammals

Russ	Benedict	<i>Central College, Iowa</i>
Patricia	Freeman	<i>University of Nebraska - Lincoln</i>
Mike	Fritz	<i>NGPC – Heritage Zoologist</i>
Hugh	Genoways	<i>University of Nebraska - Lincoln</i>

### Fish

George	Cunningham	<i>University of Nebraska – Omaha</i>
Mike	Fritz	<i>NGPC – Heritage Zoologist</i>
Ed	Peters	<i>University of Nebraska – Lincoln</i>
Steve	Schainost	<i>NGPC – Rivers and Stream Program Manager</i>
Rick	Stasiak	<i>University of Nebraska - Omaha</i>

**Birds**

Cris	Carnine	<i>Rocky Mountain Bird Observatory</i>
John	Dinan	<i>NGPC – Nongame Bird Program Manager</i>
Mike	Fritz	<i>NGPC – Heritage Zoologist</i>
Paul	Johnsgard	<i>University of Nebraska – Lincoln</i>
Joel	Jorgesen	<i>University of Nebraska - Omaha</i>
Wayne	Mollhoff	
Ross	Silcock	

NGPC - Nebraska Game and Parks Commission

## **APPENDIX 2: National guidance on fulfilling the eight required elements.**

### **National Advisory Acceptance Team (NAAT) Review Reference Guide for the Members**

Congress identified eight required elements for a state Comprehensive Wildlife Conservation Strategy, with the expectation that “species in greatest need of conservation” will be identified, while addressing the full array of wildlife and wildlife-related issues.

The NAAT believes it must make an affirmative finding that all of the eight required elements are satisfactorily fulfilled in order for an “approval” recommendation to be made to the Director of the U.S. Fish and Wildlife Service (Director). Strategy reviews will first occur at the regional level, by NAAT member-teams, prior to full discussion and voting the entire NAAT.

Below follows a template the NAAT will use as it reviews the Strategies. There are eight major topic headings, which correspond to the eight elements prescribed by Congress. Under each element heading is a series of statements to help NAAT members think about whether or not the requirements of a particular element have been satisfactorily addressed. These statements, in effect, are examples of what the NAAT expects may be helpful in evaluating the merits of a Strategy. Strategy authors may want to offer additional reasons or factors as to why they believe they satisfactorily meet the requirements of a particular element, above or beyond the examples provided.

The NAAT expects that Strategies will describe or identify sources of information, as well as critical information gaps, and plans for acquiring critical information for species in greatest need of conservation. The NAAT will consult the “Guiding Principles” developed by the International Association of Fish and Wildlife Agencies when reviewing the Strategies. While this guide includes language regarding expectations that sections of the Strategies will provide sufficient information, the NAAT has not described or quantified the level of information expected, as each State or Territory will have different levels and sources of information available. The NAAT generally expects that Strategies will provide clear explanations of how information was used to reach conclusions. Strategies should explicitly draw logical connections between the problems that affect priority species and habitats, the conservation actions proposed to address those problems, and the indicators and monitoring approaches that will be used to measure the success of the conservation strategy.

It is anticipated that the Strategy will include an executive summary, synopsis or appendix that highlights where in the document reviewers can find information about each of the elements.

**1<sup>st</sup> Element. Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife.**

- A. The Strategy indicates sources of information (e.g., literature, data bases, agencies, individuals) on wildlife abundance and distribution consulted during the planning process.
- B. The Strategy includes information about both abundance and distribution for species in all major groups to the extent that data are available. There are plans for acquiring information about species for which adequate abundance and/or distribution information is unavailable.
- C. The Strategy identifies low and declining populations to the extent data are available.
- D. All major groups of wildlife have been considered or an explanation is provided as to why they were not (e.g., including reference to implemented marine fisheries management plans). The State may indicate whether these groups are to be included in a future Strategy revision.
- E. The Strategy describes the process used to select the species in greatest need of conservation. The quantity of information in the Strategy is determined by the State with input from its partners, based on what is available to the State.

**2<sup>nd</sup> Element. Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in the 1<sup>st</sup> element.**

- A. The Strategy provides a reasonable explanation for the level of detail provided; if insufficient, the Strategy identifies the types of future actions that will be taken to obtain the information.
- B. Key habitats and their relative conditions are described in enough detail Such that the State can determine where (i.e., in which regions, watersheds, or landscapes within the State) and what conservation actions need to take place.



**3<sup>rd</sup> Element. Descriptions of problems which may adversely affect species identified in the 1<sup>st</sup> element or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats.**

- A. The Strategy indicates sources of information (e.g., literature, data bases, agencies or individuals) used to determine the problems or threats.
- B. The threats/problems are described in sufficient detail to develop focused conservation actions (for example, “increased highway mortalities” or “acid mine drainage” rather than generic descriptions such as “development” or “poor water quality”).
- C. The Strategy considers threats/problems, regardless of their origins (local, state, regional, national and international), where relevant to the State’s species and habitats.
- D. If available information is insufficient to describe threats/problems, research and survey efforts are identified to obtain needed information.
- E. The priority research and survey needs, and resulting products, are described sufficiently to allow for the development of research and projects after the strategy is approved.

**4<sup>th</sup> Element. Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions.**

- A. The Strategy identifies how conservation actions address identified threats to species of greatest conservation need and their habitats.
- B. The Strategy describes conservation actions sufficiently to guide implementation of those actions through the development and execution of specific projects and programs.
- C. The Strategy links conservation actions to objectives and indicators that will facilitate monitoring and performance measurement of those conservation actions (outlined in Element #5).
- D. The Strategy describes conservation actions (where relevant to the State’s species and habitats) that could be addressed by Federal agencies or regional, national or international partners and shared with other States.
- E. If available information is insufficient to describe needed conservation actions, the strategy identifies research or survey needs for obtaining information to develop specific conservation actions.
- F. The Strategy identifies the relative priority of conservation actions.

**5<sup>th</sup> Element. Descriptions of the proposed plans for monitoring species identified in the 1<sup>st</sup> element and their habitats, for monitoring the effectiveness of the conservation actions proposed in the 4<sup>th</sup> element, and for adapting these conservation actions to respond appropriately to new information or changing conditions.**

- A. The Strategy describes plans for monitoring species identified in Element #1, and their habitats.
- B. The Strategy describes how the outcomes of the conservation actions will be monitored.
- C. If monitoring is not identified for a species or species group, the Strategy explains why it is not appropriate, necessary or possible.
- D. Monitoring is to be accomplished at one of several levels including individual species, guilds, or natural communities.
- E. The monitoring utilizes or builds on existing monitoring and survey systems or explains how information will be obtained to determine the effectiveness of conservation actions.
- F. The monitoring considers the appropriate geographic scale to evaluate the status of species or species groups and the effectiveness of conservation actions.
- G. The Strategy is adaptive in that it allows for evaluation conservation actions and implementing new actions accordingly.

**6<sup>th</sup> Element. Descriptions of procedures to review the Strategy/Plan at intervals not to exceed ten years.**

- A. The State describes the process that will be used to review the Strategy within the next ten years.

**7<sup>th</sup> Element. Descriptions of the plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the Plan-Strategy with Federal, State and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats.**

- A. The State describes the extent of its coordination with and efforts to involve Federal, state and local agencies, and Indian Tribes in the development of its Strategy.
- B. The State describes its continued coordination with these agencies and tribes in the implementation, review and revision of its Strategy.

**8<sup>th</sup> Element. Descriptions of the necessary public participation in the development, revision and implementation of the Plan.**

- A. The State describes the extent of its efforts to involve the public in the development of its Strategy.
- B. The State describes its continued public involvement in the implementation and revision of its Strategy.

**July 15, 2004**

**APPENDIX 3:** Competitive grants awarded through the Wildlife Conservation and Restoration Program and State Wildlife Grants program (2002-2005).

Project title	Program	Grant Award	Sponsor	Project Description
Lower Platte River Hydrology Study (Levee Project)	WCRP	\$79,500	Nebraska Game & Parks Commission, et. al.	Conduct a study to determine an effective mitigation strategy regarding the clear creek levee project on the lower Platte River.
Education Small Grant Program	WCRP	\$73,072	Numerous	Provide 36 small grants to education institutions to facilitate wildlife education.
Rowe Sanctuary Wildlife Exhibits	WCRP	\$65,000	Audubon Nebraska	Provide funding for exhibits on cranes and their habitats in new education center.
Ponca State Park Classroom/Laboratory Construction	WCRP	\$20,000	Nebraska Game & Parks Commission	Provide funding for furnishings of Ponca State Park classroom.
State Parks Trails/Interpretive & Educational Signs	WCRP	\$25,595	Nebraska Game & Parks Commission	Develop wildlife viewing sites at Niobrara, Ponca, and Indian Cave State Parks and develop a model education plan for Ponca State Park.
Conservation/Environment Literacy Survey of Nebraska	WCRP	\$9,000	Nebraska Association of Conservation & Environment Education	Conduct an environmental literacy survey of a sample of Nebraskan's.
Nongame Bird Conservation and Education Project	WCRP	\$54,819	University of Nebraska-Lincoln	Initiate a program to educate and conduct outreach about nongame birds and their habitats.
Conservation Education Workshops	WCRP	\$65,070	University of Nebraska-Lincoln	Provide environmental education training to pre-service students, formal, and nonformal educators
Least Tern & Piping Plover Conservation Partnership	WCRP	\$75,194	University of Nebraska-Lincoln	Provide support to the Tern and Plover Partnership Program to initiate conflict avoidance activities at sand and gravel mines along the Elkhorn and lower Platte Rivers and to conduct outreach.
Salt Creek Tiger Beetle Recovery Plan	WCRP	\$12,000	Nebraska Game & Parks Commission	Develop a recovery plan for the endangered salt creek tiger beetle.
Biodiversity Workshops for K-12 Educators	WCRP	\$21,700	Nebraska Game & Parks Commission	Conduct six workshops on biodiversity themes around Nebraska.
Eastern Nebraska Saline Wetland Conservation Partnership	WCRP	\$30,000	Nebraska Game & Parks Commission	Develop a partnership with the city of Lincoln and conservation partners to conserve saline wetland habitats
Shortgrass Prairie Education Partnership	WCRP	\$53,000	Nebraska Game & Parks Commission	Regionally coordinate and build capacity for wildlife education in the Nebraska Panhandle.
Northeast Nebraska Oak Savannah Restoration	SWG	\$40,000	Prairie Plains Resource Institute	Restore 180 acres of burr oak savanna at Ponca State Park and Powder Creek Reservoir.
Restoration of a Sandhill's Fen	SWG	\$12,000	Ducks Unlimited, Inc.	Restore a sandhills fen by filling in a drainage ditch.

Nebraska's Natural Legacy Project

PROJECT TITLE	Program	Grant Award	Sponsor	Project Description
Nebraska Native Grassland Partnership	SWG	\$50,000	Nebraska Game & Parks Commission	Develop a partnership that will facilitate the conservation of tallgrass prairie.
Pallid Sturgeon and Sturgeon Chub Study of the Lower Platte River	SWG	\$48,000	Nebraska Association of Resource Districts	Investigate the use of the lower Platte River by pallid sturgeon and sturgeon chub.
Building a Statewide Partnership for Bird Conservation	SWG	\$18,500	Nebraska Partnership for All Bird Conservation	Provide funding for spring/fall workshops and symposiums on bird-related and capacity topics.
Shortgrass Prairie Bird Monitoring in Nebraska, with special surveys for Mountain Plover, Burrowing Owl, and Ferruginous Hawk	SWG	\$137,600	Rocky Mountain Bird Observatory	Shortgrass prairie bird monitoring and research, GIS mapping, data analysis, and composition of scientific publications.
Biological Evaluation of Central Platte River Slough Wetland Restorations	SWG	\$32,933	Southern Illinois University	Evaluate and compare the invertebrate community of restored and natural wet meadows along the Platte River.
Invertebrate Response to Wetland Management Practices, Land-use Practices, and Restorations in the Rainwater Basin Region	SWG	\$39,297	Oklahoma State University	Investigate the response of invertebrates to wetland management in the Rainwater Basins.
Tern and Plover Conservation Partnership: Bringing Conservationists and Resource Users Together to Address the Challenges of Endangered Species Management	SWG	\$122,882	University of Nebraska-Lincoln	Support the Tern and Plover Conservation Partnership Program to initiate conflict avoidance activities at sand and gravel mines along the Elkhorn and lower Platte Rivers.
Important Bird Areas of Nebraska	SWG	\$42,000	Audubon Nebraska	Start an IBA program in the state, select IBA sites and conduct outreach to build support for IBA sites.
Assessment of the Health and Reproductive Status of River Otters in Nebraska	SWG	\$20,000	Nebraska Game & Parks Commission/University of Nebraska-Lincoln	Assess the health and reproductive status of river otters through post-mortem evaluation.
Controlling Spread of nine Invasive Plant Species on Lands Owned by the Fontenelle Nature Association	SWG	\$10,000	FNA	Restore native habitats by removing non-native invasive plants.
Grassland Bird Response to Disking/Interseeding of Legumes on Conservation Reserve Program Lands in Northeast Nebraska	SWG	\$49,000	Oklahoma State University	Evaluate the impacts of disking in CRP on grassland birds
Tallgrass Prairie Habitat Database	SWG	\$32,803	Nebraska Wildlife Federation	Develop and populate a database of existing tallgrass prairies in eastern Nebraska.
Spring Creek Prairie Restoration	SWG	\$4,892	Audubon Nebraska	Restore native tallgrass prairie by removing trees and converting smooth brome.

Nebraska's Natural Legacy Project

Project Title	Program	Grant Award	Sponsor	Project Description
Griffith Prairie Restoration	SWG	\$5,550	Prairie Plains Resource Institute	Remove cedar trees from Griffith prairie in Hamilton County.
Pokorney Tract Restoration	SWG	\$10,304	Prairie Plains Resource Institute	Install fencing and water source to utilize grazing to control invasive plants on a native prairie.
Ratlaff Prairie	SWG	\$10,000	Prairie Plains Resource Institute	Install fencing to facilitate grazing management.\
Dahms Tract Grazing Management	SWG	\$7,025	The Nature Conservancy	Facilitate restoration of a 40-acre prairie by installing fencing and a water source.
District Fire Equipment	SWG	\$14,500	Natural Resource Conservation Service/Natural Resource Districts	Facilitate prescribed burning of grasslands by creating a pool of burning equipment that will be available on loan.
Tallgrass Prairie Projects (public lands)	SWG	\$20,000	Nebraska Game & Parks Commission	Restore native prairie habitats on WMA's.
Chokecherry ranch grazing enhancement	SWG	\$13,000	Jim Vanwinkle Ranch	Install fencing and water source to better utilize grazing to restore grassland and wet meadow habitat on a Sandhills ranch.
Bombeck and Speidell Tracts Grazing Management	SWG	\$7,589	The Nature Conservancy	Install fencing and water to facilitate grazing management.
Monitoring small mammal and songbird communities in upland habitats of the Niobrara River Valley during red cedar removal	SWG	\$24,053	University Nebraska-Lincoln	Investigate the impacts of cedar clearing on grassland birds and Bailey's woodrats.
Integrated public and private lands tallgrass prairie conservation	SWG	\$53,500	Nebraska Game & Parks Commission & Northern Prairies Land Trust	Restore and improve prairie management on public and private lands.
Habitat Needs and Population Viability of the Massasauga (Sistrurus catenatus) in Eastern Nebraska	SWG	\$11,250	University Nebraska-Omaha	Assess habitat use by massasauga on WMA's using radio telemetry.
Rainwater Basin high-diversity restorations	SWG	\$20,000	Rainwater Basin Joint Venture	Perform high diversity prairie restorations on WMA's in the Rainwater Basin region .
Targeted Conservation in the Missouri River Valley	SWG	\$30,000	The Nature Conservancy	Assist with implementation of the Wetland Reserve Program along the Missouri River and develop a prioritization system.
Statewide Inventory of Nebraska's Terrestrial Invertebrates Which Are Biological Indicator Species	SWG	\$27,500	University Nebraska-Kearney	Inventory terrestrial invertebrates throughout the state.
Central Platte River Tern and Plover Conservation Partnership	SWG	\$45,500	University Nebraska-Lincoln	Initiate Tern and Plover conservation program in central Nebraska.

Nebraska's Natural Legacy Project

PROJECT TITLE	Program	Grant Award	Sponsor	Project Description
Stopover Ecology of the Buff-breasted Sandpiper in the Rainwater Basin: A flagship species for shorebird conservation in Nebraska.	SWG	\$12,750	University Nebraska-Omaha	Survey use of Rainwater Basins by buff-breasted Sandpipers and do a landscape analysis.
Enhancing Riparian Habitat for Wildlife	SWG	\$43,000	National Wild Turkey Federation & Ducks Unlimited, Inc.	Remove invasive plant, restore backwater sloughs, and create forest openings on WMA's along the central Platte River.
Evaluation of the impact of introduced western mosquitofish on plains topminnow	SWG	\$44,500	University Nebraska-Kearney	Evaluate the impact of western mosquitofish on plains topminnow through field and laboratory studies.
Creation of early successional stage grassland habitat.	SWG	\$45,000	Pheasants Forever, Inc.	Create and enhance existing grasslands for birds through disking, interseeding, and other innovative management techniques.
Examining the effects of census method and land management upon measuring grassland bird productivity	SWG	\$32,000	Platte River Whooping Crane Trust	Examination of the impacts of grazing and haying management on grassland breeding birds in south central Nebraska.
An Evaluation of Landscape and Local Factors that Play a Role in the Establishment, Spread, and Dominance of Invasive Plants in the Rainwater Basin Region	SWG	\$13,136	Oklahoma State University	Determine spatial distribution, landscape characteristics, and life history attributes of invasive plants in the Rainwater Basin Region.
Grazing Management Partnership in the Sandhills	SWG	\$17,978	Sandhills Taskforce	Install wildlife-friendly grazing management systems and restore wetlands and stream hydrology in the Sandhills.
Innovative approaches to mixedgrass prairie management in the Nebraska Panhandle	SWG	\$19,633	University of Nebraska Panhandle Research and Extension Center	Investigate alternative management strategies for Panhandle mixedgrass prairies to find management methods that reduce exotics, improve native plant diversity, and improve wildlife habitat.
Tallgrass Prairie Restoration at Thompson-Barnes Wildlife Management Area	SWG	\$2,870	Wayne State College	Do a student-centered restoration of 16 acres of cropland on Thompson Barnes WMA to high diversity tallgrass prairie.
A multi-scale analysis of the impacts of roadway networks on Blanding's turtles: implications for conserving genetic, population, and landscape diversity in the Nebraska Sandhills	SWG	\$16,930	University of Central Arkansas	Identify the impacts of roadways on population nesting ecology, physiological fitness, population genetics, and landscape connectivity on blanding's turtles in the Sandhills.

Nebraska's Natural Legacy Project

<b>PROJECT TITLE</b>	<b>Program</b>	<b>Grant Award</b>	<b>Sponsor</b>	<b>Project Description</b>
Conservation genetics of the blue sucker ( <i>Cycleptus elongatus</i> ) with special emphasis on an inter-reservoir populations in the Missouri River	SWG	\$12,000	University of Nebraska-Lincoln	Assess genetics of the blue sucker in the unchannelized portion of the Missouri River.
Operation Bob-o-link	SWG	\$20,000	Crane Meadows Nature Center	Remove woody vegetation from a prairie through burning and mechanical clearing and construct educational signage.
The Scarabaeoid Beetles of Nebraska	SWG	\$6,000	University of Nebraska-Lincoln	Conduct a field survey and publish an updated identification guide to the scarabaeoid beetles of Nebraska
Wachiska Audubon Prairies-Maintenance and Monitoring	SWG	\$7,500	Wachiska Audubon Chapter	Facilitate the management and monitoring of 22 prairies owned or under easement by Wachiska Audubon.

TOTAL \$1,836,925



## **APPENDIX 4: Definitions of Heritage conservation status ranks.**

### **Global Ranks (GRANK)**

A numeric rank (G1 through G5) of the conservation status or relative endangerment globally of species or ecological communities. Primary factors used in determining rank for species are population size, number of occurrences, viability of occurrences, population trend and threats. Secondary factors are geographic distribution, environmental specificity, protection and management, and intrinsic vulnerability.

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

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

G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range. (21 to 80 occurrences)

G4 = Widespread, abundant, and apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery. Thus, the Element is of long-term concern. (81 to 300 occurrences)

G5 = Demonstrably widespread, abundant, and secure globally, though it might be quite rare in parts of its range, especially at the periphery. (More than 300 occurrences)

G#G# = Numeric range rank: A range between two of the numeric ranks. Denotes a range of uncertainty about the exact rarity of the Element.

GU = Unrankable: Status is uncertain, needs more information.

GH = Historical: Of historical occurrence throughout its range, i.e., formerly part of the established biota, with the expectation that it may be rediscovered.

GX = Extinct: Believed to be extinct throughout its range with virtually no likelihood that it will be rediscovered.

Subrank:

T = Taxonomic subdivision: rank applies to a subspecies or variety.

Qualifiers:

? = Inexact: denotes inexact numeric rank.

Q = Questionable taxonomy: taxonomic status is questionable; numeric rank may change with taxonomy.

### **State Ranks (SRANK)**

A numeric rank (S1 through S5) of conservation status or relative endangerment within the state of species or ecological communities. Primary factors used in determining rank for species are population size, number of occurrences, viability of occurrences, population trend and threats. Secondary factors are geographic distribution, environmental specificity, protection and management, and intrinsic vulnerability.

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

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

S3 = Rare and uncommon in the state. (21 to 80 occurrences)

S4 = Widespread, abundant, and apparently secure in the state, with many occurrences, but the Element is of long-term concern. (81 to 300 occurrences)

S5 = Demonstrably widespread, abundant, and secure in the state, and essentially ineradicable under present conditions. (More than 300 occurrences)

S#S# = Numeric range rank: A range between two of the numeric ranks. Denotes a range of uncertainty about the exact rarity of the Element.

SA = Accidental: Accidental or casual in the state (i.e., infrequent and far outside usual range).

SE = Exotic, established in the state. May be native elsewhere in North America.

SH = Historical: Element occurred historically in the state, (with the expectation that it may be rediscovered), perhaps having not been verified in the past 20 years and suspected to be still extant.

SR = Reported from the state, but without persuasive documentation which would provide a basis for either accepting or rejecting the report.

SRF = Reported falsely: Element erroneously reported in the state and the error has persisted in the literature.

SSYN = Synonym: Element reported as occurring in the state, but state does not recognize the taxon; therefore the Element is not ranked by the state.

SU = Unrankable: Status is uncertain, needs more information.

SX = Extirpated: Element is believed to be extirpated from the state.

S? = Unranked: Element is not yet ranked in the state.

B = Breeding.

N = Non-breeding, regularly occurring, usually migratory.

## **APPENDIX 5: SPOT: The Spatial Portfolio Optimization Tool**

The Spatial Portfolio Optimization Tool (SPOT) is a generalized computer tool for selecting a portfolio of potential conservation areas, using a flexible approach to automatically design an efficient portfolio around specific conservation goals (Shoutis 2003). SPOT analyzes a region (in this case Nebraska) by dividing it into small parcels called analysis units, then forming a portfolio by marking individual units as included or excluded from the portfolio. During the process known as simulated annealing, SPOT forms and analyzes millions of portfolios while searching for the most efficient portfolio. Each is evaluated according to three criteria:

Conservation goals. These are goals that were set for the number of occurrences of ecological communities and Tier I species populations to be included in the portfolio (see Chapter 3).

Area of portfolio. This is the total land area of the portfolio. The process works to minimize the total area by selecting analysis units with more than one occurrence of species or communities.

Fragmentation. The amount of dispersal of the analysis units selected for a portfolio. The process works to minimize the amount of fragmentation by selecting adjacent analysis units when possible.

The user can set the criteria to put more weight on different criteria. For our analyses, we put the greatest weight on meeting the conservation goals.

In a GIS, we divided the state into 13,781 equal-area hexagonal analysis units. Each unit contained 3,685 acres (~ 5.75 square miles). These units were then attributed with data from the Heritage database on known occurrences of Tier I species and ecological communities. Only records dated 1980 or later were used and for those records which had an estimated viability rating (EORank), we selected only records with an A (excellent estimated viability) or B (good estimated viability) rank. A total of 4,562 community and Tier I species records were used in the analyses.

We did a series of three runs of the analysis. In each run there were 50 iterations and in each iteration the program evaluated 1,000,000 different portfolios and selected the best fit to the criteria (i.e. met the most goals in the least amount of area with the least amount of fragmentation). Then the program would select from those 50 best fits the overall best fit and that would be the output. We used the three overall best fits together in selecting the biologically unique landscapes.

Shoutis, D. 2003. SPOT: The Spatial Portfolio Optimization Tool. 55pp., The Nature Conservancy.

## APPENDIX 6: Natural Heritage Hotspot analysis

### Process

Each Heritage tracked element (species and natural community) was given a weight of 1-5 based on its rarity and priority in the Legacy Project planning process. The GIS theme of Section boundaries was used as the planning grid. Each Section (square mile) was assigned the summed weights of all the occurrences of species and communities within that section. Only occurrences with a date of 1980 or later were used in the analysis. Scores were classified into 5 categories and each assigned a different color in GIS to visually depict areas with the highest concentrations of highly weighted elements.

Number of species in the analysis: 491

Species occurrence records used: 6,194

Number of community types in the analysis: 67

Community occurrence records used: 1,385

### **Weights**

- 5 Tier 1 species (G1-G3, Listed, declining, endemic), S1-S3 communities
- 4 S1 species (G4 or G5, not included above), S4-S5 communities
- 3 S2 species (G4 or G5, not included above)
- 2 S3 species (G4 or G5, not included above)
- 1 S4 species (G4 or G5, not included above)

### **Map classes**

<u>Score</u>	<u>Color</u>	<u>Comment</u>
1-3	blue	One S2-S4 species occurrence (no Tier 1 species or communities)
4-5	green	Typically one Tier 1 or S1 species or one community occurrence
6-15	yellow	At least two elements
16-25	orange	At least four elements
26-83	red	At least six elements

## APPENDIX 7: Ecological Communities of Nebraska

The following is the list of terrestrial ecological communities for Nebraska used in developing the Legacy project. The 69 terrestrial community types listed here cover wetland and upland types (any habitat with rooted vegetation) and are part of the National Vegetation Classification system (Grossman et al. 1998) which is the standard classification used by federal agencies (see NatureServe.org for information on the NVC). Full descriptions of each community type are found in Steinauer and Rolfsmeier (2003). The section on biologically unique landscapes in each ecoregion chapter lists which of the community types is known to occur in each landscape.

Unfortunately, there is currently no statewide classification system for open water habitats (lakes, rivers, streams) and there is an urgent need for such a system to be developed.

A few of the fields that are not self-explanatory are described below.

**G-Rank, S-Rank:** Explanation of ranks is found in appendix 4.

**Goal:** The minimum number of occurrences or examples to be conserved in Nebraska.

**Distribution:** The distribution of the community type in Nebraska relative to its entire range. This was a factor used in setting the goal for each type (see Chapter 3).

- Endemic: community types that only occur within NE or generally have more than 90% of their range within the state.
- Limited: community types that occur primarily within one region (e.g. Great Plains).
- Widespread: community types that are common in a number of regions and widespread in NE.
- Peripheral: community types that are found mainly in other regions, generally less than 10% of their range is within NE.

**Patch Size:** Refers to the amount of area a typical example would have covered historically. This factor was also used in setting the goal for each type (see Chapter 3).

- Matrix: > 1,000 acres
- Large Patch: 100-1,000 acres
- Small Patch: < 100 acres

### **TERRESTRIAL ECOLOGICAL COMMUNITIES**

(Upland and wetland systems with rooted vegetation)

**FOREST** (Trees with crowns overlapping, generally forming 60 – 100% cover)

#### **Wetland Deciduous Forests**

Eastern Riparian Forest

G-Rank: GNR S-Rank: SNR Goal: 5 Distribution: Limited

Patch size: Large Patch

Range in NE: Floodplains in eastern Nebraska

#### **Upland Deciduous Forests**

Oak – Hickory – Ironwood Forest

G-Rank: G3 S-Rank: S2 Goal: 2 Distribution: Peripheral  
 Patch size: Large Patch  
 Range in NE: Occurs along the Missouri River south of Omaha, and small patches may be scattered northward to Dakota County and westward along some major tributaries

Bur Oak – Basswood – Ironwood Forest

G-Rank: G3 S-Rank: S2 Goal: 2 Distribution: Peripheral  
 Patch size: Large Patch  
 Range in NE: Missouri River bluffs from Dakota County west to Knox County, south side of the Niobrara River to Brown County; may be present south to Omaha

Paper Birch Springbranch Canyon Forest

G-Rank: GNR S-Rank: S2 Goal: 20 Distribution: Endemic  
 Patch size: Small Patch  
 Range in NE: Central Niobrara River springbranch canyons

Red Oak – Basswood – Ironwood Forest

G-Rank: G3G4 S-Rank: S? Goal: 2 Distribution: Peripheral  
 Patch size: Large Patch  
 Range in NE: Missouri River bluffs from Washington County southward, may be present north to Dakota County and westward along the Platte River

Upland Bur Oak Forest

G-Rank: G4 S-Rank: S2S3 Goal: 5 Distribution: Limited  
 Patch size: Large Patch  
 Range in NE: Eastern quarter of the state, westward along the Niobrara and Loup Rivers; Platte, Blues and Nemaha Rivers bluffs

Lowland Bur Oak Forest

G-Rank: GNR S-Rank: SNR Goal: 5 Distribution: Limited  
 Patch size: Large Patch  
 Range in NE: Southeast Nebraska on terraces of Salt Creek, Big Blue and Big Nemaha Rivers

Lowland Hackberry – Black Walnut Forest

G-Rank: G? S-Rank: S? Goal: 5 Distribution: Peripheral  
 Patch size: Small Patch  
 Range in NE: Eastern quarter of the state on level ground at the base of deciduous forested bluffs

**Upland Coniferous Forest**

Ponderosa Pine Forest

G-Rank: G4 S-Rank: S2 Goal: 2 Distribution: Peripheral  
 Patch size: Large Patch  
 Range in NE: Pine Ridge, Niobrara Valley, Wildcat Hills

**WOODLAND** (Open stands of trees, generally forming 25 – 60% cover)

**Wetland Deciduous Woodlands**

Western Riparian Woodland

G-Rank: GU S-Rank: S4 Goal: 5 Distribution: Limited

Patch size: Large Patch

Range in NE: Along streams in central and western Nebraska

Eastern Cottonwood – Dogwood Riparian Woodland

G-Rank: GNR S-Rank: S3 Goal: 5 Distribution: Limited

Patch size: Large Patch

Range in NE: Missouri River floodplain from Washington County northward, may also be present on lower Platte River

Eastern Cottonwood – Willow Riparian Woodland

G-Rank: G? S-Rank: S? Goal: 5 Distribution: Widespread

Patch size: Small Patch/Large Patch

Range in NE: Missouri River, Platte River and Elkhorn River floodplains in eastern Nebraska

Diamond Willow Woodland

G-Rank:G3G4 S-Rank: SU Goal: 10 Distribution: Limited

Patch size: Small Patch

Range in NE: Missouri River, Middle Loup River and Elkhorn River floodplains

**Upland Deciduous Woodlands**

Green Ash – Elm Canyon Bottom Woodland

G-Rank: G3 S-Rank: S2 Goal: 10 Distribution: Limited

Patch size: Small Patch

Range in NE: Pine Ridge and Wildcat Hills canyons; canyons on the North Platte and Loup Rivers

Oak Woodland

G-Rank: G1 S-Rank: S2 Goal: 5 Distribution: Limited

Patch size: Large Patch

Range in NE: East half of Nebraska, usually in stream valleys

**Upland Coniferous Woodlands**

Ponderosa Pine Woodland

G-Rank: GU S-Rank: S2 Goal: 5 Distribution: Limited

Patch size: Large Patch

Range in NE: Pine Ridge, central Niobrara River, Wildcat Hills

Mixed Conifer Woodland

G-Rank: G4Q S-Rank: S3 Goal: 5 Distribution: Limited

Patch size: Large Patch

Range in NE: Wildcat Hills and southward in Panhandle of north side of escarpments



Juniper Woodland

G-Rank: G3 S-Rank: S4S5 Goal: 10 Distribution: Limited

Patch size: Small Patch

Range in NE: Central and western Nebraska mainly on the north side of bluffs, hills, canyons, ravines and escarpments

**SHRUBLAND** (Typically > 25% shrub cover)

**Wetland Deciduous Shrublands**

Sandbar Willow Shrubland

G-Rank: G5Q S-Rank: S4S5 Goal: 5 Distribution: Widespread

Patch size: Small Patch

Range in NE: Along streams and rivers throughout the state on sandbars, islands and stream banks

Riparian Dogwood – False Indigobush Shrubland

G-Rank: GU S-Rank: S4? Goal: 5 Distribution: Widespread

Patch size: Small Patch

Range in NE: Streams and rivers in eastern half of Nebraska on high banks and raised islands

**Upland Deciduous Shrublands**

Mountain Mahogany Shrubland

G-Rank: G5 S-Rank: S3 Goal: 5 Distribution: Widespread

Patch size: Small Patch

Range in NE: Wildcat Hills and, to a lesser extent, other escarpments in the west; upper slopes and canyon sides

Buckbrush Shrubland

G-Rank: G4G5 S-Rank: S4 Goal: 10 Distribution: Limited

Patch size: Small Patch

Range in NE: West half of state in mesic swale and depressions

Sumac – Dogwood Shrubland

G-Rank: GNR S-Rank: S5 Goal: 10 Distribution: Limited

Patch size: Small Patch

Range in NE: East half of Nebraska usually bordering upland woods; also in ravines

**HERBACEOUS COMMUNITIES**

**Wetland Meadow Communities**

Marsh Seep

G-Rank: G? S-Rank: S? Goal: 5 Distribution: Widespread

Patch size: Small Patch

Range in NE: Valleys of large rivers and streams throughout the state; margins of streams and natural lakes with high groundwater levels; basins below permanent discharge

areas

Spring Seep

G-Rank: GU S-Rank: S3 Goal: 5 Distribution: Widespread  
 Patch size: Small Patch  
 Range in NE: Throughout the state but best developed in the Sandhills and Pine Ridge; slope of hills, base of bluffs, and valleys where groundwater discharge is present

Prairie Fen

G-Rank: GU S-Rank: S1 Goal: 10 Distribution: Limited  
 Patch size: Small Patch  
 Range in NE: Little Blue River valley in Jefferson County; associated with sandstone slopes, peat soils and groundwater discharge

Sandhills Fen

G-Rank: G3 S-Rank: S1 Goal: 14 Distribution: Endemic  
 Patch size: Large Patch  
 Range in NE: Sandhill valleys; areas with extensive groundwater discharge, peat and muck soils

Eastern Cordgrass Wet Prairie

G-Rank: G3? S-Rank: S1 Goal: 10 Distribution: Limited  
 Patch size: Small Patch/Large Patch  
 Range in NE: Valleys in the tallgrass prairie region of eastern Nebraska on nearly level floodplains

Eastern Saline Meadow

G-Rank:G2G3 S-Rank: S1 Goal: 5 Distribution: Limited  
 Patch size: Large Patch  
 Range in NE: Salt Creek drainage, in shallow depressions and nearly level ground of floodplains. This community contains meadow areas and salt flats

Eastern Sedge Wet Meadow

G-Rank: GNR S-Rank: S1 Goal: 10 Distribution: Limited  
 Patch size: Small Patch  
 Range in NE: Extreme eastern Nebraska along floodplains of the Missouri and Big Nemaha Rivers

Northern Sedge Wet Meadow

G-Rank:G3G4 S-Rank: S3 Goal: 5 Distribution: Limited  
 Patch size: Large Patch  
 Range in NE: Throughout the Sandhills; drainages of Sandhills rivers, the Loup River and the Elkhorn River; along streams, in wet valleys and poorly drained sand flats

Northern Cordgrass Wet Prairie

G-Rank:G2G3 S-Rank: S2 Goal: 5 Distribution: Limited  
 Patch size: Large Patch  
 Range in NE: Platte River valley northward in central Nebraska; on  
 depressions and nearly level ground of floodplains and  
 terraces of streams

Perennial Sandbar

G-Rank: GNR S-Rank: SNR Goal: 5 Distribution: Widespread  
 Patch size: Small Patch  
 Range in NE: Channels of streams throughout the state; sandbars,  
 islands and shorelines

Playa Wetland

G-Rank: GNR S-Rank: SNR Goal: 10 Distribution: Limited  
 Patch size: Small Patch  
 Range in NE: Throughout the state but most common in the Rainwater  
 Basin region; shallow depressions on nearly level ground,  
 temporarily flooded

Western Streamside Wet Meadow

G-Rank: G4 S-Rank: S2 Goal: 10 Distribution: Limited  
 Patch size: Small Patch  
 Range in NE: Nebraska Panhandle; occurs on stream banks and  
 streambeds that contain standing water much of the year

Spikerush Vernal Pool

G-Rank: G5 S-Rank: S1 Goal: 10 Distribution: Limited  
 Patch size: Small Patch  
 Range in NE: Northwestern and north-central Nebraska; small, relatively  
 deep (.5-1m) basin-like depressions in streambeds or  
 vicinity of ponds and marshes

Western Alkaline Meadow

G-Rank: G3 S-Rank: S3 Goal: 5 Distribution: Limited  
 Patch size: Large Patch  
 Range in NE: North Platte River valley and closed basin area of the  
 Sandhills, Niobrara River valley in Sioux County, level  
 ground on river bottoms and interdunal valley bottoms  
 in areas of alkaline lakes and marshes

Wheatgrass Playa Grassland

G-Rank: GNR S-Rank: S1 Goal: 10 Distribution: Limited  
 Patch size: Small Patch/Large Patch  
 Range in NE: Most abundant in level loess plain areas in the Rainwater  
 Basin regions of south-central and southwest Nebraska,  
 but is also apparently present in extreme northwest  
 Nebraska, in the loess hills of central Nebraska, and  
 possibly in the Todd Valley wetlands in eastern Nebraska

**Marsh Communities**

## Pondweed Aquatic Wetland

G-Rank: GNR S-Rank: S4 Goal: 10 Distribution: Limited

Patch size: Small Patch

Range in NE: Freshwater habitats throughout the state; shallow water (&lt;0.5m deep) in natural and artificial basins, backwater and oxbows

## Sandhills Aquatic Wetland

G-Rank: G? S-Rank: S4? Goal: 20 Distribution: Endemic

Patch size: Small Patch/Large Patch

Range in NE: Freshwater lakes region of the Sandhills in water 0.5 to 1.5 meters deep

## Pond Marsh

G-Rank: G4 S-Rank: S3 Goal: 10 Distribution: Limited

Patch size: Small Patch/Large Patch

Range in NE: Rainwater basin, Todd Valley and some in Custer County; basin-like depressions not associated with streams; several zones

## Sandhills Freshwater Marsh

G-Rank: G3? S-Rank: S3 Goal: 20 Distribution: Endemic

Patch size: Small Patch/Large Patch

Range in NE: Sandhills valleys; associated with lakes and meadows; groundwater fed

## Western Alkaline Marsh

G-Rank: G3? S-Rank: S1? Goal: 10 Distribution: Limited

Patch size: Small Patch/Large Patch

Range in NE: Most abundant in closed basin area of the western Sandhills, also in North Platte River Valley; in depressions of the bottomland of the Platte River and alkaline basin in the Sandhills

## Eastern Saline Marsh

G-Rank: GU S-Rank: S1 Goal: 10 Distribution: Limited

Patch size: Small Patch

Range in NE: Salt Creek drainage depression in floodplain with water above the surface most of the year

## Freshwater Marsh

G-Rank: GU S-Rank: S3 Goal: 5 Distribution: Widespread

Patch size: Small Patch/Large Patch

Range in NE: Valleys of streams throughout the state and may be associated with artificial impoundments in the uplands

### **Upland Tallgrass Prairie Communities**

#### Sandhills Dry Valley Prairie

G-Rank: GNR S-Rank: S4 Goal: 14 Distribution: Endemic  
 Patch size: Large Patch  
 Range in NE: Broad to nearly level interdunal valleys and upland stream terraces; soils well drained

#### Tallgrass Prairie

G-Rank: G2 S-Rank: S2 Goal: 3 Distribution: Limited  
 Patch size: Matrix  
 Range in NE: Eastern quarter of the state but westward in eastern Sandhills and valleys of the Loup and Platte Rivers

#### Wet-Mesic Tallgrass Prairie

G-Rank: G2 S-Rank: S2 Goal: 5 Distribution: Limited  
 Patch size: Large Patch  
 Range in NE: Along river and stream valleys within the tallgrass region, primarily on floodplains and terraces; also ravines in uplands

#### Missouri River Floodplain Terrace Grassland

G-Rank: S-Rank: S? Goal: 20 Distribution: Endemic  
 Patch size: Small Patch/Large Patch  
 Range in NE: High terraces of the Missouri River in northeast Nebraska on sands formed from alluvium

### **Upland Mixed-grass Prairie Communities**

#### Missouri River Valley Dune Grassland

G-Rank: S-Rank: S1 Goal: 20 Distribution: Endemic  
 Patch size: Small Patch  
 Range in NE: Terraces of the Missouri River in northeast Nebraska on Moderately sloping sand dunes

#### Sand Sage Prairie

G-Rank: G2 S-Rank: S2? Goal: 3 Distribution: Limited  
 Patch size: Matrix  
 Range in NE: Panhandle, western edge of the Sandhills, Wildcat Hills, Chase, Dundy and Perkins Counties; on rolling dunes, fine and loamy sands

#### Sandhills Dune Prairie

G-Rank: G3? S-Rank: S5 Goal: 3 Distribution: Limited  
 Patch size: Matrix  
 Range in NE: Sandhills and outlying dunes; uplands

#### Dry-Mesic Sand Prairie

G-Rank: GNR S-Rank: S4 Goal: 5 Distribution: Limited  
 Patch size: Large Patch/Matrix

Range in NE: Eastern Sandhills west to Logan and eastern Cherry County; mostly on lower dune slopes and small sandy rises associated with wet meadows

Southern Sand/Gravel Mixed-grass Prairie

G-Rank: GU S-Rank: S3? Goal: 10 Distribution: Limited  
Patch size: Small Patch

Range in NE: Uplands on the north side of the Little Blue River in western Jefferson and Thayer Counties and on the north side of the Republican River in Nuckolls and Webster Counties

Western Floodplain Terrace Grassland

G-Rank: G4 S-Rank: S3 Goal: 10 Distribution: Limited  
Patch size: Small Patch/Large Patch

Range in NE: Along river and stream valleys through at least the western half of the Panhandle; level ground in the floodplains

Silver Sagebrush Shrub Prairie

G-Rank: G4 S-Rank: S1? Goal: 10 Distribution: Limited  
Patch size: Small Patch/Large Patch

Range in NE: White River and Hat Creek drainages in Dawes and Sioux Counties; terraces and floodplains of intermittent streams; poorly drained soils

Greasewood Shrub Prairie

G-Rank: G4 S-Rank: S2 Goal: 10 Distribution: Limited  
Patch size: Small Patch

Range in NE: Hat Creek Basin in northern Sioux County; nearly level ground on upland terraces adjacent to stream valleys; poorly drained alkaline clay and silty clay loam soils

Loess Bluff Prairie

G-Rank: G3? S-Rank: S1 Goal: 10 Distribution: Limited  
Patch size: Small Patch/Large Patch

Range in NE: South side of the Missouri River from Dixon to Knox County, may be westward along the Niobrara River; nearly level slopes and bluff tops of loess

Loess Mixed-grass Prairie

G-Rank: G4 S-Rank: S3 Goal: 3 Distribution: Limited  
Patch size: Matrix

Range in NE: Loess mantled hills and plains of central Nebraska and portions of southeastern and northeastern Nebraska

Western Mixed-grass Prairie

G-Rank: G5 S-Rank: S3S4 Goal: 3 Distribution: Limited  
Patch size: Matrix

Range in NE: Most of the Nebraska Panhandle with the exception of extreme northwest and portions of southwestern Nebraska in Keith and Chase Counties, also occurs eastward along the Niobrara River; on gentle uplands, level to moderate slopes

Northwestern Mixed-grass Prairie

G-Rank: G4 S-Rank: S3S4 Goal: 3 Distribution: Limited

Patch size: Matrix

Range in NE: Occurs in the Hat Creek and White River basins in Dawes, Sheridan and Sioux Counties in extreme northwest Nebraska; uplands with clay soils

Western Sandy Slope Prairie

G-Rank: GNR S-Rank: S3? Goal: 10 Distribution: Limited

Patch size: Small Patch/Large Patch

Range in NE: Within the range of the western mixed-grass prairie in the Panhandle, on slopes below sandstone outcrops and escarpments

Pine Ridge Sandy Slope Prairie

G-Rank: GNR S-Rank: S3? Goal: 5 Distribution: Limited

Patch size: Large Patch

Range in NE: Pine Ridge on slopes below sandstone outcrops and escarpments

Northern Sand/Gravel Prairie

G-Rank: G4 S-Rank: S4 Goal: 10 Distribution: Limited

Patch size: Small Patch/Large Patch

Range in NE: On shoulders of upland bluffs above stream valleys in the Niobrara River drainage from Cherry County to Knox County

**Upland Shortgrass Prairie Communities**

Shortgrass Prairie

G-Rank: G2? S-Rank: S2? Goal: 10 Distribution: Limited

Patch size: Small Patch/Large Patch

Range in NE: Mostly found in the Panhandle on nearly level to rolling uplands; not a very common community

**SPARSELY VEGETATED COMMUNITIES** (Total vegetation cover typically < 25%)

**Wetland Sparsely Vegetated Communities**

Sandbar/Mudflat

G-Rank: G3? S-Rank: S3 Goal: 5 Distribution: Widespread

Patch size: Small Patch

Range in NE: Within channels of larger streams and rivers throughout the state

## **Upland Sparsely Vegetated Communities**

### Western Gravel Flats

G-Rank: G? S-Rank: S3? Goal: 10 Distribution: Limited  
Patch size: Small Patch/Large Patch  
Range in NE: Occurs along the Platte Rivers in Dawson County westward; occurs as patches or bands on level ground, usually on the first terrace of rivers or in level canyon bottoms

### Dry Cliff

G-Rank: GNR S-Rank: S5 Goal: 10 Distribution: Limited  
Patch size: Small Patch  
Range in NE: Escarpments of the Panhandle; > 60% slopes on sandstone and siltstone escarpments

### Rock Outcrop

G-Rank: GNR S-Rank: S4 Goal: 10 Distribution: Limited  
Patch size: Small Patch  
Range in NE: Escarpments in the Panhandle and southwest Nebraska; occurs on level to moderately steep (40% grade) upper and middle slopes on irregularly eroded sandstone and siltstone escarpments and ravines

### Badlands

G-Rank:G4G5 S-Rank: S3 Goal: 10 Distribution: Limited  
Patch size: SMALL PATCH/LARGE PATCH  
Range in NE: Occurs in Dawes, Scottsbluff and Sioux counties, on eroded slopes of siltstone, clay and clay with cobbles; most sites bordered by mixed-grass prairie



**AQUATIC** (Open water systems)

Below is a very basic classification of aquatic systems that was used to attribute the biologically unique landscapes. There is an urgent need to develop a more rigorous aquatic habitat classification system for Nebraska.

**LAKES**

Alkaline  
Non-alkaline

**RIVERS and STREAMS**

Headwater, cold water stream  
Headwater, warm water stream  
Mid-order, cold water river  
Mid-order, warm water river  
Large, warm water river

## **APPENDIX 8: Tier I At-Risk Species**

Tier I species are those that are globally or nationally most at-risk of extinction and which occur in Nebraska. This list is used to help prioritize conservation planning and actions and does not have legal or regulatory ramifications. Conservation of these species is needed to prevent future state/federal listings and help existing listed species recover.

The Tier I at-risk species lists will be periodically reviewed and revised by taxon experts. This revision will occur on an ongoing basis as new information on the abundance, distribution, and population trends becomes available, with an overall review at least every five years.

Species were selected for the Tier I when they met one or more of the following criteria:

**State and Federally Listed Species:** Species listed as threatened or endangered under the federal Endangered Species Act or the Nebraska Non-game and Endangered Species Conservation Act. Recovery and de-listing of these species is a goal of the plan.

**G1-G3 Species:** Species ranked by NatureServe and the Natural Heritage Network as either globally critically imperiled (G1), imperiled (G2) or vulnerable (G3) (see Appendix 4).

**Declining species:** Species whose abundance and/or distribution has been declining across much of their entire range. For land birds, the Partners in Flight national watch list was used as a guide.

**Endemic Species** (or nearly so): Species whose entire range of distribution occurs within or primarily within Nebraska. Conservation actions in Nebraska would be critical to the conservation of the species.

**Disjunct Species:** Species whose populations in Nebraska are widely disjunct (200 miles +) from the species' main range of distribution. Such populations may contain genetic variations that could be important to the long-term survival of the species.

Following the list of species is information on each Tier I species. A few of the fields that are not self-explanatory are described below.

**G-Rank, S-Rank:** Explanation of ranks is found in appendix 4.

**Goal:** The minimum number of populations to be conserved in Nebraska.

**Distribution:** The species distribution in Nebraska relative to its entire range. This was a factor used in setting the goal for each species (see Chapter 3).

Endemic: species that only occur within NE or generally have more than 90% of their range within the state.

Limited: species that occur primarily within one region (e.g. Great Plains)

Widespread: species that are common in a number of regions and widespread in NE.

Peripheral: species that are found mainly in other regions, generally less than 10% of the range is within NE.

**Landscapes:** These are the biologically unique landscapes for which there were known occurrences of populations (or migratory stopover sites) for the species.

## Nebraska Natural Legacy Project Tier 1 At-risk Species

### **Birds**

Bald Eagle  
Bell's Vireo  
Brewer's Sparrow  
Buff-breasted Sandpiper  
Burrowing Owl  
Cerulean Warbler  
Ferruginous Hawk  
Greater-Prairie Chicken  
Henslow's Sparrow  
Interior Least Tern  
King Rail  
Lewis' Woodpecker  
Long-Billed Curlew  
McCown's Longspur  
Mountain Plover  
Piping Plover  
Short-Eared Owl  
Trumpeter Swan  
Whooping Crane

### **Fish**

Blacknose Shiner  
Blue Sucker  
Finescale Dace  
Lake Sturgeon  
Northern Redbelly Dace  
Pallid Sturgeon  
Pearl Dace  
Plains Topminnow  
Sicklefin Chub  
Sturgeon Chub  
Topeka Shiner

### **Insects**

American Burying Beetle  
Bucholz Black Dash  
Iowa Skipper  
Ottoe Skipper  
Platte River Caddisfly  
Regal Fritillary  
Salt Creek Tiger Beetle  
Tawny Crescent

### **Reptiles**

Blanding's Turtle  
Massasauga  
Timber Rattlesnake

### **Mammals**

Fringe-Tailed Myotis  
Long-legged Myotis  
Northern River Otter  
Plains Harvest Mouse  
Plains Pocket Mouse  
Rocky Mountain Bighorn Sheep  
Southern Flying Squirrel  
Swift Fox  
Townsend's Big-Eared Bat

### **Mollusks**

Fatmucket  
Flat Floater  
Pimpleback  
Pistolgrip  
Plain pocketbook  
Pondmussel  
Scaleshell  
Slough Sandshell  
Threeridge  
Higgins eye

### **Plants**

American Ginseng  
Barr's Orophaca  
Blowout Penstemon  
Colorado Butterfly Plant  
Dog-Parsley  
Gordon's Wild Buckwheat  
Hall's Bulrush  
Iowa Moonwort  
Large-Spike Prairie-Clover  
Matted Prickly-phlox  
Meadow Lousewort  
Missouri Sedge  
Saltwort  
Sandhill Goosefoot  
Short's Milkvetch  
Small White Lady's-Slipper  
Snow trillium  
Ute Ladies' Tresses  
Western Prairie White-Fringed Orchid  
Wolf's Spikerush

## BIRDS

<b><u>Common Name</u></b>	Bald Eagle	<b><u>Scientific Name</u></b>	Haliaeetus leucocephalus				
<b><u>G-Rank</u></b>	G4	<b><u>S-Rank</u></b>	S1	<b><u>Goal</u></b>	10	<b><u>Distribution</u></b>	Widespread
<b><u>Criteria for selection as Tier I</u></b>	State and federally listed						
<b><u>Range in NE</u></b>	Statewide						
<b><u>Habitat</u></b>	Riparian woodlands associated with large rivers and lakes						
<b><u>Threats</u></b>	Loss of nesting trees, power lines, illegal shooting and poisoning						
<b><u>Research/Inventory</u></b>	Continued and additional survey and monitoring of nests and winter roost sites						
<b><u>Landscapes</u></b>	Calamus River, Central Loess Hills, Central Platte, Elkhorn Headwaters, Lower Niobrara River, Lower Loup River Core, Lower Platte River, Middle Loup River, Missouri River, Niobrara River, North Platte River Wetlands, Panhandle Prairies, Platte Confluence, Sandhills Alkaline Lakes, Southeast Prairies						

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<b><u>Common Name</u></b>	Bell's Vireo	<b><u>Scientific Name</u></b>	Vireo bellii				
<b><u>G-Rank</u></b>	G5	<b><u>S-Rank</u></b>	S4	<b><u>Goal</u></b>	4	<b><u>Distribution</u></b>	Widespread
<b><u>Criteria for selection as Tier I</u></b>	Declining, PIF watch list						
<b><u>Range in NE</u></b>	Statewide						
<b><u>Habitat</u></b>	All shrubland types except buckbrush, grasslands with shrubs, dependant on shrubs						
<b><u>Threats</u></b>	Encroachment of trees, habitat conversion, fire suppression, cowbirds						
<b><u>Research/Inventory</u></b>	Determine minimum patch size and ratio of shrub to grassland; how to manage with fire control -control cedars but not burn up shrubs						
<b><u>Landscapes</u></b>	Central Loess Hills, Cherry County Wetlands, Dismal River, Indian Cave Bluffs, Loess Canyons, Lower Loup River Core, Lower Niobrara River, Middle Loup River, Missouri River, Niobrara River, North Loup River, Pine Ridge, Platte Confluence, Ponca Bluffs, Oglala Grasslands, Thurston-Dakota Bluffs, Sandhills Alkaline Lakes, Sandsage South, Sandsage North, Sandstone Prairies, Upper Niobrara River						

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<b><u>Common Name</u></b>	Brewer's Sparrow	<b><u>Scientific Name</u></b>	Spizella breweri				
<b><u>G-Rank</u></b>	G5	<b><u>S-Rank</u></b>	S4	<b><u>Goal</u></b>	1	<b><u>Distribution</u></b>	Peripheral
<b><u>Criteria for selection as Tier I</u></b>	Declining, PIF watch list						

**Range in NE** Shortgrass Prairie ecoregion in the panhandle  
**Habitat** Sandsage Prairie, shortgrass, mixed grass w/sandsage component, shrub associated species - low shrubs  
**Threats** Sage removal (to improve rangeland), land conversion – pivots  
**Research/Inventory** Identify habitat requirements, continue surveys, survey for sage  
**Landscapes** Oglala Grasslands, Panhandle Prairies, Upper Niobrara River

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**Common Name** Buff-breasted Sandpiper      **Scientific Name** Tryngites subruficollis  
**G-Rank** G4      **S-Rank** S?      **Goal** 7      **Distribution** Limited  
**Criteria for selection as Tier I** Declining, PIF watch list

**Range in NE** Rainwater basins in East-Central area of state  
**Habitat** Cropland associated with palustrine wetlands-open flats, very short stature grasslands, playa wetlands, require mixture of agricultural and wetlands  
**Threats** Agricultural practices, contaminants  
**Research/Inventory** Identify food sources, migratory stopover duration, roost sites, what agricultural practices favor them, effects of agricultural practices-contaminants, population trend  
**Landscapes** Rainwater Basin-East

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**Common Name** Burrowing Owl      **Scientific Name** Athene cunicularia  
**G-Rank** G4      **S-Rank** S3      **Goal** 4      **Distribution** Widespread  
**Criteria for selection as Tier I** Ranked as imperiled or vulnerable in nearly all states in its range  
**Range in NE** Western two-thirds of state  
**Habitat** Prairie dog towns, Shortgrass Prairie, Mixed-grass Prairie, heavily grazed grasslands  
**Threats** Prairie dog control, habitat conversion-pivots, loss of short, open grasslands; plague  
**Research/Inventory** Expand inventory, productivity, cause of population variability-predators, status and trends of prairie dogs  
**Landscapes** Central Loess Hills, Cherry County Wetlands, Kimball Grasslands, North Platte River Wetlands, Oglala Grasslands, Panhandle Prairies, Sandhills Alkaline Lakes, Upper Niobrara River, Wildcat Hills, Sandsage North, Sandsage South, Rainwater Basins-West, Rainwater Basins-East, Elkhorn Headwaters, Dismal Headwaters

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**Common Name** Cerulean Warbler                      **Scientific Name** Dendroica cerulea  
**G-Rank** G4                      **S-Rank** S2                      **Goal** 1                      **Distribution** Peripheral

**Criteria for selection as Tier I**      Declining, PIF watch list

**Range in NE**                      Missouri River bluffs from Thurston to Richardson counties

**Habitat**                      Deciduous forest with emergents, old forest with little undergrowth, Eastern Riparian Forest, Red Oak-Basswood-Ironwood Forest, Lowland Hackberry Forest, streams where bluff meets floodplain

**Threats**                      Logging, fragmentation, cowbirds

**Research/Inventory**      Habitat requirements - particularly in relation to habitat alteration

**Landscapes**                      Missouri River, Indian Cave Bluffs, Ponca Bluffs, Thurston-Dakota Bluffs

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**Common Name** Ferruginous Hawk                      **Scientific Name** Buteo regalis  
**G-Rank** G4                      **S-Rank** S2                      **Goal** 7                      **Distribution** Widespread

**Criteria for selection as Tier I**      Ranked as imperiled or vulnerable in nearly all states in its range

**Range in NE**                      Western third of state-primarily panhandle

**Habitat**                      Rock Outcrop, Shortgrass Prairie, Sandhills Dune Prairie, prairie dog towns, (may be using rock outcrops less now)

**Threats**                      Human activity (agriculture/farming), prairie dog control, habitat fragmentation

**Research/Inventory**      Survey southwest NE, Sandhills, and southern Sioux County, identify range in Sandhills associated with prairie dogs, long range movement

**Landscapes**                      Central Loess Hills, Kimball Grasslands, Oglala Grasslands, Panhandle Prairies, Pine Ridge, Sandsage South, Upper Niobrara River

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**Common Name** Greater-Prairie Chicken                      **Scientific Name** Tympanuchus cupido  
**G-Rank** G4                      **S-Rank** S3S4                      **Goal** 4                      **Distribution** Limited

**Criteria for selection as Tier I**      Declining, PIF watch list

**Range in NE**                      Primarily north-central sandhills, scattered eastern three-quarters of state

**Habitat**                      Sandsage Prairie, Tallgrass Prairie, Sandhills Dry Valley Prairie, Loess Mixed-grass Prairie

**Threats**                      Habitat conversion and fragmentation, grassland management (loss of forbs), loss of some shrubs

**Research/Inventory**      Continue surveys

**Landscapes**                      Central Loess Hills, Cherry County Wetlands, Sandsage Prairie, Sandstone Prairies, Southeast Prairies, Verdigre-Bazile Watershed

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<b><u>Common Name</u></b>	Henslow's Sparrow	<b><u>Scientific Name</u></b>	Ammodramus henslowii				
<b><u>G-Rank</u></b>	G4	<b><u>S-Rank</u></b>	S1	<b><u>Goal</u></b>	7	<b><u>Distribution</u></b>	Limited
<b><u>Criteria for selection as Tier I</u></b>	Declining, PIF watch list						
<b><u>Range in NE</u></b>	SE portion of state						
<b><u>Habitat</u></b>	Tallgrass Prairie, Wet-mesic Tallgrass Prairie, will use CRP, prefers large open grasslands						
<b><u>Threats</u></b>	Annual burning (lack of litter), habitat conversion, woody species invasion, haying during nesting period						
<b><u>Research/Inventory</u></b>	Needs inventory, identify prairie size requirements						
<b><u>Landscapes</u></b>	Sandstone Prairies, Southeast Prairies						

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<b><u>Common Name</u></b>	Interior Least Tern	<b><u>Scientific Name</u></b>	Sterna antillarum athalassos				
<b><u>G-Rank</u></b>	G4T2	<b><u>S-Rank</u></b>	S2	<b><u>Goal</u></b>	10	<b><u>Distribution</u></b>	Limited
<b><u>Criteria for selection as Tier I</u></b>	State and federally listed, G2						
<b><u>Range in NE</u></b>	Platte River east of Lake McConaughy, lower reaches of major rivers north of Platte River						
<b><u>Habitat</u></b>	Bare sand bars and sandy shorelines of large rivers, lakes and sand pits						
<b><u>Threats</u></b>	Loss of natural river flows to maintain bare sandbar and shoreline habitat; flooding of nests; loss of nests to vehicles and human disturbance						
<b><u>Research/Inventory</u></b>	Nesting surveys throughout breeding range in state						
<b><u>Landscapes</u></b>	Calamus River, Central Platte, Lower Loup River, Lower Loup River Core, Lower Platte River, Lower Niobrara River, Middle Loup River, Missouri River, Niobrara River, Verdigre-Bazile Watershed, Elkhorn Confluence, Ponca Bluffs, Lake McConaughy						

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<b><u>Common Name</u></b>	King Rail	<b><u>Scientific Name</u></b>	Rallus elegans				
<b><u>G-Rank</u></b>	G4	<b><u>S-Rank</u></b>	S1	<b><u>Goal</u></b>	1	<b><u>Distribution</u></b>	Widespread
<b><u>Criteria for selection as Tier I</u></b>	Declining						
<b><u>Range in NE</u></b>	Primarily eastern third of state - scattered and localized west						
<b><u>Habitat</u></b>	Marshes, wetland complexes that maintain wet habitat during drought						
<b><u>Threats</u></b>	Habitat loss and degradation, needs high quality marsh						
<b><u>Research/Inventory</u></b>	Inventory, determine specific habitat requirements						



**Landscapes** Rainwater Basin-East

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**Common Name** Lewis' Woodpecker      **Scientific Name** Melanerpes lewis  
**G-Rank** G5      **S-Rank** S2      **Goal** 1      **Distribution** Peripheral  
**Criteria for selection as Tier I** Declining, PIF watch list  
**Range in NE** Pine ridge in northern Sioux County  
**Habitat** Ponderosa pine forest and woodland, associated with burns and some live forest edges  
**Threats** Fire suppression, Kestral predation  
**Research/Inventory** Survey Fort Robinson and Pine Ridge area (recently burned areas)  
**Landscapes** Pine Ridge

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**Common Name** Long-Billed Curlew      **Scientific Name** Numenius americanus  
**G-Rank** G5      **S-Rank** S3      **Goal** 4      **Distribution** Widespread  
**Criteria for selection as Tier I** Ranked as imperiled or vulnerable in nearly all states in its range  
**Range in NE** North-central through panhandle  
**Habitat** Sandhills Dune Prairie, Sandhill Valley Prairie with mixed grass, prairie dog towns, mixedgrass and shortgrass prairie in the Panhandle  
**Threats** Habitat conversion, pivots, fragmentation  
**Research/Inventory** More inventory, determine nest success, habitat needs, and management impacts  
**Landscapes** Central Loess Hills, Cherry County Wetlands, Dismal River Headwaters, Oglala Grasslands, Panhandle Prairies, Platte Confluence, Sandhills Alkaline Lakes, Sandsage Prairie, Upper Loup River, Upper Niobrara River

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**Common Name** Mccown's Longspur      **Scientific Name** Calcarius mccownii  
**G-Rank** G5      **S-Rank** S3      **Goal** 7      **Distribution** Limited  
**Criteria for selection as Tier I** Declining, PIF watch list  
**Range in NE** Panhandle - primarily Sioux, Scotts Bluff, Banner and Kimball counties  
**Habitat** Shortgrass with mixed grass, short stature vegetation, prairie dog colonies  
**Threats** Habitat fragmentation and conversion, management that maintains higher vegetation structure, prairie dog control

**Research/Inventory** Identify habitat requirements, continue surveys

**Landscapes** Kimball Grasslands, Ogala Grasslands, Panhandle Prairies

**Common Name** Mountain Plover **Scientific Name** Charadrius montanus

**G-Rank** G2 **S-Rank** S1 **Goal** 10 **Distribution** Limited

**Criteria for selection as Tier I** State listed, G2

**Range in NE** Kimball and Cheyenne, possibly Sioux counties

**Habitat** Shortgrass, fallow fields, prairie dog towns, very low stature vegetation, flat

**Threats** Agriculture practices, predation on range sites, grazing management that maintains higher vegetation structure, habitat conversion and fragmentation

**Research/Inventory** Native grassland surveys, determine productivity on field vs. native prairie, spatial requirements for prairie near fallow, habitats for brood rearing and migration, and effects of agriculture practices on foraging

**Landscapes** Kimball Grasslands, Panhandle Prairies

**Common Name** Piping Plover **Scientific Name** Charadrius melodus

**G-Rank** G3 **S-Rank** S2 **Goal** 10 **Distribution** Limited

**Criteria for selection as Tier I** State and federally listed, G3

**Range in NE** Platte River east of Lake McConaughy, lower reaches of major rivers north of Platte River

**Habitat** Bare sand bars and sandy shorelines of large rivers, lakes and sand pits

**Threats** Loss of natural river flows to maintain bare sandbar and shoreline habitat; flooding of nests; loss of nests to vehicles and human disturbance

**Research/Inventory** Nesting surveys throughout breeding range in state

**Landscapes** Calamus River, Central Platte, Lower Loup River, Lower Loup River Core, Lower Platte River, Lower Niobrara River, Middle Loup River, Missouri River, Niobrara River, Verdigre-Bazile Watershed, Ponca Bluffs

**Common Name** Short-Eared Owl **Scientific Name** Asio flammeus

**G-Rank** G5 **S-Rank** S2 **Goal** 4 **Distribution** Widespread

**Criteria for selection as Tier I** Declining, PIF watch list

**Range in NE** Scattered statewide

**Habitat** Open grasslands with standing cover and little disturbance

**Threats** Habitat loss and fragmentation, disturbance of nesting habitat

**Research/Inventory** Surveys to identify location and extent of breeding activity, determine specific nesting habitat requirements

**Landscapes** Central Loess Hills, Cherry County Wetlands, Sandhills Alkaline Lakes, Sandsage Prairie

**Common Name** Trumpeter Swan **Scientific Name** Cygnus buccinator

**G-Rank** G4 **S-Rank** S2 **Goal** 4 **Distribution** Limited

**Criteria for selection as Tier I** Ranked as imperiled or vulnerable in all states in its range  
**Range in NE** Primarily Cherry, Sheridan and Garden counties

**Habitat** Deep water wetlands and marsh lakes with dense emergent vegetation; spring fed streams

**Threats** Wetland drainage/loss, disturbance, pollution

**Research/Inventory** Continue inventory

**Landscapes** Cherry County Wetlands, Dismal River Headwaters, Elkhorn Headwaters, Middle Loup River, Sandhills Alkaline Lakes, Snake River

**Common Name** Whooping Crane **Scientific Name** Grus americana

**G-Rank** G1 **S-Rank** S1 **Goal** 10 **Distribution** Limited

**Criteria for selection as Tier I** State and federally listed, G1

**Range in NE** Platte River from Scottsbluff to Chapman, wetlands and major rivers in central flyway

**Habitat** Wetlands, wet meadows, sandbars and shallow water in rivers

**Threats** Loss of natural river flows to maintain wet meadows, bare sandbar and shallow water habitat, loss of wetland habitat

**Research/Inventory** Continue migration surveys, increased surveys of sandhill wetlands

**Landscapes** Calamus River, Central Platte River, Cherry County Wetlands, Elkhorn Headwaters, Lower Loup River Core, Middle Loup River, Niobrara River, North Loup River, North Platte River Wetlands, Panhandle Prairies, Rainwater Basin-East, Rainwater Basin-West, Verdigre-Bazile Watershed

## Fish

<b><u>Common Name</u></b>	Blacknose Shiner	<b><u>Scientific Name</u></b>	Notropis heterolepis	
<b><u>G-Rank</u></b>	G4	<b><u>S-Rank</u></b>	S1	<b><u>Goal</u></b> 10
				<b><u>Distribution</u></b> Disjunct
<b><u>Criteria for selection as Tier I</u></b>	State listed, disjunct			
<b><u>Range in NE</u></b>	North-central portion of state			
<b><u>Habitat</u></b>	Headwater streams, spring fed, clear water, pools, quiet waters			
<b><u>Threats</u></b>	De-watering, siltation, interruption of stream movement, channelization, exotic species, culverts, water control structures			
<b><u>Research/Inventory</u></b>	Determine age structure, recruitment, population dynamics, seasonal movement, habitat use			
<b><u>Landscapes</u></b>	Cherry County Wetlands, Keya Paha Watershed, North Loup River, Upper Niobrara River			

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<b><u>Common Name</u></b>	Blue Sucker	<b><u>Scientific Name</u></b>	Cycleptus elongatus	
<b><u>G-Rank</u></b>	G3G4	<b><u>S-Rank</u></b>	S3	<b><u>Goal</u></b> 7
				<b><u>Distribution</u></b> Limited
<b><u>Criteria for selection as Tier I</u></b>	G3			
<b><u>Range in NE</u></b>	Lower Platte and Missouri River - Boyd through Richardson counties			
<b><u>Habitat</u></b>	Large turbid rivers			
<b><u>Threats</u></b>	Channelization, alteration of flow, lack of sedimentation in some areas of Missouri River, interruption of movement, water quality			
<b><u>Research/Inventory</u></b>	Determine specific habitat requirements, population dynamics, seasonal movement			
<b><u>Landscapes</u></b>	Lower Platte River, Missouri River			

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<b><u>Common Name</u></b>	Finescale Dace	<b><u>Scientific Name</u></b>	Phoxinus neogaeus	
<b><u>G-Rank</u></b>	G5	<b><u>S-Rank</u></b>	S2	<b><u>Goal</u></b> 10
				<b><u>Distribution</u></b> Disjunct
<b><u>Criteria for selection as Tier I</u></b>	State listed, disjunct			
<b><u>Range in NE</u></b>	Sandhills of central portion of state			
<b><u>Habitat</u></b>	Headwater streams, spring fed, clear water, sandhill streams, beaver ponds, undercut banks, meandering streams, small pools			

**Threats** Channel modification, de-watering, exotics, culverts, water control structures

**Research/Inventory** Determine age structure, recruitment, population dynamics, seasonal movements, habitat use

**Landscapes** Cherry County Wetlands, Dismal River Headwaters, Keya Paha Watershed, North Loup River, Panhandle Prairies, Platte Confluence, Snake River, Upper Niobrara River

**Common Name** Lake Sturgeon **Scientific Name** Acipenser fulvescens

**G-Rank** G3G4 **S-Rank** S1 **Goal** 10 **Distribution** Peripheral

**Criteria for selection as Tier I** State listed, G3

**Range in NE** Lower Platte and Missouri River - Boyd through Richardson counties

**Habitat** Shallow water, gravel/rocky substrate – for spawning, large rivers, lakes in other states

**Threats** Pollution, lack of spawning habitat, fragmentation of habitat (dams), interruption of movement, decreasing water levels in Platte River

**Research/Inventory** Increase surveys, determine specific spawning habitat, population dynamics

**Landscapes** Lower Platte River, Missouri River

**Common Name** Northern Redbelly Dace **Scientific Name** Phoxinus eos

**G-Rank** G5 **S-Rank** S3 **Goal** 10 **Distribution** Disjunct

**Criteria for selection as Tier I** State listed, disjunct

**Range in NE** Sandhills of central portion of state

**Habitat** Spring-fed, clear, headwater streams, pools

**Threats** De-watering, siltation, interruption of stream movement, exotic species

**Research/Inventory** Determine age structure, recruitment, population dynamics, seasonal movement, specific habitat use

**Landscapes** Cherry County Wetlands, Dismal River Headwaters, Keya Paha Watershed, North Loup River, Panhandle Prairies, Platte Confluence, Snake River

**Common Name** Pallid Sturgeon **Scientific Name** Scaphirhynchus albus

**G-Rank** G1 **S-Rank** S1 **Goal** 10 **Distribution** Limited

**Criteria for selection as Tier I** State and federally listed, G1

**Range in NE** Lower Platte and Missouri River - Boyd through Richardson counties

**Habitat** Large turbid rivers, steep drop-offs at the edge of sandbars, sandy areas

**Threats** Manipulation of water flow, sediment transport, channelization, lack of low flow habitat, fragmentation, loss of spawning habitat

**Research/Inventory** Determine specific spawning habitat requirements, population dynamics, seasonal movement

**Landscapes** Lower Platte River, Lower Niobrara River, Missouri River, Verdigre-Bazile Watershed, Ponca Bluffs

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**Common Name** Pearl Dace   **Scientific Name** Margariscus margarita

**G-Rank** G5           **S-Rank** S3   **Goal** 1           **Distribution** Disjunct

**Criteria for selection as Tier I** Disjunct

**Range in NE** Sandhills of central portion of state

**Habitat** Spring-fed, clear, headwater, Sandhill streams, beaver ponds, undercut banks, meandering streams, small pools

**Threats** De-watering, siltation, interruption of stream movement, channelization, culverts, control structures, exotic species

**Research/Inventory** Determine age structure, recruitment, population dynamics, seasonal movement, specific habitat use

**Landscapes** Cherry County Wetlands, Dismal River Headwaters, Keya Paha Watershed, North Loup River, Panhandle Prairies, Snake River, Upper Niobrara River

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**Common Name** Plains Topminnow   **Scientific Name** Fundulus sciaticus

**G-Rank** G4           **S-Rank** S4   **Goal** 10           **Distribution** Endemic

**Criteria for selection as Tier I** Endemic, declining

**Range in NE** Northwest two-thirds of state

**Habitat** Vegetative backwaters and headwaters, shallow parts of rivers and streams

**Threats** Predation, competition from Gambusia, exotics, de-watering

**Research/Inventory** Distribution surveys, identify secure occurrence locations, determine competition dynamic with Gambusia

**Landscapes** Calamus River, Central Platte, Cherry County Wetlands, Dismal River, Elkhorn Headwaters, Keya Paha Watershed, Lower Platte River, Lower Loup River Core, North Loup River, Panhandle Prairies, Platte Confluence, Sandsage North, Snake River, Upper Niobrara River, Verdigre-Bazile Watershed, Wildcat Hills, Willow Creek

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**Common Name** Sicklefin Chub   **Scientific Name** Macrhybopsis meeki

**G-Rank** G3      **S-Rank** S2      **Goal** 7      **Distribution** Limited

**Criteria for selection as Tier I**      G3

**Range in NE**      Missouri River - Boyd through Richardson counties

**Habitat**      Large turbid rivers - Missouri River

**Threats**      Reduction of turbidity, channelization, modified water flows

**Research/Inventory**      Determine specific habitat requirements, population dynamics, seasonal movement

**Landscapes**      Missouri River

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**Common Name**      Sturgeon Chub      **Scientific Name**      *Macrhybopsis gelida*

**G-Rank** G3      **S-Rank** S1      **Goal** 10      **Distribution** Limited

**Criteria for selection as Tier I**      State listed, G3

**Range in NE**      Lower Platte and Missouri River - Boyd through Richardson counties

**Habitat**      Large turbid rivers with gravel, turbidity

**Threats**      Reduction of turbidity, channelization, modified water flows, loss of spawning habitat, de-watering, sediment transport

**Research/Inventory**      Determine specific habitat requirements, population dynamics, seasonal movement

**Landscapes**      Lower Platter River, Missouri River

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**Common Name**      Topeka Shiner      **Scientific Name**      *Notropis topeka*

**G-Rank** G3      **S-Rank** S1      **Goal** 10      **Distribution** Limited

**Criteria for selection as Tier I**      State and federally listed, G3

**Range in NE**      Very localized: Cherry and Madison counties

**Habitat**      Cold/cool clear water streams with gravel, low gradient

**Threats**      Sedimentation, exotics, channelization, stocking of sport fish, row crop agriculture, flow modification, de-watering, decrease in water quality

**Research/Inventory**      Determine age structure, recruitment, population dynamics, seasonal movements

**Landscapes**      Cherry County Wetlands, North Loup River

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## Insects

**Common Name** American Burying Beetle      **Scientific Name** Nicrophorus americanus  
**G-Rank** G2G3      **S-Rank** S1      **Goal** 10      **Distribution** Limited  
**Criteria for selection as Tier I** State and federally listed, G2  
**Range in NE** North-central and southwest-central portion of the state  
**Habitat** Wet meadows in sandhills, open woodlands, loess prairie, Platte River riparian woodlands  
**Threats** Woody encroachment, drought, agriculture and land development, light pollution  
**Research/Inventory** Determine specific habitat use, effects of land management practices, population sizes  
**Landscapes** Calamus River, Cherry County Wetlands, Dismal River, Elkhorn Headwaters, Keya Paha Watershed, Middle Loup River, North Loup River, Loess Canyons

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**Common Name** Bucholz Black Dash      **Scientific Name** Euphyes conspicua bucholzi  
**G-Rank** G4T1      **S-Rank** S1      **Goal** 10      **Distribution** Endemic  
**Criteria for selection as Tier I** G1, endemic  
**Range in NE** North-eastern portion of state  
**Habitat** Eastern Sedge Wet Meadow - larvae feed on wide leaf sedge, adults in boggy areas  
**Threats** Habitat conversion and fragmentation, exotics, drying up of "wet" areas  
**Research/Inventory** Inventory surveys, determine population size and dynamics, best management practices  
**Landscapes** Calamus River, Elkhorn Confluence

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**Common Name** Iowa Skipper      **Scientific Name** Atrytone arogos iowa  
**G-Rank** G3G4      **S-Rank** S?      **Goal** 7      **Distribution** Limited  
**Criteria for selection as Tier I** G3  
**Range in NE** Eastern half of state  
**Habitat** Tallgrass Prairie, Mixed-grass Prairie along the Niobrara - bluestems likely host plant, requires native prairie with standing grass stems



**Threats** Management practices that remove all standing grass stems, litter and nectar sources, burning of entire grassland site can be detrimental, habitat fragmentation

**Research/Inventory** Inventory survey, determine best management practices

**Landscapes** Keya Paha Watershed

**Common Name** Ottoe Skipper **Scientific Name** Hesperia ottoe

**G-Rank** G3G4 **S-Rank** S3 **Goal** 7 **Distribution** Limited

**Criteria for selection as Tier I** G3

**Range in NE** Eastern half of state

**Habitat** Tallgrass Prairie, rolling/hilly prairie, Mixed-grass Prairie - feed on bluestems

**Threats** Loss of native grasslands, management practices that remove all standing grass stems, litter and nectar sources, burning of entire grassland site can be detrimental, exotics, habitat fragmentation

**Research/Inventory** Inventory survey, determine best management practices

**Landscapes** Lower Loup River, Niobrara River, Sandstone Prairies

**Common Name** Platte River Caddisfly **Scientific Name**

**G-Rank** G!? **S-Rank** S1 **Goal** 10 **Distribution** Endemic

**Criteria for selection as Tier I** G1, endemic

**Range in NE** Central Platte River: Kearney, Hall, and Merrick counties

**Habitat** Sloughs, backwaters, wet meadows

**Threats** Loss of natural river flows to maintain sloughs, backwater, and wet meadow habitat, use of insecticides, habitat conversion

**Research/Inventory** Inventory surveys, determine population dynamics, specific habitat requirements

**Landscapes** Central Platte

**Common Name** Regal Fritillary **Scientific Name** Speyeria idalia

**G-Rank** G3 **S-Rank** S3 **Goal** 4 **Distribution** Widespread

**Criteria for selection as Tier I** G3

**Range in NE** Western three-fourths of state (primarily the eastern half of this area)

**Habitat** Tallgrass and midgrass prairie with violets

**Threats** Habitat loss and fragmentation, exotics, drought, overgrazing or herbicide use that eliminates violets

**Research/Inventory** Inventory surveys, monitor population trends

**Landscapes** Central Loess Hills, Central Platte, Cherry County Wetlands, Dismal River, Keya Paha Watershed, Lower Loup River, Lower Loup River Core, Lower Platte River, Middle Loup River, Niobrara River, North Platte River Wetlands, Panhandle Prairies, Southeast Prairies, Upper Niobrara River, Willow Creek Prairies

**Common Name** Salt Creek Tiger Beetle      **Scientific Name** Cicindela nevadica lincolniana

**G-Rank** G5T3      **S-Rank** S1      **Goal** 10      **Distribution** Endemic

**Criteria for selection as Tier I** State listed, federal candidate, endemic

**Range in NE** Lancaster county

**Habitat** Eastern Nebraska saline wetlands and their associated streams

**Threats** Habitat loss and degradation, urban development, impacts to natural hydrology, wetland drainage due to stream channelization and headcutting, light pollution

**Research/Inventory** Identify specific reproductive habitat parameters, determine best habitat restoration methods

**Landscapes** Saline Wetlands

**Common Name** Tawny Crescent      **Scientific Name** Phyciodes batesii

**G-Rank** G4      **S-Rank** S2      **Goal** 4      **Distribution** Widespread

**Criteria for selection as Tier I** Declining, ranked as possibly extirpated, imperiled or vulnerable in most states in its range

**Range in NE** Pine ridge- Sioux county

**Habitat** Canyon type habitat - close to water, between stream and dry, pine wooded areas with grassland openings

**Threats** Limited by host plant availability - Aster laevis, over grazing

**Research/Inventory** Inventory surveys, determine life cycle and specific habitat requirements

**Landscapes** Pine Ridge

## Mammals

**Common Name** Fringe-Tailed Myotis      **Scientific Name** Myotis thysanodes pahasapensis  
**G-Rank** G4G5T2    **S-Rank** S1      **Goal** 7      **Distribution** Limited  
**Criteria for selection as Tier I** G2  
**Range in NE** Pine forests in panhandle  
**Habitat** Ponderosa Pine Forest and Woodland, Green Ash-Elm Bottom Woodland  
**Threats** Loss of mature pine forests (logging); large scale, stand removing fires  
**Research/Inventory** Inventory surveys, identify maternal roost habitat requirements and winter hibernacula  
**Landscapes** Pine Ridge, Wildcat Hills

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**Common Name** Long-legged Myotis      **Scientific Name** Myotis volans  
**G-Rank** G5      **S-Rank** S2      **Goal** 1      **Distribution** Peripheral  
**Criteria for selection as Tier I** Declining  
**Range in NE** Extreme northwest panhandle  
**Habitat** Ponderosa Pine Forest and Woodland, Green Ash-Elm Bottom Woodland, Canyon Bottom Woodland, Badlands  
**Threats** Logging and large scale, stand removing fires, loss of mature forests and woodlands  
**Research/Inventory** Inventory surveys, identify maternal roost habitat requirements and winter hibernacula  
**Landscapes** Oglala Grasslands, Pine Ridge

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**Common Name** Northern River Otter      **Scientific Name** Lontra canadensis  
**G-Rank** G5      **S-Rank** S2      **Goal** 10      **Distribution** Widespread  
**Criteria for selection as Tier I** State listed  
**Range in NE** Statewide  
**Habitat** Along rivers and streams with sloughs and backwater areas, marshes, will frequent lakes and ponds  
**Threats** Accidental trapping, habitat loss, pesticides and pollution

**Research/Inventory** Inventory and monitoring surveys

**Landscapes** Calamus River, Central Platte River, Elkhorn Headwaters, Lower Platte River, North Loup River, North Platte River Wetlands, Upper Loup River, Upper Niobrara River

**Common Name** Plains Harvest Mouse      **Scientific Name** Reithrodontomys montanus griseus

**G-Rank** G5TNR    **S-Rank** S1      **Goal** 7      **Distribution** Limited

**Criteria for selection as Tier I** Regional endemic, declining?

**Range in NE** Southeast portion of state

**Habitat** Tallgrass Prairie - heavily grazed

**Threats** Loss of Tallgrass Prairie habitat, lack of heavy grazing/management issues

**Research/Inventory** Inventory surveys, determine specific habitat requirements

**Landscapes** Sandstone Prairies, Southeast Prairies

**Common Name** Plains Pocket Mouse      **Scientific Name** Perognathus flavescens perniger

**G-Rank** G5TNR    **S-Rank** SU?      **Goal** 7      **Distribution** Limited

**Criteria for selection as Tier I** Regional endemic, declining?

**Range in NE** Northeast portion of state-potentially southeast portion of state

**Habitat** Tallgrass Prairie, sandy-loose soil prairies, Loess Bluff Prairie, Loess Mixed-grass Prairie, Northern Sand/Gravel Prairie

**Threats** Loss of Tallgrass Prairie habitat

**Research/Inventory** Inventory surveys, determine specific habitat requirements

**Landscapes** Sandstone Prairies, Southeast Prairies

**Common Name** Rocky Mountain Bighorn Sheep      **Scientific Name** Ovis canadensis canadensis

**G-Rank** G4T4    **S-Rank** S1      **Goal** 1      **Distribution** Disjunct

**Criteria for selection as Tier I** Disjunct

**Range in NE** Buttes in Scottsbluff and Sioux counties

**Habitat** Rocky buttes of Pine Ridge and Wildcat Hills

**Threats** Parasites, hoof deformations, potential disease

**Research/Inventory** Monitor for parasites and disease, determine source of hoof deformities

**Landscapes** Pine Ridge, Wildcat Hills

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**Common Name** Southern Flying Squirrel      **Scientific Name** Glaucomys volans  
**G-Rank** G5      **S-Rank** S1      **Goal** 5      **Distribution** Peripheral  
**Criteria for selection as Tier I** State listed  
**Range in NE** Missouri River bluffs-Washington to Richardson counties  
**Habitat** Red Oak-Basswood-Ironwood Forest  
**Threats** Loss of mature forest with old growth trees with nest holes  
**Research/Inventory** Inventory and monitoring surveys  
**Landscapes** Missouri River, Indian Cave Bluffs, Rulo Bluffs

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**Common Name** Swift Fox      **Scientific Name** Vulpes velox  
**G-Rank** G3      **S-Rank** S2      **Goal** 10      **Distribution** Limited  
**Criteria for selection as Tier I** State listed, G3  
**Range in NE** Panhandle  
**Habitat** Shortgrass Prairie, Western Mixed-grass Prairie  
**Threats** Predator control, conversion to cropland, fragmentation of habitat, loss of prairie dog colonies  
**Research/Inventory** Inventory and monitoring surveys  
**Landscapes** Kimball Grasslands, Oglala Grasslands, Panhandle Prairies, Pine Ridge, Upper Niobrara River, Wildcat Hills

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**Common Name** Townsend's Big-Eared Bat      **Scientific Name** Corynorhinus townsendii  
**G-Rank** G4      **S-Rank** S1      **Goal** 1      **Distribution** Peripheral  
**Criteria for selection as Tier I** Declining, ranked as imperiled or vulnerable in all states in its range  
**Range in NE** Sheridan and Sioux counties  
**Habitat** Ponderosa Pine Forest and Woodland, Dry Cliff or Rock Outcrop - requires caves, crevasses  
**Threats** Lack of maternal roost sites and winter hibernacula  
**Research/Inventory** Inventory surveys, identify maternal roost habitat requirements and winter hibernacula

**Landscapes** Pine Ridge

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## Mollusks

**Common Name** Fatmucket **Scientific Name** *Lampsilis siliquoidea*  
**G-Rank** G5 **S-Rank** S1 **Goal** 4 **Distribution** Widespread  
**Criteria for selection as Tier I** Declining  
**Range in NE** Streams in eastern third of state  
**Habitat** Lakes and small to medium sized streams and large rivers in mud, sand, or gravel  
**Threats** Stream channelization, siltation, degradation of water quality, agriculture and urban effluent  
**Research/Inventory** Inventory surveys, determine specific habitat requirements  
**Landscapes** Missouri River, Elkhorn Confluence, Saline Wetlands

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**Common Name** Flat Floater **Scientific Name** *Anodonta suborbiculata*  
**G-Rank** G5 **S-Rank** S1 **Goal** 4 **Distribution** Widespread  
**Criteria for selection as Tier I** Declining, ranked as imperiled or vulnerable in nearly all states in its range  
**Range in NE** Missouri River- Boyd through Richardson counties  
**Habitat** Quiet water of sloughs, oxbows, and backwaters of Missouri River  
**Threats** Drainage, filling and siltation of sloughs, oxbows, and backwaters, stream channelization, degradation of water quality  
**Research/Inventory** Inventory surveys, determine specific habitat requirements  
**Landscapes** Missouri River

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**Common Name** Higgins eye **Scientific Name** *Lampsilis higginsii*  
**G-Rank** G1 **S-Rank** S1 **Goal** 7 **Distribution** Limited  
**Criteria for selection as Tier I** G1  
**Range in NE** Upper reach of Missouri River

**Habitat** Large to medium rivers in mud and sand

**Threats** Stream channelization, siltation, degradation of water quality, agriculture and urban effluent

**Research/Inventory** Inventory surveys, determine specific habitat requirements

**Landscapes** Missouri River

**Common Name** Pimpleback                      **Scientific Name** *Quadrula pustulosa*

**G-Rank** G5              **S-Rank** S2                      **Goal** 4              **Distribution** Widespread

**Criteria for selection as Tier I** Declining

**Range in NE** Streams in eastern quarter of state

**Habitat** Large streams to medium rivers in mud, sand, or gravel

**Threats** Stream channelization, siltation, degradation of water quality, agriculture and urban effluent

**Research/Inventory** Inventory surveys, determine specific habitat requirements

**Landscapes** Elkhorn Confluence, Southeast Prairies

**Common Name** Pistolgrip Mussell                      **Scientific Name** *Tritogonia verrucosa*

**G-Rank** G4              **S-Rank** S1                      **Goal** 4              **Distribution** Widespread

**Criteria for selection as Tier I** Declining

**Range in NE** Missouri River and streams in southeast portion of state

**Habitat** Large streams to medium rivers in mud, sand, or gravel

**Threats** Stream channelization, siltation, degradation of water quality, agriculture and urban effluent

**Research/Inventory** Inventory surveys, determine specific habitat requirements

**Landscapes** Missouri River, Southeast Prairies

**Common Name** Plain pocketbook                      **Scientific Name** *Lampsilis cardim*

**G-Rank** G5              **S-Rank** S2                      **Goal** 4              **Distribution** Widespread

**Criteria for selection as Tier I** Declining

**Range in NE** Streams in eastern third of state

**Habitat** Small creeks to medium rivers in mud, sand, or gravel

**Threats** Stream channelization, siltation, degradation of water quality, agriculture and urban effluent

**Research/Inventory** Inventory surveys, determine specific habitat requirements

**Landscapes** Elkhorn Headwaters, Elkhorn Confluence, Southeast Prairies

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**Common Name** Pondmussel **Scientific Name** Ligumia subrostrata

**G-Rank** G4G5 **S-Rank** S1 **Goal** 4 **Distribution** Widespread

**Criteria for selection as Tier I** Declining

**Range in NE** Streams in eastern third of state-especially in the southeast portion

**Habitat** Small to medium streams, possibly ponds, in mud or sand

**Threats** Stream channelization, siltation, degradation of water quality, agriculture and urban effluent

**Research/Inventory** Inventory surveys, determine specific habitat requirements

**Landscapes** Elkhorn Headwaters, Elkhorn Confluence, Southeast Prairies

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**Common Name** Scaleshell **Scientific Name** Leptodea leptodon

**G-Rank** G1 **S-Rank** S1 **Goal** 7 **Distribution** Limited

**Criteria for selection as Tier I** State and federally listed, G1

**Range in NE** Upper reach of Missouri River

**Habitat** Large rivers in mud and sand

**Threats** Stream channelization, degradation of water quality

**Research/Inventory** Inventory surveys, determine specific habitat requirements

**Landscapes** Missouri River

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**Common Name** Slough Sandshell **Scientific Name** Lampsilis teres teres

**G-Rank** G5T1Q **S-Rank** S? **Goal** 7 **Distribution** Disjunct/Limited

**Criteria for selection as Tier I** G1

**Range in NE** Streams in southeast portion of state

**Habitat** Medium streams to medium rivers, muddy sloughs and pond-like areas of rivers where water is slow moving

**Threats** Stream channelization, siltation, degradation of water quality, agriculture and urban effluent



**Research/Inventory** Inventory surveys, determine specific habitat requirements

**Landscapes** Lower Platte River, Southeast Prairies

**Common Name** Threeridge **Scientific Name** Amblema plicata

**G-Rank** G5 **S-Rank** S1 **Goal** 4 **Distribution** Widespread

**Criteria for selection as Tier I** Declining

**Range in NE** Streams in eastern quarter of state

**Habitat** Small to large rivers and impoundments in mud, sand, or gravel

**Threats** Stream channelization, siltation, degradation of water quality, agriculture and urban effluent

**Research/Inventory** Inventory surveys, determine specific habitat requirements

**Landscapes** Missouri River

## Reptiles

**Common Name** Blanding's Turtle **Scientific Name** Emydoidea blandingii

**G-Rank** G4 **S-Rank** S4 **Goal** 4 **Distribution** Limited

**Criteria for selection as Tier I** Ranked as imperiled or vulnerable in all but one state in its range

**Range in NE** Primarily sandhills marshes, very locally in eastern portion of state

**Habitat** Sandhills fens, proximity to water, Sandhills Freshwater Marsh, Northern Cordgrass Wet Prairie, small tributaries, sandhills prairies (upland habitat), marshes and oxbows in eastern portion of state

**Threats** Pet industry, road kill, loss of wetlands in east

**Research/Inventory** Inventory along Elkhorn, telemetry work on Two Rivers population

**Landscapes** Lower Platte River, Cherry County Wetlands, Dismal River Headwaters, Elkhorn River Headwaters, Sandhill Alkaline

**Common Name** Massasauga **Scientific Name** Sistrurus catenatus

**G-Rank** G3G4 **S-Rank** S1 **Goal** 10 **Distribution** Widespread

**Criteria for selection as Tier I** State listed, G3

**Range in NE** Very southeast portion of state

**Habitat** Wet Mesic Tallgrass Prairie, wet meadow/marsh/wet prairie, lower-middle Tallgrass Prairie, Cordgrass Wet Prairie, crayfish burrows

**Threats** Loss/degradation of Tallgrass Prairie habitat, woody invasion, drying of prairies, road kill

**Research/Inventory** Life history dynamics, determine size/extent of Colfax population, distributional investigation, best management practices

**Landscapes** Lower Platte River, Sandstone Prairies, Southeast Prairies

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**Common Name** Timber Rattlesnake      **Scientific Name** Crotalus horridus

**G-Rank** G4      **S-Rank** S1      **Goal** 4      **Distribution** Widespread

**Criteria for selection as Tier I** Declining, ranked as imperiled or vulnerable in nearly all states in its range

**Range in NE** Very southeast portion of state

**Habitat** Deciduous woodland, riparian woodland - both in conjunction with rock outcrops

**Threats** Cedar encroachment, malicious killing, limestone quarrying

**Research/Inventory** Inventory surveys, determine life history dynamics, best management practices

**Landscapes** Missouri River, Sandstone Prairies, Southeast Prairies, Indian Cave Bluffs

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## Plants

**Common Name** American Ginseng      **Scientific Name** Panax quinquefolium

**G-Rank** G3G4      **S-Rank** S1      **Goal** 10      **Distribution** Peripheral

**Criteria for selection as Tier I** State listed, G3

**Range in NE** Missouri River bluff woodlands

**Habitat** Oak-Hickory-Ironwood Forest, Bur Oak-Basswood-Ironwood Forest, Red Oak-Basswood-Ironwood Forest

**Threats** Over collecting, grazing of woodlands, logging, housing development, invasive species.

**Research/Inventory** Detail inventory and population monitoring

**Landscapes** Missouri River, Ponca Bluffs, Rulo Bluffs

**Common Name** Barr's Orophaca                      **Scientific Name** Astragalus barrii

**G-Rank** G3              **S-Rank** S1                      **Goal** 7              **Distribution** Limited

**Criteria for selection as Tier I** G3

**Range in NE** Dawes County

**Habitat** Badland, Rock Outcrop

**Threats** Unknown

**Research/Inventory** Detail inventory and population monitoring

**Landscapes** Oglala Grasslands

**Common Name** Blowout Penstemon                      **Scientific Name** Penstemon haydenii

**G-Rank** G1              **S-Rank** S1                      **Goal** 10              **Distribution** Endemic

**Criteria for selection as Tier I** State and federally listed, G1

**Range in NE** Sandhills Ecoregion

**Habitat** Sandhills Dune Prairie (blowouts)

**Threats** Loss of blowouts due to range management practices and lack of fire

**Research/Inventory** Research on how to create and maintain blowout habitat

**Landscapes** Cherry County Wetlands, Dismal Headwaters, Dismal River, North Loup River, Panhandle Prairies, Sandhills Alkali Lakes, Upper Niobrara River

**Common Name** Colorado Butterfly Plant                      **Scientific Name** Gaura neomexicana ssp coloradensis

**G-Rank** G3T2              **S-Rank** S1                      **Goal** 5              **Distribution** Limited

**Criteria for selection as Tier I** State and federally listed, G2

**Range in NE** Kimball County

**Habitat** Western Floodplain Terrace Grassland

**Threats** Canada thistle invasion of habitat, herbicide spraying, groundwater level decline, haying and overgrazing of habitat

**Research/Inventory** Population monitoring, research on best management practices

**Landscapes** Kimball Grasslands

**Common Name** Dog-Parsley **Scientific Name** Lomatium nuttallii

**G-Rank** G3 **S-Rank** S2 **Goal** 7 **Distribution** Limited

**Criteria for selection as Tier I** G3

**Range in NE** Scottsbluff and Morrill counties

**Habitat** Rock Outcrops

**Threats** Unknown

**Research/Inventory** Inventory of distribution

**Landscapes** Wildcat Hills

**Common Name** Gordon's Wild Buckwheat **Scientific Name** Eriogonum gordonii

**G-Rank** G4 **S-Rank** S1 **Goal** 7 **Distribution** Limited

**Criteria for selection as Tier I** Regional endemic, ranked imperiled or vulnerable in most states in its range

**Range in NE** Sioux County

**Habitat** Rocky prairies (most likely Western Mixedgrass Prairie)

**Threats** Unknown

**Research/Inventory** Inventory of distribution

**Landscapes** Oglala Grasslands, Panhandle Prairies

**Common Name** Hall's Bulrush **Scientific Name** Schoenoplectus hallii

**G-Rank** G2 **S-Rank** S2 **Goal** 7 **Distribution** Limited

**Criteria for selection as Tier I** G2

**Range in NE** Eastern Sandhills Ecoregion

**Habitat** Northern Sedge Wet Meadow, Northern Cordgrass Wet Prairie, Sandhills Freshwater Marsh

**Threats** Wetland drainage, invasive species

**Research/Inventory** Research on best management practices

**Landscapes** Calamus River, Elkhorn Headwaters

**Common Name** Iowa Moonwort **Scientific Name** Botrychium campestre

**G-Rank** G3G4 **S-Rank** S1 **Goal** 7 **Distribution**

**Criteria for selection as Tier I** G3

**Range in NE** Brown County

**Habitat** Bur Oak-Basswood-Ironwood Forest

**Threats** Unknown

**Research/Inventory** Inventory of distribution

**Landscapes** Middle Niobrara River Valley

**Common Name** Large-Spike Prairie-Clover **Scientific Name** Dalea cylindriceps

**G-Rank** G3G4 **S-Rank** S2 **Goal** 7 **Distribution** Limited

**Criteria for selection as Tier I** G3

**Range in NE** Shortgrass Prairie Ecoregion

**Habitat** Gravelly terrace prairies

**Threats** Overgrazing

**Research/Inventory** Inventory of distribution

**Landscapes** Sandsage South

**Common Name** Matted Prickly-phlox **Scientific Name** Linanthus caespitosus

**G-Rank** G4 **S-Rank** S1 **Goal** 7 **Distribution** Limited

**Criteria for selection as Tier I** Regional endemic, ranked as imperiled or vulnerable in most states in its range

**Range in NE** Scottsbluff County

**Habitat** Rock Outcrop

**Threats** Unknown

**Research/Inventory** Inventory of distribution

**Landscapes** Wildcat Hills

**Common Name** Meadow Lousewort      **Scientific Name** Pedicularis crenulata  
**G-Rank** G4      **S-Rank** S1      **Goal** 7      **Distribution** Limited  
**Criteria for selection as Tier I** Regional endemic, ranked as imperiled or vulnerable in most states in its range  
**Range in NE** Sioux County  
**Habitat** Western Streamside Wet Meadow  
**Threats** Annual haying, overgrazing, exotic plant invasion, conversion of meadows to cropland  
**Research/Inventory** Inventory of distribution  
**Landscapes** Panhandle Prairies, Upper Niobrara River

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**Common Name** Missouri Sedge      **Scientific Name** Carex missouriensis  
**G-Rank** G4      **S-Rank** S1      **Goal** 7      **Distribution** Limited  
**Criteria for selection as Tier I** Regional endemic, ranked as imperiled or vulnerable in most states in its range  
**Range in NE** Johnson County  
**Habitat** Eastern Cordgrass Wet Prairie, Eastern Sedge Wet Meadow, Wet-mesic Tallgrass Prairies  
**Threats** Conversion of prairie to cropland, herbicide spraying, invasive species, overgrazing  
**Research/Inventory** Inventory of distribution  
**Landscapes**

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**Common Name** Saltwort      **Scientific Name** Salicornia rubra  
**G-Rank** G5      **S-Rank** S1      **Goal** 10      **Distribution** Disjunct  
**Criteria for selection as Tier I** State listed, disjunct  
**Range in NE** Lancaster and southern Saunders counties  
**Habitat** Eastern Saline Meadow  
**Threats** Wetland drainage, development, reduced groundwater levels, loss of salinity in wetlands, invasive plants  
**Research/Inventory** Research needed on how to restore and manage saline wetlands  
**Landscapes** Central Platte, Saline Wetlands

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**Common Name** Sandhill Goosefoot      **Scientific Name** Chenopodium cycloides

**G-Rank** G3      **S-Rank** S1      **Goal** 7      **Distribution** Limited

**Criteria for selection as Tier I** G3

**Range in NE** Chase and Dundy counties

**Habitat** Sandsage Prairie

**Threats** Overgrazing, herbicide spraying, conversion of prairie to cropland

**Research/Inventory** Inventory of distribution

**Landscapes** Sandsage South

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**Common Name** Short's Milkvetch      **Scientific Name** Astragalus shortianus

**G-Rank** G4      **S-Rank** S1      **Goal** 7      **Distribution** Limited

**Criteria for selection as Tier I** Regional endemic, ranked as imperiled or vulnerable in most states in its range

**Range in NE** Kimball and Banner counties

**Habitat** Rocky and gravelly Western Mixedgrass Prairie

**Threats** Unknown

**Research/Inventory** Inventory of distribution

**Landscapes** Kimball Grasslands

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**Common Name** Small White Lady's-Slipper      **Scientific Name** Cypripedium candidum

**G-Rank** G4      **S-Rank** S1S2      **Goal** 10      **Distribution** Widespread

**Criteria for selection as Tier I** State listed

**Range in NE** Loup River valleys in the Mixedgrass Prairie Ecoregion and eastern Sandhills Ecoregion

**Habitat** Northern Sedge Wet Meadow, Northern Cordgrass Wet Prairie, Wet-mesic Tallgrass Prairie

**Threats** Conversion of meadows to cropland and development, invasive species, reduced groundwater levels, annual mid-summer haying, herbicide spraying

**Research/Inventory** Research to determine best management practices

**Landscapes** Elkhorn Headwaters, Lower Loup River Core, Lower Platte River

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**Common Name** Snow trillium      **Scientific Name** Trillium nivale

**G-Rank** G4      **S-Rank** S1      **Goal** 1      **Distribution** Peripheral

**Criteria for selection as Tier I** Ranked as imperiled or vulnerable in nearly all states in its range

**Range in NE** Cass County

**Habitat** Oak-Hickory-Ironwood Forest, Bur Oak-Basswood-Ironwood Forest, Red Oak-Basswood-Ironwood Forest

**Threats** Invasive species, logging, overgrazing

**Research/Inventory** Unknown

**Landscapes**

**Common Name** Ute Ladies' Tresses **Scientific Name** *Spiranthes diluvialis*

**G-Rank** G2 **S-Rank** S1 **Goal** 2 **Distribution** Limited

**Criteria for selection as Tier I** State and federally listed, G2

**Range in NE** Sioux County

**Habitat** Western Alkaline Meadow

**Threats** Reduced groundwater levels, invasive species, conversion of meadows to cropland, annual haying of meadows

**Research/Inventory** Research to determine management needs

**Landscapes** Panhandle Prairies, Upper Niobrara River

**Common Name** Western Prairie White-Fringed Orchid **Scientific Name** *Platanthera praeclara*

**G-Rank** G2 **S-Rank** S2 **Goal** 10 **Distribution** Limited

**Criteria for selection as Tier I** State and federally listed, G2

**Range in NE** Tallgrass Prairie and Sandhills Ecorgions

**Habitat** Eastern Cordgrass Wet Prairie, Northern Cordgrass Wet Prairie, Wet-mesic Tallgrass Prairie, Tallgrass Prairie

**Threats** Invasive species, herbicide spraying, conversion of prairie to cropland and development, annual mid-summer haying, overgrazing, reduced gene flow among isolated populations

**Research/Inventory** Research on best management practices

**Landscapes** Central Platte, Cherry County Wetlands, Elkhorn Headwaters, Lower Platte River, North Loup River, Willow Creek Prairies

**Common Name** Wolf's Spikerush **Scientific Name** *Eleocharis wolfii*

**G-Rank** G3? **S-Rank** S2 **Goal** 7 **Distribution** Widespread



**Criteria for selection as Tier I**     G3

**Range in NE**             Sandhills Ecoregion

**Habitat**                 Northern Cordgrass Wet Prairie, Northern Sedge Wet Prairie

**Threats**                 Wetland drainage, invasive species

**Research/Inventory**     Inventory of distribution

**Landscapes**             Cherry County Wetlands, Elkhorn Headwaters, Middle Loup River

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## APPENDIX 9: Tier II At-risk Species

Tier II species include those that did not meet the Tier I criteria but were ranked by the Nebraska Natural Heritage Program as either State Critically Imperiled (S1), State Imperiled (S2) or State Vulnerable (S3) (see appendix 4 for explanation of ranks). This list is used to help prioritize conservation planning/actions and does not have legal or regulatory ramifications. Tier II species are typically those that are not at-risk from a global or national perspective but are rare or imperiled within Nebraska. Conservation of these species is needed to ensure they remain a part of Nebraska's flora and fauna.

During the development of the Natural Legacy Plan, the "S-Ranks" were reviewed and revised for amphibians, mammals, fish, reptiles, mollusks, a limited number of insects, and Tier I birds. The "S-ranks" for the remaining birds are in need of revision. Some bird species are included on the Tier II list that have a previous rank of S4 or S5, due to expert opinion that indicated when the ranks are revised they would likely be within the S1-S3 range.

The Tier II at-risk species lists will be periodically reviewed and revised by taxon experts. This revision will occur on an ongoing basis as new information on the abundance, distribution, and population trends becomes available, with an overall review at least every five years.

<u>Common Name</u>	<u>Scientific Name</u>	<u>Grank</u>	<u>Srank</u>
<b>Amphibians</b>			
American Toad	<i>Bufo americanus</i>	G5	S1
Great Plains Narrowmouth Toad	<i>Gastrophryne olivacea</i>	G5	S2
Smallmouth Salamander	<i>Ambystoma texanum</i>	G5	S1
<b>Birds</b>			
Acadian Flycatcher	<i>Empidonax virescens</i>	G5	S4
American Avocet	<i>Recurvirostra americana</i>	G5	S4
American Bittern	<i>Botaurus lentiginosus</i>	G4	S3
American White Pelican	<i>Pelecanus erythrorhynchos</i>	G3	S3
American Wigeon	<i>Anas americana</i>	G5	S2
American Woodcock	<i>Scolopax minor</i>	G5	S3
Barn Owl	<i>Tyto alba</i>	G5	S3
Barred Owl	<i>Strix varia</i>	G5	S2
Black Rail	<i>Laterallus jamaicensis</i>	G4	S1
Black-and-White Warbler	<i>Mniotilta varia</i>	G5	S3
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	G5	S5
Black-crowned Night-heron	<i>Nycticorax nycticorax</i>	G5	S2
Black-necked Stilt	<i>Himantopus mexicanus</i>	G5	S3
Black Tern	<i>Chlidonias niger</i>	G4	S3
Blue-Gray Gnatcatcher	<i>Poliophtila caerulea</i>	G5	S3
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	G5	S2
Brown Creeper	<i>Certhia americana</i>	G5	S3
Canvasback	<i>Aythya valisineria</i>	G5	S3
Carolina Wren	<i>Thryothorus ludovicianus</i>	G5	S2
Cassin's Kingbird	<i>Tyrannus vociferans</i>	G5	S3

<u>Common Name</u>	<u>Scientific Name</u>	<u>Grank</u>	<u>Srank</u>
Chestnut-Collared Longspur	<i>Calcarius ornatus</i>	G5	S2
Chuck-Will's-Widow	<i>Caprimulgus carolinensis</i>	G5	S1
Cinnamon Teal	<i>Anas cyanoptera</i>	G5	S?
Clark's Grebe	<i>Aechmophorus clarkii</i>	G5	S?
Clark's Nutcracker	<i>Nucifraga columbiana</i>	G5	S1
Common Poorwill	<i>Phalaenoptilus nuttallii</i>	G5	S2
Common Snipe	<i>Gallinago gallinago</i>	G5	S2
Cooper's Hawk	<i>Accipiter cooperii</i>	G5	S1
Cordilleran Flycatcher	<i>Empidonax occidentalis</i>	G5	S1
Dark Eyed Junco	<i>Junco hyemalis</i>	G5	S1
Eastern Meadowlark	<i>Sturnella magna</i>	G5	S3
Forster's Tern	<i>Sterna forsteri</i>	G5	S3
Golden Eagle	<i>Aquila chrysaetos</i>	G5	S3
Greater Sage-Grouse	<i>Centrocercus urophasianus</i>	G4	S1
Kentucky Warbler	<i>Oporornis formosus</i>	G5	S3
King Rail	<i>Rallus elegans</i>	G4G5	S1
Least Bittern	<i>Ixobrychus exilis</i>	G5	S2
Lesser Scaup	<i>Aythya affinis</i>	G5	S3
Long-Eared Owl	<i>Asio otus</i>	G5	S4
Louisiana Waterthrush	<i>Seiurus motacilla</i>	G5	S1
Merlin	<i>Falco columbarius</i>	G5	S1
Mississippi Kite	<i>Ictinia mississippiensis</i>	G5	S?
Mountain Bluebird	<i>Sialia currucoides</i>	G5	S4
Northern Bobwhite	<i>Colinus virginianus</i>	G5	S4
Northern Harrier	<i>Circus cyaneus</i>	G5	S3
Ovenbird	<i>Seiurus aurocapilla</i>	G5	S4
Peregrine Falcon	<i>Falco peregrinus</i>	G4	S3
Pileated Woodpecker	<i>Dryocopus pileatus</i>	G5	S1
Pine Siskin	<i>Carduelis pinus</i>	G5	S3
Pinyon Jay	<i>Gymnorhinus cyanocephalus</i>	G5	S3
Plumbeous Vireo	<i>Vireo plumbeus</i>	G5	S2
Prairie Falcon	<i>Falco mexicanus</i>	G5	S3
Prairie Loggerhead Shrike	<i>Lanius ludovicianus excubitorides</i>	G4T4	S?
Prothonotary Warbler	<i>Protonotaria citrea</i>	G5	S2
Pygmy Nuthatch	<i>Sitta pygmaea</i>	G5	S3
Red-Shouldered Hawk	<i>Buteo lineatus</i>	G5	S1
Red Crossbill	<i>Loxia curvirostra</i>	G5	S4
Ruby-Throated Hummingbird	<i>Archilochus colubris</i>	G5	S3
Sage Thrasher	<i>Oreoscoptes montanus</i>	G5	S1
Savannah Sparrow	<i>Passerculus sandwichensis</i>	G5	S3
Sandhill Crane	<i>Grus canadensis</i>	G5	S3
Scissor-Tailed Flycatcher	<i>Tyrannus forficatus</i>	G5	S4
Sedge Wren	<i>Cistothorus platensis</i>	G5	S2
Sharp-Shinned Hawk	<i>Accipiter striatus</i>	G5	S1
Summer Tanager	<i>Piranga rubra</i>	G5	S4
Swainson's Hawk	<i>Buteo swainsoni</i>	G5	S3
Swamp Sparrow	<i>Melospiza georgiana</i>	G5	S3
Townsend's Solitaire	<i>Myadestes townsendi</i>	G5	S2
Tufted Titmouse	<i>Baeolophus bicolor</i>	G5	S3

<u>Common Name</u>	<u>Scientific Name</u>	<u>Grank</u>	<u>Srank</u>
Violet-Green Swallow	Tachycineta thalassina	G5	S3
Virginia Rail	Rallus limicola	G5	S4
Western Grebe	Aechmophorus occidentalis	G5	S3
Western Tanager	Piranga ludoviciana	G5	S4
Western Yellow-Billed Cuckoo	Coccyzus americanus	G5	S5
Whip-Poor-Will	Caprimulgus vociferus	G5	S2
White-Eyed Vireo	Vireo griseus	G5	S2
White-Faced Ibis	Plegadis chihi	G5	S1
White-Throated Swift	Aeronautes saxatalis	G5	S4
Willet	Catoptrophorus semipalmatus	G5	S3
Yellow-Breasted Chat	Icteria virens	G5	S5
Yellow-Throated Vireo	Vireo flavifrons	G5	S2
Yellow-Throated Warbler	Dendroica dominica	G5	S?
<b>Fish</b>			
Black Buffalo	Ictiobus niger	G5	S2
Blacknose Dace	Rhinichthys atratulus	G5	S2
Bluntnose Minnow	Pimephales notatus	G5	S3
Brook Stickleback	Culaea inconstans	G5	S3
Chestnut Lamprey	Ichthyomyzon castaneus	G4	S1
Common Shiner	Luxilus cornutus	G5	S2
Johnny Darter	Etheostoma nigrum	G5	S3
Lake Chub	Couesius plumbeus	G5	S1
Mountain Sucker	Catostomus platyrhynchus	G5	S1
Orangethroat Darter	Etheostoma spectabile	G5	S3
Paddlefish	Polyodon spathula	G4	S2
Silver Lamprey	Ichthyomyzon unicuspis	G5	S1
Tadpole Madtom	Noturus gyrinus	G5	S3
Trout-Perch	Percopsis omiscomaycus	G5	S1
<b>Mammals</b>			
Bailey's Eastern Woodrat	Neotoma floridana baileyi	G5T3	S2
Black-Tailed Jackrabbit	Lepus californicus	G5	S?
Bushy-Tailed Woodrat	Neotoma cinerea	G5	S3
Eastern Chipmunk	Tamias striatus	G5	S1
Eastern Gray Squirrel	Sciurus carolinensis	G5	S3
Eastern Pipistrelle	Pipistrellus subflavus	G5	S1
Eastern Spotted Skunk	Spilogale putorius	G5	S1
Eastern Woodrat	Neotoma floridana	G5	S3
Elk	Cervus elaphus	G5	S3
Evening Bat	Nycticeius humeralis	G5	S3
Dwarf Shrew	Sorex nanus	G4	S1
Franklin's Ground Squirrel	Spermophilus franklinii	G5	S5
Fringed Myotis	Myotis thysanodes	G4G5	S1
Hispid Cotton Rat	Sigmodon hispidus	G5	S3
Least Chipmunk	Tamias minimus	G5	S3
Long-Tailed Weasel	Mustela frenata	G5	S2

<u>Common Name</u>	<u>Scientific Name</u>	<u>Grank</u>	<u>Srank</u>
Merriam's Shrew	<i>Sorex merriami</i>	G5	S1
Mountain Lion	<i>Felis concolor</i>	G5	S1
Northern Myotis	<i>Myotis septentrionalis</i>	G4	S3
Northern Pocket Gopher	<i>Thomomys talpoides cheyennensis</i>	G5T3T4S?	
Olive-Backed Pocket Mouse	<i>Perognathus fasciatus</i>	G5	S3
Silky Pocket Mouse	<i>Perognathus flavus</i>	G5	S?
White-Tailed Jackrabbit	<i>Lepus townsendii</i>	G5	S?
Woodland Vole	<i>Microtus pinetorum</i>	G5	S3

## Reptiles

Black Hills Redbelly Snake	<i>Storeria occipitomaculata</i>	G5	S1
Brown Snake	<i>Storeria dekayi</i>	G5	S3
Coachwhip	<i>Masticophis flagellum</i>	G5	S3
Common Kingsnake	<i>Lampropeltis getula</i>	G5	S2
Copperhead	<i>Agkistrodon contortrix</i>	G5	S1
False Map Turtle	<i>Graptemys pseudogeographica</i>	G5	S3
Five-Lined Skink	<i>Eumeces fasciatus</i>	G5	S1
Glossy Snake	<i>Arizona elegans</i>	G5	S2
Graham's Crayfish Snake	<i>Regina grahamii</i>	G5	S2
Great Plains Skink	<i>Eumeces obsoletus</i>	G5	S3
Greater Short-Horned Lizard	<i>Phrynosoma hernandesi</i>	G5	S3
Plains Black-Headed Snake	<i>Tantilla nigriceps</i>	G5	S1
Prairie Kingsnake	<i>Lampropeltis calligaster</i>	G5	S3
Redbelly Snake	<i>Storeria occipitomaculata</i>	G5	S1
Sagebrush Lizard	<i>Sceloporus graciosus</i>	G5	S1
Smooth Green Snake	<i>Liochlorophis vernalis</i>	G5	S1
Western Ribbon Snake	<i>Thamnophis proximus</i>	G5	S2
Worm Snake	<i>Carphophis amoenus</i>	G5	S2
Yellow Mud Turtle	<i>Kinosternon flavescens</i>	G5	S3

## Insects

Acastus Checkerspot	<i>Chlosyne acastus</i>	G4G5	S1
Arogos Skipper	<i>Atrytone arogos</i>	G3	S?
Beautiful Tiger Beetle	<i>Cicindela pulchra</i>	G4	S1
Black Dash	<i>Euphyes conspicua</i>	G4	S1
Broad-Winged Skipper	<i>Poanes viator viator</i>	G5T4	S2
Colorado Giant Skipper	<i>Megathymus yuccae coloradensis</i>	G5T5	S1
Colorado Rita Dotted-Blue	<i>Euphilotes rita coloradensis</i>	G3G4	S?
Dion Skipper	<i>Euphyes dion</i>	G4	S2
Dotted Skipper	<i>Hesperia attalus attalus</i>	G3	S?
Great Plains Giant Tiger Beetle	<i>Amblycheila cylindriformis</i>	G5	S2
Green Skipper	<i>Hesperia viridis</i>	G5	S1
Indra Swallowtail	<i>Papilio indra</i>	G5	S2
Mead's Wood-Nymph	<i>Cercyonis meadii</i>	G5	S1
Mormon Fritillary	<i>Speyeria mormonia</i>	G5	S1
Nebraska Tiger Beetle	<i>Cicindela nebraskana</i>	G4	S1

<u>Common Name</u>	<u>Scientific Name</u>	<u>Grank</u>	<u>Srank</u>
Persius Dusky Wing	<i>Erynnis persius persius</i>	G5T3	S2
Rita Dotted-Blue	<i>Euphyllotes rita</i>	G3G4	S1
Shasta Blue	<i>Caricia shasta</i>	G5	S2
Small Wood-Nymph	<i>Cercyonis oetus</i>	G5	S1
Smoky Eyed Brown	<i>Satyroides eurydice fumosa</i>	T3	S3
White-Cloaked Tiger Beetle	<i>Cicindela togata</i>	G5	S1
<b>Mollusks</b>			
Fat Pocketbook	<i>Potamilus capax</i>	G1	S1
Spectaclecase	<i>Cumberlandia monodonta</i>	G2G3	S1
A Freshwater Snail	<i>Fossaria techella</i>	G3G4	S?
<b>Plants</b>			
American Alumroot	<i>Heuchera americana</i> var. <i>hirsuticaulis</i>	G5T5	S1
American False-Pennyroyal	<i>Hedeoma pulegioides</i>	G5	S1
American Lotus	<i>Nelumbo lutea</i>	G4	S1
American Slough Grass	<i>Beckmannia syzigachne</i>	G5	S3S4
American Sweet-Flag	<i>Acorus americanus</i>	G5	S2
Arrow-Feather Three-Awn	<i>Aristida purpurascens</i>	G5	S1
Ashy Sunflower	<i>Helianthus mollis</i>	G4G5	S1
Autumnal Water-Starwort	<i>Callitriche hermaphroditica</i>	G5	S2
Awned Slender Wheatgrass	<i>Elymus trachycaulus</i> ssp. <i>subsecundus</i>	G5T5	S1S2
Bay Forget-Me-Not	<i>Myosotis laxa</i>	G5	S1
Beaked Spikerush	<i>Eleocharis rostellata</i>	G5	S2
Bearded Wood Grass	<i>Brachyelytrum erectum</i>	G5	S2
Bebb's Sedge	<i>Carex bebbii</i>	G5	S2S3
Berlandier's Flax	<i>Linum berlandieri</i>	G5	S1
Big-Tree Plum	<i>Prunus mexicana</i>	G4G5	S2
Bird's-Foot Violet	<i>Viola pedata</i>	G5	S1
Blackjack Oak	<i>Quercus marilandica</i>	G5	S1
Black-Seed Ricegrass	<i>Piptatherum racemosum</i>	G5	S2S3
Blue Cohosh	<i>Caulophyllum thalictroides</i>	G4G5	S2S3
Blue Larkspur	<i>Delphinium nuttallianum</i>	G5	S3
Bluebunch Wheatgrass	<i>Elymus spicatus</i>	G5	S1
Blunt-Scale Wood Sedge	<i>Carex albursina</i>	G5	S1
Bog Aster	<i>Symphyotrichum boreale</i>	G5	S2
Bog Spikerush	<i>Eleocharis elliptica</i>	G5	S3
Bog White Violet	<i>Viola lanceolata</i>	G5	S2S3
Bog-Buckbean	<i>Menyanthes trifoliata</i>	G5	S2
Bouquet Mud Plantain	<i>Heteranthera multiflora</i>	G4	S1
Brazilian Watermeal	<i>Wolffia brasiliensis</i>	G5	S1
Bristly Buttercup	<i>Ranunculus hispidus</i> var. <i>caricetorum</i>	G5T5	S1
Britton's Skullcap	<i>Scutellaria brittonii</i>	G4G5	S2S3
Broad-Leaf Spring Panicum	<i>Panicum latifolium</i>	G5	S1
Brown Bog Sedge	<i>Carex buxbaumii</i>	G5	S2
Buckley's Penstemon	<i>Penstemon buckleyi</i>	G4G5	S1

<u>Common Name</u>	<u>Scientific Name</u>	<u>Grank</u>	<u>Srank</u>
Buff Fleabane	<i>Erigeron ochroleucus</i> var. <i>scribneri</i>	G5T5	S2
Bulblet Bladder Fern	<i>Cystopteris bulbifera</i>	G5	S1
Bulbous Bittercress	<i>Cardamine bulbosa</i>	G5	S2
Bulbous Water-hemlock	<i>Cicuta bulbifera</i>	G5	S3
Bush's Sedge	<i>Carex bushii</i>	G4	S2
Bushy Seedbox	<i>Ludwigia alternifolia</i>	G5	S1
Butterweed	<i>Senecio glabellus</i>	G5	S1
Canada Lousewort	<i>Pedicularis canadensis</i>	G5	S1
Canada Rush	<i>Juncus canadensis</i>	G5	S3
Capitate Spikerush	<i>Eleocharis geniculata</i>	G5	S1
Cardinal Flower	<i>Lobelia cardinalis</i>	G5	S3
Carolina False-Dandelion	<i>Pyrrhopappus carolinianus</i>	G5	S1
Carruth's Sagebrush	<i>Artemisia carruthii</i>	G4?	S1
Chaffweed	<i>Anagallis minima</i>	G5	S1S2
Clammy Hedge-Hyssop	<i>Gratiola neglecta</i>	G5	S2
Clasping-Leaf Milkweed	<i>Asclepias amplexicaulis</i>	G5	S1S2
Climbing Prairie Rose	<i>Rosa setigera</i> var. <i>tomentosa</i>	G5T5?	S3S4
Coreopsis Beggar-Tick	<i>Bidens polylepis</i>	G5	S2
Cottongrass Bulrush	<i>Scirpus cyperinus</i>	G5	S1
Creeping Juniper	<i>Juniperus horizontalis</i>	G5	S2
Culver's-Root	<i>Veronicastrum virginicum</i>	G4	S1
Curve-Pod Fumewort	<i>Corydalis curvisiliqua</i> ssp. <i>occidentalis</i>	G5T5	S1S2
Cutleaf Cyclanthera	<i>Cyclanthera dissecta</i>	G5	S1
Cut-Leaf Toothwort	<i>Cardamine concatenata</i>	G5	S2
Double Twinpod	<i>Physaria brassicoides</i>	G5	S1
Douglas' Slender Knotweed	<i>Polygonum douglasii</i>	G5	S2
Downy Ground-Cherry	<i>Physalis missouriensis</i>	G5?	S1
Dwarf Chinkapin Oak	<i>Quercus prinoides</i>	G5	S2
Dwarf Ground-Cherry	<i>Physalis pumila</i>	G5	S2
Dwarf Indigo-Bush	<i>Amorpha nana</i>	G5	S1
Dwarf Locoweed	<i>Oxytropis multiceps</i>	G5	S2
Dwarf Spikerush	<i>Eleocharis coloradoensis</i>	G5T?	S1
Dwarf St. John's- Wort	<i>Hypericum mutilum</i>	G5	S1
Dwarf-Dandelion	<i>Krigia caespitosa</i>	G5	S1
Early Buttercup	<i>Ranunculus fascicularis</i>	G5	S1
Early Ladies'-Tresses	<i>Spiranthes vernalis</i>	G5	S2
Eastern Star Sedge	<i>Carex radiata</i>	G4	S1S2
Ebony Spleenwort	<i>Asplenium platyneuron</i>	G5	S1
Engelmann's Flatsedge	<i>Cyperus engelmannii</i>	G4Q	S2
False Garlic	<i>Nothoscordum bivalve</i>	G4	S1
False Pennyroyal	<i>Trichostema brachiatum</i>	G4G5	S1
False-melic	<i>Schizachne purpurascens</i>	G5	S3?
Fen Panicked Sedge	<i>Carex prairea</i>	G5?	S3
Fen Tussock Sedge	<i>Carex aquatilis</i> var. <i>substricta</i>	G5T?	S2
Fendler's Aster	<i>Symphotrichum fendleri</i>	G4?	S2
Few-Flower Spikerush	<i>Eleocharis quinqueflora</i>	G5	S1
Field Milkvetch	<i>Astragalus agrestis</i>	G5	S1
Fireweed	<i>Chamerion angustifolium</i> ssp. <i>circumvagum</i>	G5T5	S1
Flat-Stalk Pondweed	<i>Potamogeton friesii</i>	G4	S1S2

<u>Common Name</u>	<u>Scientific Name</u>	<u>Grank</u>	<u>Srank</u>
Flat-Top Aster	<i>Doellingeria umbellata</i> var. <i>pubens</i>	G5T5	S1
Forest Bluegrass	<i>Poa interior</i>	G5	S2S3
Forked-Chickweed	<i>Paronychia canadensis</i>	G5	S1
Foxglove Penstemon	<i>Penstemon digitalis</i>	G5	S1S2
Frank's Sedge	<i>Carex frankii</i>	G5	S1S2
Fraser's Marsh-St. John's-Wort	<i>Triadenum fraseri</i>	G4G5	S2
Fraser's Wild Onion	<i>Allium canadense</i> var. <i>fraseri</i>	G5T4T5S2	
Fremont's Evening-Primrose	<i>Oenothera macrocarpa</i> ssp. <i>fremontii</i>	G5T?	S2
Fremont's Leather-Flower	<i>Clematis fremontii</i>	G5	S2
Fringed Brome	<i>Bromus ciliatus</i>	G5	S3S4
Frost Grape	<i>Vitis vulpina</i>	G5	S1
Frostweed	<i>Helianthemum bicknellii</i>	G5	S3S4
Geyer's Larkspur	<i>Delphinium geyeri</i>	G5	S2
Golden Corydalis	<i>Corydalis aurea</i>	G5	S1
Gordon's Wild Buckwheat	<i>Eriogonum gordonii</i>	G4	S1
Grassleaf Arrowhead	<i>Sagittaria graminea</i>	G5	S2S3
Graybark Grape	<i>Vitis cinerea</i>	G4G5	S2
Great St. John's-Wort	<i>Hypericum pyramidatum</i>	G4	S2
Green Dragon	<i>Arisaema dracontium</i>	G5	S2S3
Green Rabbitbrush	<i>Chrysothamnus viscidiflorus</i>	G5	S1
Green-Leaf Rattlesnake-Plantain	<i>Goodyera oblongifolia</i>	G5?	S1
Grove Sandwort	<i>Arenaria lateriflora</i>	G5	S3
Hairy Bugseed	<i>Corispermum villosum</i>	G4?	S1
Hairy Mountain-Mint	<i>Pycnanthemum verticillatum</i> var. <i>pilosum</i>	G5T5	S1
Hairy Pinweed	<i>Lechea mucronata</i>	G5	S2
Hairy Wood Sedge	<i>Carex hirtifolia</i>	G5	S1
Hairy-Stem Gooseberry	<i>Ribes hirtellum</i>	G5	S1
Hare's-Foot Locoweed	<i>Oxytropis lagopus</i> var. <i>atropurpurea</i>	G4G5T4T5S1	
Hedgehog Cactus	<i>Echinocereus viridiflorus</i>	G5	S2
Hoary Pea	<i>Tephrosia virginiana</i>	G5	S1
Holzinger's Venus'-Looking-Glass	<i>Triodanis holzingeri</i>	G4	S2S3
Hooked Buttercup	<i>Ranunculus recurvatus</i>	G5	S2
Hook-Spur Violet	<i>Viola adunca</i>	G5	S1
Hop Sedge	<i>Carex lupulina</i>	G5	S1
Indian Pipe	<i>Monotropa uniflora</i>	G5	S2
Indian Tobacco	<i>Lobelia inflata</i>	G5	S1
Inflated Duckweed	<i>Lemna gibba</i>	G4G5	S1
Interior Wild-rice	<i>Zizania palustris</i> var. <i>interior</i>	G4G5T4T5S3	
James' Rushpea	<i>Pomaria jamesii</i>	G5	S1
Joint-Leaf Rush	<i>Juncus articulatus</i>	G5	S1
Lace Grass	<i>Eragrostis capillaris</i>	G5	S1
Lanceleaf Stonecrop	<i>Sedum lanceolatum</i>	G5	S1
Late Coral-Root	<i>Corallorhiza odontorhiza</i>	G5	S1S2
Lavender Giant-Hyssop	<i>Agastache foeniculum</i>	G4G5	S2
Least Duckweed	<i>Lemna minuta</i>	G4	S1?
Leopard-Lily	<i>Fritillaria atropurpurea</i>	G5	S2
Lesser Bladder Sedge	<i>Carex vesicaria</i> var. <i>monile</i>	G5T4	S1
Lesser Bladderwort	<i>Utricularia minor</i>	G5	S2
Lesser Tussock Sedge	<i>Carex diandra</i>	G5	S2



<u>Common Name</u>	<u>Scientific Name</u>	<u>Grank</u>	<u>Srank</u>
Limber Pine	<i>Pinus flexilis</i>	G5	S1
Limestone Adder's-Tonque	<i>Ophioglossum engelmannii</i>	G5	S1
Limestone Ruellia	<i>Ruellia strepens</i>	G4G5	S1S2
Loesel's Twayblade	<i>Liparis loeselii</i>	G5	S1S2
Long-Barb Arrowhead	<i>Sagittaria longiloba</i>	G5	S1
Long-Bract Green Orchid	<i>Coeloglossum viride</i>	G5T5	S1
Longleaf Tick-Clover	<i>Desmodium cuspidatum</i> var. <i>longifolium</i>	G5T5?	S2
Lowland Bluets	<i>Houstonia purpurea</i> var. <i>calycosa</i>	G5T5	S1
Lowland Toothcup	<i>Rotala ramosior</i>	G5	S3
Many-flower Stickseed	<i>Hackelia floribunda</i>	G5?	S3
Mariposa-Lily	<i>Calochortus gunnisonii</i>	G5	S1
Marsh Arrowgrass	<i>Triglochin palustris</i>	G5	S2
Marsh Hedge-Nettle	<i>Stachys hispida</i>	G?	S1
Marsh Vetchling	<i>Lathyrus palustris</i>	G5	S1
Marsh-Marigold	<i>Caltha palustris</i>	G5	S2
Mat Muhly	<i>Muhlenbergia richardsonis</i>	G5	S1
Matted Prickly-Phlox	<i>Linanthus caespitosus</i>	G4	S1
May Apple	<i>Podophyllum peltatum</i>	G5	S2S3
Meadow Buttercup	<i>Ranunculus rhomboideus</i>	G5	S2
Meadow Gayfeather	<i>Liatris ligulistylis</i>	G5?	S1
Meadow Lousewort	<i>Pedicularis crenulata</i>	G4	S1
Mild Water-pepper	<i>Polygonum hydropiperoides</i>	G5	S3S4
Missouri Pincushion Cactus	<i>Coryphantha missouriensis</i>	G5	S2S3
Missouri Sedge	<i>Carex missouriensis</i>	G4	S1
Montana Wildrye	<i>Elymus albicans</i>	G5?	S1
Moss Phlox	<i>Phlox bryoides</i>	G4Q	S2S3
Mountain Birch	<i>Betula occidentalis</i>	G4G5	S1
Mountain Bladderpod	<i>Lesquerella montana</i>	G5	S2
Mountain Brome	<i>Bromus marginatus</i>	G?	S2
Mud Sedge	<i>Carex limosa</i>	G5	S1
Mullein-Foxglove	<i>Dasistoma macrophylla</i>	G4	S2
Nannyberry	<i>Viburnum lentago</i>	G5	S1
Narrowleaf Hawkweed	<i>Hieracium umbellatum</i>	G5?	S1
Narrowleaf Paleseed	<i>Leucospora multifida</i>	G5	S2
Narrow-Leaf Pinweed	<i>Lechea tenuifolia</i>	G5	S1
Narrowleaf Vervain	<i>Verbena simplex</i>	G5	S1
Needle-Leaf Navarretia	<i>Navarretia intertexta</i> ssp. <i>propinqua</i>	G5?T5	S1
Needle-pod Rush	<i>Juncus scirpoides</i>	G5	S3
Nevada Bulrush	<i>Amphiscirpus nevadensis</i>	G4	S2
Ninebark	<i>Physocarpus opulifolius</i> var. <i>intermedius</i>	G5T?	S2S3
Nodding Brome	<i>Bromus porteri</i>	G5	S3?
Nodding Mouse-Ear Chickweed	<i>Cerastium nutans</i>	G5	S1
Nodding Pogonia	<i>Triphora trianthophora</i>	G3G4	S1
Nodding Wild Buckwheat	<i>Eriogonum cernuum</i>	G5	S2
Nodding Wild Onion	<i>Allium cernuum</i>	G5	S2
Northern Adder's-Tongue	<i>Ophioglossum pusillum</i>	G5	S2
Northern Bog Violet	<i>Viola nephrophylla</i>	G5	S3?
Northern Green Orchid	<i>Platanthera aquilonis</i>	G5	S3
Northern Mannagrass	<i>Glyceria borealis</i>	G5	S2

<u>Common Name</u>	<u>Scientific Name</u>	<u>Grank</u>	<u>Srank</u>
Northern Rhombo-Pod	<i>Cleomella angustifolia</i>	G5	S2
Northwest Territory Sedge	<i>Carex utriculata</i>	G5	S1
Notchbract Waterleaf	<i>Hydrophyllum appendiculatum</i>	G5	S1
Old-Field Toadflax	<i>Nuttallanthus texanus</i>	G4G5	S1
One-Flower Broomrape	<i>Orobanche uniflora</i>	G5	S1
Ostrich Fern	<i>Matteuccia struthiopteris</i>	G5	S1
Pale Corydalis	<i>Corydalis flavula</i>	G5	S1
Pale Goosefoot	<i>Chenopodium pallescens</i>	G5	S1
Pale Indian-plantain	<i>Arnoglossum atriplicifolium</i>	G4G5	S3
Pale Purple Coneflower	<i>Echinacea pallida</i>	G4	S1
Parasol Sedge	<i>Carex umbellata</i>	G5	S1
Parry's Rabbitbrush	<i>Ericameria parryi</i> var. <i>howardii</i>	G5T5	S2S3
Pearly Everlasting	<i>Anaphalis margaritacea</i>	G5	S1
Peck's Sedge	<i>Carex peckii</i>	G4G5	S2S3
Pennsylvania Bittercress	<i>Cardamine pensylvanica</i>	G5	S1
Persimmon	<i>Diospyros virginiana</i>	G5	S1
Pillwort	<i>Pilularia americana</i>	G5	S1
Pine-Drops	<i>Pterospora andromedea</i>	G5	S2
Pinesap	<i>Monotropa hypopithys</i>	G5	S1
Pitcher's Leather-Flower	<i>Clematis pitcheri</i>	G4G5	S1
Plains Cutleaf Violet	<i>Viola viarum</i>	G5	S1S2
Plains Gayfeather	<i>Liatris squarrosa</i> var. <i>hirsuta</i>	G5T4?	S1
Plains Shooting Star	<i>Dodecatheon pulchellum</i>	G5	S2S3
Platte River Cinquefoil	<i>Potentilla plattensis</i>	G4	S1
Poison Suckle	<i>Suckleya suckleyana</i>	G5	S1
Pond-Sedge	<i>Dulichium arundinaceum</i>	G5	S2S3
Poverty Oatgrass	<i>Danthonia spicata</i>	G5	S1
Prairie Bluebells	<i>Mertensia lanceolata</i>	G5	S3
Prairie Crabapple	<i>Malus ioensis</i>	G4G5	S2
Prairie Dog-tooth-violet	<i>Erythronium mesochoreum</i>	G4G5	S3
Prairie Pinweed	<i>Lechea stricta</i>	G4?	S1
Prairie Spurge	<i>Euphorbia missurica</i> var. <i>missurica</i>	G5T?	S1
Prairie Star	<i>Lithophragma parviflora</i>	G5	S1
Prickly Naiad	<i>Najas marina</i>	G5	S1
Prince's Plume	<i>Stanleya pinnata</i>	G4G5	S1
Pull-Up Muhly	<i>Muhlenbergia filiformis</i>	G5	S1
Purple Cliff Brake	<i>Pellaea atropurpurea</i>	G5	S2
Purple Cudweed	<i>Gamochaeta purpurea</i>	G5	S1
Purple False Foxglove	<i>Agalinis purpurea</i>	G5	S1
Purple Giant-Hyssop	<i>Agastache scrophulariifolia</i>	G4	S1
Purple Milkweed	<i>Asclepias purpurascens</i>	G5?	S1
Purple Rattlesnake-Root	<i>Prenanthes racemosa</i> var. <i>multiflora</i>	G5T4?	S1
Purple Spikerush	<i>Eleocharis atropurpurea</i>	G4G5	S1
Quaking Aspen	<i>Populus tremuloides</i>	G5	S1S2
Quillwort	<i>Isoetes melanopoda</i>	G5	S1
Rattlesnake Master	<i>Eryngium yuccifolium</i>	G5	S1
Red Bearberry	<i>Arctostaphylos uva-ursi</i>	G5	S1
Red Lovegrass	<i>Eragrostis secundiflora</i> ssp. <i>oxylepis</i>	G5T?	S1
Red-Seed Plantain	<i>Plantago rhodosperma</i>	G?	S1

<u>Common Name</u>	<u>Scientific Name</u>	<u>Grank</u>	<u>Srank</u>
Red-Tinge Bulrush	<i>Scirpus microcarpus</i>	G5	S1
Rillscale	<i>Atriplex suckleyi</i>	G4?	S1
River Grass	<i>Scolochloa festucacea</i>	G5	S1
Rock Elm	<i>Ulmus thomasii</i>	G5	S3
Rock Sandwort	<i>Minuartia michauxii</i> var. <i>texana</i>	G5T3T5S2S3	
Rockpink Fameflower	<i>Phemeranthus calycinus</i>	G5	S2
Rocky Mountain Bulrush	<i>Schoenoplectus saximontanus</i>	G5	S1
Rocky Mountain Fescue	<i>Festuca saximontana</i>	G5	S1
Rocky Mountain Knotweed	<i>Polygonum sawatchense</i>	G5T?	S2
Rocky Mountain Maple	<i>Acer glabrum</i>	G5	S1
Rose Heath	<i>Chaetopappa ericoides</i>	G5	S2
Ross' Sedge	<i>Carex rossii</i>	G5	S3
Rough Avens	<i>Geum laciniatum</i> var. <i>trichocarpum</i>	G5T3T5S2S3	
Round-Head Prairie-Clover	<i>Dalea multiflora</i>	G5	S1
Round-Pod St. John's-Wort	<i>Hypericum sphaerocarpum</i>	G5	S1
Rubber Rabbitbrush	<i>Ericameria nauseosa</i> var. <i>nauseosa</i>	G5	S2
Sagebrush Buttercup	<i>Ranunculus glaberrimus</i> var. <i>ellipticus</i>	G5T5	S1
Saltmarsh Aster	<i>Symphotrichum subulatum</i>	G5	S1
Saltwort	<i>Salicornia rubra</i>	G5	S1
Sandhills Fameflower	<i>Phemeranthus rugospermus</i>	G3G4	S3S4
Scorpionweed	<i>Phacelia hastata</i>	G5	S3
Sea-Milkwort	<i>Glaux maritima</i>	G5	S1
Seaside Heliotrope	<i>Heliotropium curassavicum</i> var. <i>curassavicum</i>	G5T5	S1
Seaside Heliotrope	<i>Heliotropium curassavicum</i> var. <i>obovatum</i>	G5T5	S2
Sessile-Leaf Tick-Clover	<i>Desmodium sessilifolium</i>	G5	S2
Sharpwing Monkey-Flower	<i>Mimulus alatus</i>	G5	S2
Shining Sumac	<i>Rhus copallina</i> var. <i>latifolia</i>	G5T5	S1
Short-Pod Whitlow-Wort	<i>Draba brachycarpa</i>	G4G5	S1
Short-Ray Fleabane	<i>Erigeron lonchophyllus</i>	G5	S1
Shortray Prairie Coneflower	<i>Ratibida tagetes</i>	G4G5	S1
Short's Milkvetch	<i>Astragalus shortianus</i>	G4	S1
Short's Rockcress	<i>Arabis shortii</i>	G5	S2
Showy Monkey-Flower	<i>Mimulus guttatus</i>	G5	S1
Showy Orchid	<i>Galearis spectabilis</i>	G5	S2
Silverweed	<i>Potentilla anserina</i>	G5	S1
Simple-Stem Bur-Reed	<i>Sparganium emersum</i>	G5	S2
Slender Cottongrass	<i>Eriophorum gracile</i>	G5	S2
Slender Fimbry	<i>Fimbristylis autumnalis</i>	G5	S1
Slender Ladies'-Tresses	<i>Spiranthes lacera</i> var. <i>gracilis</i>	G5T4T5S1	
Slender Lip Fern	<i>Cheilanthes feei</i>	G5	S2
Slender Mountain-Mint	<i>Pycnanthemum tenuifolium</i>	G5	S1
Slender Muhly	<i>Muhlenbergia tenuiflora</i>	G5	S1
Slender Pondweed	<i>Stuckenia filiformis</i>	G5	S2
Slender Toothcup	<i>Ammannia auriculata</i>	G5	S1
Slender Yellow-Eyed-Grass	<i>Xyris torta</i>	G5	S1?
Slimleaf Scurfpea	<i>Pediomelum linearifolium</i>	G4?	S1
Small Bluets	<i>Houstonia pusilla</i>	G5	S1
Small Sundrops	<i>Oenothera perennis</i>	G5	S1
Small Venus'-Looking-Glass	<i>Triodanis biflora</i>	G5	S1

<u>Common Name</u>	<u>Scientific Name</u>	<u>Grank</u>	<u>Srank</u>
Small Wallflower	<i>Erysimum inconspicuum</i>	G5	S2S3
Small White Lady's-Slipper	<i>Cypripedium candidum</i>	G4	S1S2
Small-Flower Sandpuffs	<i>Tripterocalyx micranthus</i>	G5	S1
Smooth Cliff Brake	<i>Pellaea glabella</i>	G5	S1
Smooth Four-o'clock	<i>Mirabilis glabra</i>	G5	S3
Smooth Goosefoot	<i>Chenopodium subglabrum</i>	G3G4	S3
Snow Trillium	<i>Trillium nivale</i>	G4	S1
Snowberry	<i>Symphoricarpos albus</i>	G5	S1
Soft Rush	<i>Juncus effusus</i>	G5	S1
Southern Dewberry	<i>Rubus enslenii</i>	G?	S1
Southern Wild-Chervil	<i>Chaerophyllum tainturieri</i>	G5	S1
Spider Antelope-Horns	<i>Asclepias asperula</i> var. <i>decumbens</i>	G5T?	S1
Spike Fescue	<i>Leucopoa kingii</i>	G5	S1
Spikebent	<i>Agrostis exarata</i> var. <i>minor</i>	G5T?	S1
Spiked Muhly	<i>Muhlenbergia glomerata</i>	G5	S2
Spikenard	<i>Aralia racemosa</i>	G4G5	S3?
Spinulose Wood Fern	<i>Dryopteris carthusiana</i>	G5	S2S3
Spotted Coral-Root	<i>Corallorhiza maculata</i> var. <i>occidentalis</i>	G5T3T5S1	
Spotted Evening-primrose	<i>Oenothera canescens</i>	G4G5	S3
Spotted St. John's-Wort	<i>Hypericum punctatum</i>	G5	S1
Spreading Fleabane	<i>Erigeron divergens</i>	G5	S2
Spring Avens	<i>Geum vernum</i>	G5	S1
Spring Beauty	<i>Claytonia virginica</i>	G5	S2
Spring Coral-Root	<i>Corallorhiza wisteriana</i>	G5	S1
Spring Forget-Me-Not	<i>Myosotis verna</i>	G5	S1
Starved Spring Panicum	<i>Panicum depauperatum</i>	G5	S1
Stickleaf	<i>Mentzelia oligosperma</i>	G4	S1
Stiff Arrowhead	<i>Sagittaria rigida</i>	G5	S2S3
Straight-Leaf Pondweed	<i>Potamogeton strictifolius</i>	G5	S1
Streambank Ragwort	<i>Senecio pseud aureus</i> var. <i>semicordatus</i>	G5T3T5QS2	
Sugarbowl	<i>Clematis hirsutissima</i> var. <i>scottii</i>	G4T4?	S1
Summer Grape	<i>Vitis aestivalis</i>	G5	S1
Summer Orophaca	<i>Astragalus hyalinus</i>	G4	S2
Swamp Lousewort	<i>Pedicularis lanceolata</i>	G5	S2
Tall Breadroot Scurfpea	<i>Pediomelum cuspidatum</i>	G4	S2S3
Tall Cottongrass	<i>Eriophorum angustifolium</i>	G5	S2
Tall Four-O'Clock	<i>Mirabilis exaltata</i>	G3G4Q	S1
Tall Melic	<i>Melica nitens</i>	G5	S2
Tall Nut-Rush	<i>Scleria triglomerata</i>	G5	S1
Tapegrass	<i>Vallisneria americana</i>	G5	S1
Texas Bergia	<i>Bergia texana</i>	G5	S1S2
Texas Dropseed	<i>Sporobolus texanus</i>	G5	S1
Texas Sedge	<i>Carex texensis</i>	G5	S1
Thickspike Gayfeather	<i>Liatris pycnostachya</i>	G5	S2
Three-Nerve Fleabane	<i>Erigeron subtrinervis</i>	G5	S1
Thrift Mock Goldenweed	<i>Stenotus armerioides</i>	G4G5	S3
Tine-Leaf Milkvetch	<i>Astragalus pectinatus</i>	G5	S2
Tower-mustard	<i>Arabis glabra</i>	G5	S3
Trailing Fleabane	<i>Erigeron flagellaris</i>	G5	S3

<u>Common Name</u>	<u>Scientific Name</u>	<u>Grank</u>	<u>Srank</u>
Tufted Fleabane	<i>Erigeron caespitosus</i>	G5	S2
Turk's-cap Lily	<i>Lilium michiganense</i>	G5	S3
Two-Leaf Waterweed	<i>Elodea bifoliata</i>	G4G5	S1
Veiny Meadow Rue	<i>Thalictrum venulosum</i>	G5	S3?
Veiny Pepperwort	<i>Lepidium oblongum</i>	G5	S1
Vernal Water-Starwort	<i>Callitriche palustris</i>	G5	S2
Violet Bush-Clover	<i>Lespedeza violacea</i>	G5	S1
Water Dock	<i>Rumex verticillatus</i>	G5	S1
Water Horsetail	<i>Equisetum fluviatile</i>	G5	S1
Watershield	<i>Brasenia schreberi</i>	G5	S1
Water-Thread Pondweed	<i>Potamogeton diversifolius</i>	G5	S2
Wedgeleaf Whitlow-Wort	<i>Draba cuneifolia</i>	G5	S1
Western Aster	<i>Symphotrichum ascendens</i>	G5	S1
Western Blue Flax	<i>Linum lewisii</i>	G4G5	S1
Western Blue-Flag	<i>Iris missouriensis</i>	G5	S1
Western Buckeye	<i>Aesculus glabra</i> var. <i>arguta</i>	G5T4?QS2S3	
Western Marsh Cudweed	<i>Gnaphalium palustre</i>	G5	S3
White Baneberry	<i>Actaea pachypoda</i>	G5	S1
White Oak	<i>Quercus alba</i>	G5	S1
White Water-Lily	<i>Nymphaea odorata</i>	G5	S2
White Woodland Aster	<i>Symphotrichum lateriflorum</i>	G5	S1
White-Scale Sedge	<i>Carex xerantica</i>	G5	S2
White-Stem Pondweed	<i>Potamogeton praelongus</i>	G5	S1S2
Whorled Water Milfoil	<i>Myriophyllum verticillatum</i>	G5	S1
Wild Leek	<i>Allium tricoccum</i>	G5	S1
Wild Lily-Of-The-Valley	<i>Maianthemum canadense</i> var. <i>interius</i>	G5T4	S1
Wild Sarsaparilla	<i>Aralia nudicaulis</i>	G5	S3
Wild Senna	<i>Senna marilandica</i>	G5	S2S3
Wild Sweet Potato	<i>Ipomoea pandurata</i>	G5	S1
Wild Yam	<i>Dioscorea villosa</i>	G5	S1
Wire-Lettuce	<i>Stephanomeria runcinata</i>	G5	S2
Wood Lily	<i>Lilium philadelphicum</i> var. <i>andinum</i>	G5T4T5S2	
Wood-Mint	<i>Blephilia hirsuta</i>	G5?	S1
Woolly Cinquefoil	<i>Potentilla hippiana</i> ssp. <i>effusa</i>	G5?	S1
Woolly Milkweed	<i>Asclepias lanuginosa</i>	G4?	S3S4
Woolly-Fruit Sedge	<i>Carex lasiocarpa</i> var. <i>americana</i>	G5T5	S1
Yellow Lady's-Slipper	<i>Cypripedium parviflorum</i>	G5	S1
Yellow Pond-lily	<i>Nuphar variegata</i>	G5	S3
Yellow Vetchling	<i>Lathyrus ochroleucus</i>	G4G5	S2
Yellow-Fruit Sedge	<i>Carex brachyglossa</i>	G5	S2S3
Zigzag Goldenrod	<i>Solidago flexicaulis</i>	G5	S1

## APPENDIX 10: Map of the Ecoregions of Nebraska

Ecoregions are relatively large units of land and water delineated by the biotic and abiotic factors (e.g. climate, topography, geology, vegetation) that regulate the structure and function of the ecosystems within them. There are two main ecoregion maps for the United States, one developed by the U.S. Forest Service (Bailey et al. 1994) and the other developed by the U.S. Environmental Protection Agency (Omernik et al. 1987). For the Natural Legacy Project we delineated ecoregions using primarily Level III ecoregion lines from Ecoregions of Nebraska and Kansas (Chapman et al. 2001), which was a joint project of the USFS and EPA to blend the two systems. However, we used Bailey's Section level line to delineate the western boundary of tallgrass prairie south of the Sandhills since this was a better fit with Kaul and Rolfsmeier's (1993) map of the native vegetation of Nebraska.

