

# Little Sioux River Valley Conservation Action Plan



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## CONSERVATION ACTION PLANNING

The Nature Conservancy has developed a planning process for helping conservation practitioners to develop strategies, take action, measure success, and adapt and learn over time. Conservation Action Planning (CAP) involves an iterative sequence of action steps, designed to increase conservation effectiveness and implement adaptive management by refining and improving the linkage between actions and project goals (Figure X).

**Figure X.** The Nature Conservancy's Conservation Action Planning process.



The intent of this conservation plan for the Little Sioux River watershed is to:

- Outline the primary targets for the Little Sioux River watershed
- Define and explain the threats to our target communities
- Outline general strategies that could be used to mitigate the threats to the system, more specific strategies and details will be inserted into the conservation plans
- Outline general monitoring strategies that will help conservation partners measure success
- Define general roles of conservation partners in the landscape in order to achieve a mutual desired future condition of the landscape

Conservation Action Planning is an iterative process. The CAP is intended to be an every evolving document guiding conservation action in the project area, and should be used to inform work plans for the various conservation partners. As more knowledge is gained about our target communities and species, and/or as situations surrounding the threats to those targets change or become better understood, this plan should be updated and revised.

## **EXECUTIVE SUMMARY**

Outside of the Loess Hills, the largest concentrations of prairie remnant left in Iowa occur on the slopes and ridge tops of the Little Sioux River valley of northwestern Iowa. Prairie, river and wetland systems comprise much of this area which includes such unique habitats as oak savanna, glacial kettle lakes and rare calcareous fens. Conservation organizations have been active in this landscape for the past 20 years, and recognized a need for a unified conservation vision to enable each organization to achieve their own missions, while contributing to greater conservation at a large landscape scale, across multiple habitats.

The project area is the Iowa portion of the Little Sioux River's watershed (1.5 million acres or ~2,226 square miles). Land use is predominantly row crop agriculture (73.0%), followed by 13.9% native grasses (includes grazed lands), 0.7% non-native pasture/forage, 2.52% forest/savanna, 1.8% wetland, 1.6% open water, and 6.5% developed lands. Although the project area encompasses the watershed boundary, conservation work to date has primarily been in 3 landscapes with concentrated targets, such as rare fens and prairies. The 3 focal areas have been the Little Sioux Headwaters, the Elk Creek/Hawk Valley complex, and the Waterman/Glacial Hills area comprising 408,742 acres, or 27% of the watershed.

Our vision for the project area is a mosaic of protected lands and private working lands managed for sustainable agriculture that promotes wildlife habitat, ecological integrity of streams, floodplains and grassland habitats, and preserves the cultural heritage of the valley.

We will achieve this vision through developing a voluntary and cooperative stewardship strategy between natural resource professionals and private landowners that sustains the long term viability of native plants and animals, the integrity of ecosystem functions in a working lands landscape, the production of commodities and ecosystem services, and the human communities that depend on them.

The persistence of globally significant conservation targets in the Little Sioux River watershed depends on innovative systems of sustainable agricultural and natural resource management that simultaneously provide viable local livelihoods, conservation of biodiversity and ecosystem services, and sustainable agricultural production at a landscape level. Restoration of native communities in the Little Sioux depends upon continued successful partnership efforts between conservation professionals of multiple agencies and organizations and private landowners. Partnership efforts will include connecting habitats to restore long-term ecological viability, landscape scale invasive species management, and community engagement. The planning team believes that priority actions for conservation include:

- Fire partnership
- Outreach/education (assistance with private lands management, preservation of cultural heritage sites, conservation grazing opportunities, etc.)
- Acquisition of key remnant habitats, gaps in protection, etc.
- Enrollment of landowners into private land management coop agreements
- Dedicated management and restoration of areas that are under conservation ownership

## ACKNOWLEDGEMENTS/PLANNING TEAM

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## **PLANNING AREA**

### **Introduction**

The vision of the Little Sioux planning team for the project area is a mosaic of protected lands and private working lands managed for sustainable agriculture that promotes wildlife habitat, ecological integrity of streams, floodplains and grassland habitats, and preserves the cultural heritage of the valley.

We will achieve this vision through developing a voluntary and cooperative stewardship strategy between natural resource professionals and private landowners that sustains the long term viability of native plants and animals, the integrity of ecosystem functions in a working lands landscape, the production of commodities and ecosystem services, and the human communities that depend on them.

Successful conservation of biodiversity in the Little Sioux has global significance in that it contributes to biodiversity of the Earth's temperate grasslands – one of our most endangered biomes.

### **The Northern Tallgrass Prairie Ecoregion**

The Little Sioux River valley is part of the Northern Tallgrass Prairie Ecoregion. Stretching from Lake Manitoba in the province of Manitoba, south to Des Moines, Iowa, the Northern Tallgrass Prairie ecoregion covers parts of five U.S. states and one Canadian province and lies on the northeastern corner of the Great Plains. In all, the ecoregion encompasses 73,234 square miles, or 7.2% of the Great Plains. Figure 1 shows where the Little Sioux River Valley is located within the ecoregion. It is one of several priority conservation areas that, if effectively conserved, represent the conservation of the biodiversity in the entire ecoregion. The specific priority conservation areas within the Little Sioux include both the upper and lower Little Sioux River Valleys, the Excelsior Fen Complex, Steele Prairie State Preserve and Kirchner Prairie.

Figure 1. Northern Tallgrass Prairie Ecoregion (from "Ecoregional Planning in the Northern Tallgrass Prairie, TNC, 1998)

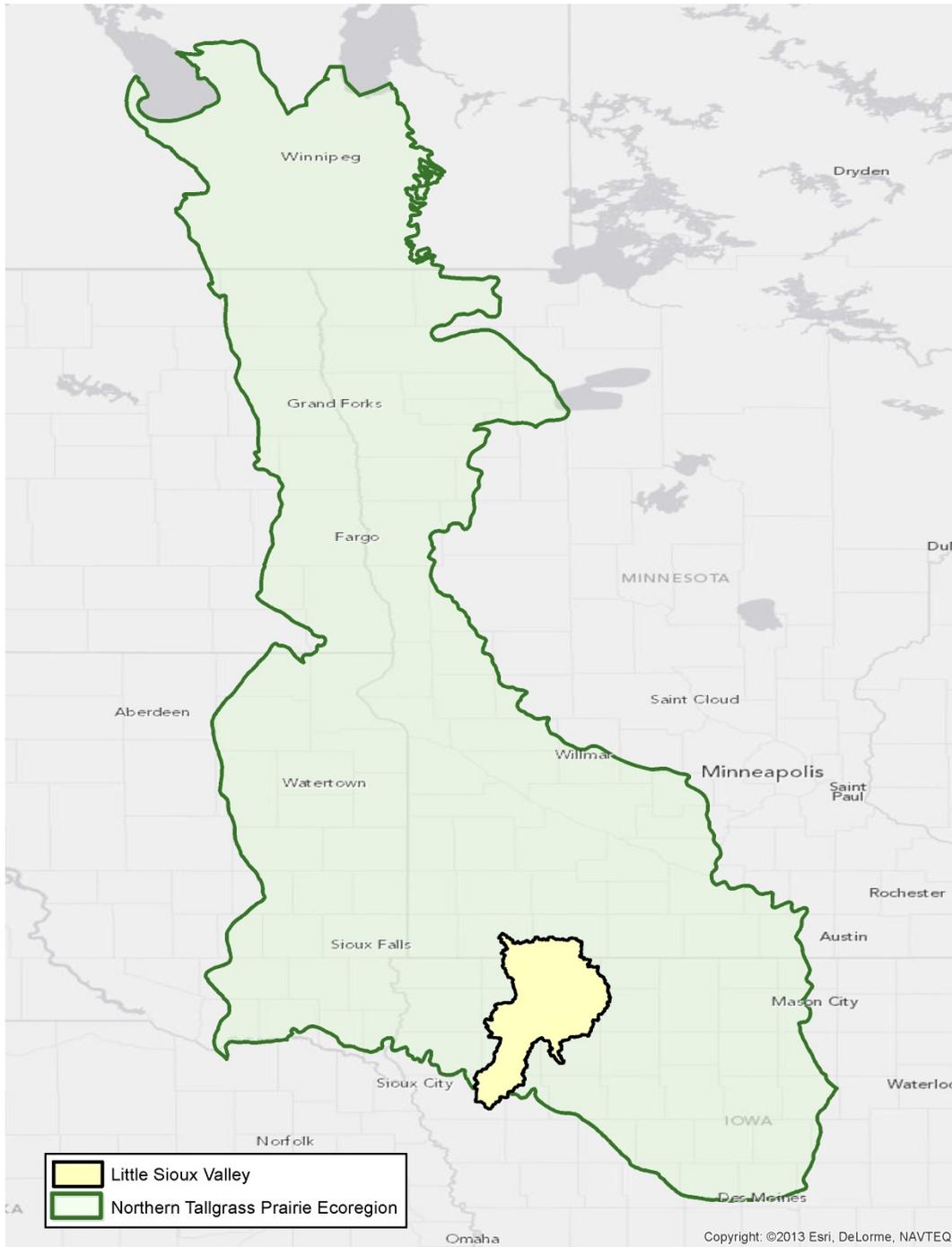


Table 1. Conservation targets of the Northern Tallgrass Prairie Ecoregional Assessment that occur in the Little Sioux River valley.\*

NatureServe Code	Target	Global NatureServe Rank**
CEGL002267	Great Plains calcareous fen	G2 – Imperiled
CEGL002377	Little bluestem/Porcupine grass/dry mesic hill prairie	G3
CEGL002158	Northern burr oak openings	G1/G2
CEGL002499	Northern little bluestem gravel prairie	G2/G3
IILEP57010	Powesheik skipperling	G2/G3
PDFAB27090	Prairie bush clover	
PMORC1YOSO	Western prairie fringed orchid	G3
CEGL002027	Northern cordgrass wet prairie	G3
CEGL002202	Northern mesic tallgrass prairie	G2/G3

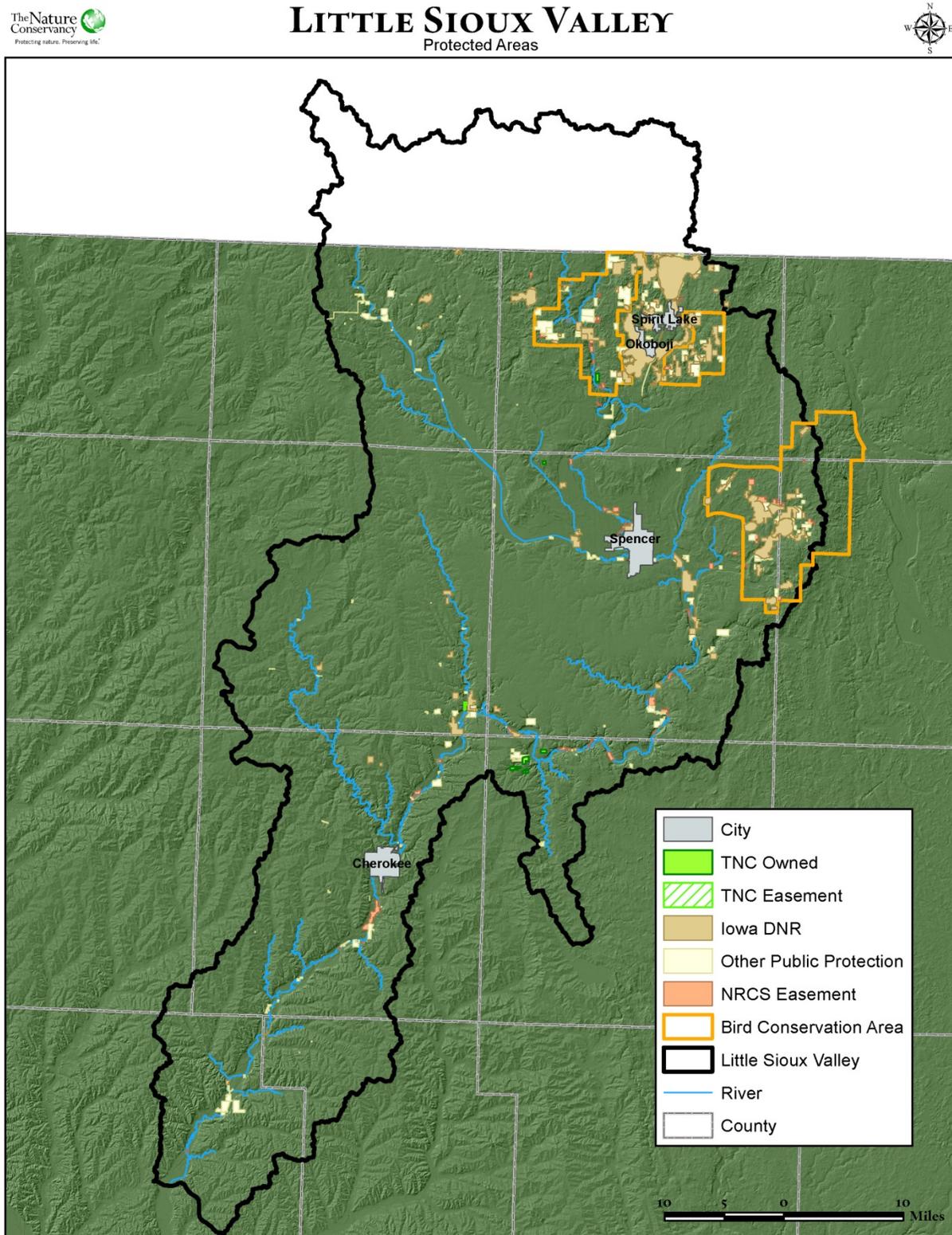
\*Note that the ecoregional assessment was completed in 1998, so records are greater than 10 years old. Iowa’s Natural Areas Inventory tracks current occurrences and is referenced later in this plan.

\*\*See Appendix 1 for definitions of rankings.

**The Little Sioux River Watershed**

The project area is the Iowa portion of the Little Sioux River’s watershed, with the exception of the lowest portion of the watershed which is located in Iowa’s Loess Hills. (The lowest portion of the Little Sioux watershed, located in Iowa’s Loess Hills, is part of the Loess Hills land form of Iowa, covered in the Loess Hills Conservation Action Plan, created by another set of partners in Iowa.) The effective project area is 1,494,961 acres or ~2,336 square miles (Figure 2).

Figure 2. Little Sioux project area boundaries with protected lands highlighted.



Beginning in southern Minnesota, the Little Sioux River meanders through sand and gravel deposits left behind by glaciers over 10,000 years ago. Prairie, river and wetland systems comprise much of this area, which once was covered by native tallgrass prairie. The project area contains all or part of 11 Iowa counties - Osceola, Dickinson, Emmet, Palo Alto, O'Brien, Clay, Buena Vista, Cherokee, Plymouth, Woodbury and Ida – from the Minnesota border south to Iowa's Loess Hills. Today, much of this area has been converted to row crop agriculture; however, native prairie remnants and prairie pothole wetlands still exist within the watershed that include undisturbed rare calcareous fens, dry hill prairies and oak savannas.

Land use is predominantly row crop agriculture (73.0%), followed by 13.9% native grasses (includes grazed lands), 0.7% non-native pasture/forage, 2.52% forest/savanna, 1.8% wetland, 1.6% open water, and 6.5% developed lands.

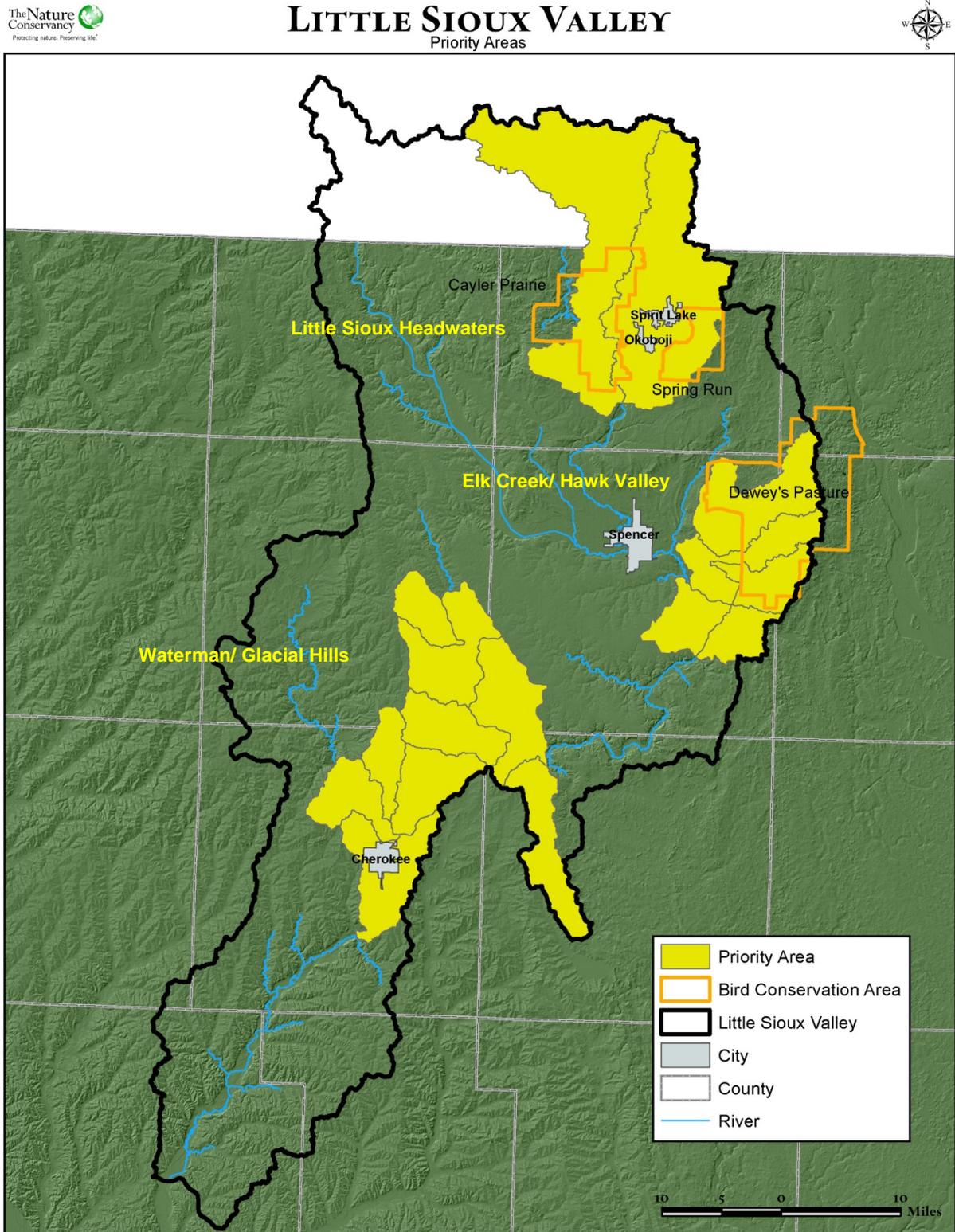
The hilly topography and sand and gravel deposits are difficult to farm and have predominantly been grazed. Therefore much of the hillside and ridgetop habitat is unplowed prairie remnant. In the 1940s, botanist Dr. Ada Hayden identified the area around the lower Little Sioux River valley as having some of the best native prairie left in the state. Several globally rare species can be found in the Little Sioux Valley, including the federally-threatened prairie bush clover (*Lespedeza leptostachya*) (G2/Federally threatened), Western prairie fringed orchid (*Platanthera praeclera*) (G2/Federally threatened), Poweshiek Skipperling (*Oarisma poweshiek*) (G2/G3), and Dakota skipper (*Hesperia dacotae*) (G2/G3/Federal candidate). Many uncommon grassland birds can also be found in the area, e.g. Northern Harrier and Henslows sparrow, due to the larger tracts of native grasslands. Overall sixty-eight species of state concern can be found in the Little Sioux Watershed.

The plant and animal communities of concern are rapidly being encroached upon by eastern red cedar (among other woody trees and shrubs) and leafy spurge, especially in the southern portions of the project area. These invasive species represent a serious threat to the continued persistence of the prairie plant and animal communities. Other notable threats include suppression of the natural fire regime, conversion of pasture to row crop and inappropriate grazing.

This part of Iowa is also notable for a unique cultural resource – the ancient settlements of the Mill Creek Culture. Settlements dating back to A.D. 1000-1200 have been documented along the Little Sioux River and three tributaries – Brooke Creek, Mill Creek and Waterman Creek. One settlement, the Wittrock Indian Village located along Waterman Creek, is now a dedicated state preserve. These rich cultural resources exist throughout the watershed.

Although the project area encompasses the watershed boundary, conservation work to date has primarily been in 3 landscapes (Figure 3) with concentrated targets such as rare fens and remnant prairies. The 3 focal areas have been the Little Sioux Headwaters, the Elk Creek/Hawk Valley complex, and the Waterman/Glacial Hills area together comprising 392,804.2 acres, or 23% of the watershed. Conservation work to date has focused on two main strategies: 1) land management (both public and private lands) and 2) protection of key tracts with conservation value (both through fee title acquisition and easement programs).

Figure 3. Focal landscapes of the Little Sioux project area.



### **Key Landscape Areas**

A sub-group was formed to examine past targeting of conservation work in the watershed and to determine where partners should be concentrating preservation efforts. It was determined that the 3 key landscape areas were, indeed, the highest priorities for targeting because: 1) The highest concentration of remaining prairie, wetlands, and oak savanna were located in these 3 key areas. 2) These focal areas all present the opportunity to expand current complexes, increasing the size of habitat blocks. 3) Landowners in these areas are generally more receptive to the idea of habitat preservation and restoration.

The sub-group developed ranking criteria to prioritize protection projects to maximize any available costshare funds (Appendix 5). This ranking form can easily be adapted to habitat projects and demonstrates the shared priorities of all involved agencies and organizations.

### ***Little Sioux Headwaters***

The Little Sioux Headwaters, totaling 198,199 acres, includes the Iowa Great Lakes area (104,269 ac) and portions of two counties in Minnesota (93,930 ac). We acknowledge that the watershed does not honor political boundaries; however, we feel that it would be better to proceed with the Iowa portion only due to existing partnerships and the good handle Minnesota seems to have on the area. Minnesota currently has several conservation projects in the Little Sioux Watershed, including Reinvest in Minnesota (RIM), a state easement program aimed at preserving grasslands and forests and the Missouri River Basin Project, aimed at improving surface water quality on large scale watersheds.

There are several protected lands in the area including Cayler Prairie, Freda Hafner Kettlehole State Preserve, and Silver Lake Fen. Numerous partners have individually targeted the Little Sioux Headwaters area to prevent overdevelopment and destruction of the many prairie pothole wetlands and associated native uplands. In 2011, the 37,000 acre Cayler Prairie Bird Conservation Area (BCA), the first to be centered on a state preserve, was dedicated. It joins Spring Run Grasslands BCA, one of Iowa's oldest.

### ***Elk Creek/Hawk Valley***

At 104,833 acres, Elk Creek/Hawk Valley contains the second largest concentration of high quality calcareous fens in the state in addition to several wetland complexes vitally important to migrating and nesting waterfowl. Dewey's Pasture BCA, dedicated in 2006, has been awarded National Natural Landmark status by the National Park Service. The potential for prairie, savanna, and riverine wetland preservation and/or restoration is very high with 22,855 acres already protected. Of the three focal areas, Elk Creek/Hawk Valley has the highest potential for upland wetland restoration (prairie potholes).

### ***Waterman/Glacial Hills***

The Waterman/Glacial Hills area, at 199,441 acres the largest focal area in the watershed, consists of rolling hills and contains 42,642 acres (21.38% of the watershed) of native grasslands. Despite this fact, the Waterman/ Glacial Hills area is the least protected at only 4890 acres or 2.45%. Several threatened and endangered species, such as the federally threatened prairie bush clover (*Lespedeza leptostachya*) and Western Prairie fringed orchid (*Platanthera praeclera*) have been found in the area. In her 1944 report to the Iowa Conservation Commission, Dr. Ada Hayden called attention to this area as a landscape in need of preservation due to the quality and abundance of the remaining native prairie. As a result, there is a long history of targeted conservation programs in this working landscape ensuing in good local landowner relationships with conservation staff.

Table 2. Summary of protection efforts in key landscapes of the Little Sioux Watershed.

Landscape	Landscape acreage	Protected lands acreage*	Proportion protected
Little Sioux Headwaters	104,269	15,264	14.64%
Elk Creek/ Hawk Valley	104,833	11,535	11.00%
Waterman Creek/ Glacial Hills	199,640	4,890	2.45%
Cayler Prairie BCA**	28,681	6,245	21.77%
Spring Run BCA**	11,778	4,420	37.53%
Dewey's Pasture BCA**	49,539	18,417	37.18%

\*Includes FWS easements

\*\*Acres within key landscapes only

### Private Landowner Partnerships

As it should be in a primarily private lands state, private landowners in the Little Sioux watershed continue to play a major role in conservation in this landscape. In 2005, Iowa DNR selected the watershed as a priority area for the Landowner Incentive Program (LIP). Other private lands incentive programs such as USFWS Private Stewardship Program and the USDA-NRCS Wildlife Habitat Incentive Program (WHIP) followed this lead by also targeting these rare and declining habitats. From 2005 through 2010, nearly \$500,000 of cost share funding was invested in land management and prairie restoration practices such as invasive woody removal, fencing, prescribed fire, seeding, timber stand improvement and deferred grazing. Cost share dollars are meant to aid landowners in implementation of practices – this \$500,000 does not reflect staff time, partner contributions or landowner match funds. In all, targeting cost share dollars to the Little Sioux over the 5 years measured resulted in the restoration of over 3,700 acres of rare and declining habitats. Although restoration has slowed some due to reductions in funding, management and preservation continue in the watershed.

Restoration of these lands also resulted in increased awareness and involvement of private landowners, including a demand for assistance with long term management. As a result a private lands burn crew was formed, and burns have been conducted through a cooperative effort by staff from local volunteer fire departments, CCBs, DNR, and landowners. Equipment needs were supported by DNR. Staff and budget cuts forced this burn crew into hiatus – but it remains an example of necessary public and private cooperative management of native habitat.

## CONSERVATION TARGETS

Focal conservation targets are a limited suite of species, communities and ecological systems that represent and encompass the biodiversity of the project area. As it would be impossible to plan for all of the elements of biodiversity, it is critical to identify a representative subset of the biological diversity in the Little Sioux. There are three basic types of conservation targets: an ecological system, an ecological community, and species. Species can be individual species of concern (i.e. threatened or endangered), “flagship” or “umbrella” species that indicate the health of a greater system, or species groupings (e.g. migratory birds, freshwater mussels). The focal conservation targets form the foundation for conservation strategies and actions.

The Little Sioux River Watershed is a critical conservation focus area for:

- northern tallgrass prairie systems
- savanna
- prairie streams and riparian wetlands
- glacial lakes/prairie potholes
- great plains calcareous fen
- migratory birds
- cultural resources

To further calibrate our thinking about these focal conservation targets, a suite of ‘nested’ targets are considered under them and are enumerated in Table 3. Nested conservation targets list natural communities, species assemblages and species groups that should be conserved if the broader focal conservation targets are effectively conserved.

Table 3. Nested Conservation Targets

Conservation target	Nested targets
Northern tallgrass prairie	little bluestem-porcupine grass dry mesic hill prairie*
	Northern little bluestem gravel prairie
	Bottomland prairie/wet prairie, including northern cordgrass wet prairie
	Northern mesic tallgrass prairie
	Western prairie-fringed orchid
	Poweshiek skipperling
	Prairie bush clover
	Grassland bird assemblage
Savanna	Northern burr oak openings*
	Savanna specific plant or animal species?
Prairie Streams	Native fish assemblages
	Freshwater mussels
	Aquatic invertebrate assemblage
	Riparian wetland structure and composition
Calcareous fen	Great Plains calcareous fen
Migratory birds	Grassland bird assemblage
	Waterfowl/stopover habitat
Cultural resources	Mill Creek sites
	Pioneer era sites
	Pre-depression era sites

\*See appendix 3 for NatureServe description

### **Northern Tallgrass Prairie System**

This ecological system once dominated the landscape as the matrix forming community. The ecological goal for the northern tallgrass prairie system is to ensure the long-term viability of the entire resident biota.

The primary ecological processes driving the northern tallgrass prairie were climate, grazing and fire, each operating at multiple scales, frequencies and intensities. Grazing and fire interacting with climate, landform, and soils produced variable regional vegetation patterns. The landscape experienced frequent surface fire, primarily anthropogenic in origin, with the fire return interval typically ranging from 1 to 7 years, depending on topography, vegetation, and moisture regime. Large portions of the landscape were kept open and repeatedly ignited by Native Americans to stimulate new growth to attract wildlife, clear vegetation and facilitate travel, as a tool of warfare or hunting, and to reduce the likelihood of wildfire. Bison, elk and white-tailed deer were the principal large grazers in the landscape. They moved to locations with preferred forage in response to patterns of precipitation, drought and fire. Their transitory grazing patterns allowed the vegetation to recover from intermittent, and sometimes intensive, grazing events.

Today, remnant northern tallgrass prairie system patches exist across the landscape in the Little Sioux River Valley. Some of these remnants patches are actively managed; these typically occur on protected lands. Others are unmanaged and are found on private lands, however an increasing number of prairie remnants on private lands are managed under cost share agreements with public agencies. Remnant prairies are most commonly located in landscape positions that make them unsuitable for farming – shallow, gravelly soils on hillsides or hilltops. These habitats have typically been heavily grazed however and sometimes planted with cool season grasses. Restoration efforts are worthwhile though, as the soil hasn't been plowed.

Wetter prairies of the area are much less frequent as these areas with deep soils and flat aspects are quite suitable and have been converted to agriculture.

Grassland habitats are encroached upon by eastern red cedar (among other woody trees and shrubs) and leafy spurge, especially in the southern portions of the project area. These invasive species represent a serious threat to the continued persistence of the prairie plant and animal communities. Blanket herbicide spraying to control thistles on pasture has caused a tremendous loss of broad-leafed prairie plants in the Little Sioux. Alternative practices such as mowing, wicking plants with Round-up, use of biological controls are needed.

### **Savanna**

Savannas are physically characterized by a widely spaced oak-dominated tree canopy (varying by as much as 10-80% canopy cover) with a species rich herbaceous understory. Regular surface fires were integral in structuring and maintaining woodland/savanna communities. Canopy presence along with associated shading was perhaps the single most important community attribute, but topographic roughness coupled with fire behavior patterns and propagation are equally important.

Savanna habitat in the Little Sioux is little studied and documented. There are concentrations of oak trees in the draws of the landscape and on the slopes – whether these areas were historically savanna habitat, and thus restorable, is difficult to determine. In June of 2010, the CAP team along with natural resource biologists of differing backgrounds, but all with an interest and experience in savanna restoration, visited a sampling of savannas in varying stages of restoration and management near the Waterman Complex.

The team attempted to do a rapid assessment of current savanna condition, and establish a “starting point” for constructing initial conservation goals for savanna in the project area (Filipiak 2010). The team determined that indicators of healthy savanna habitat include the presence of large old oaks with horizontally “reaching” lower limbs (i.e. “wolf” trees), diverse herbaceous understory, varied age structure of the tree canopy, and oak regeneration. The team noted that some dense even-aged stands of oak trees in the draws of hill prairie were likely not historic savanna, more a result of overgrazed pasture and fire suppression.

Savanna condition in the Little Sioux is generally fair, though most savannas are over-grazed and fire suppressed even aged stands. These areas also have a history of logging. Recently, due to the outreach component of private lands cost share programs, several landowners have become interested in restoring savanna with the intention of grazing it at levels conducive to the maintenance of a rich herbaceous understory.

### **Prairie Streams**

The Little Sioux River itself is a large river (6<sup>th</sup> order) about 220 miles long, flowing from southwest Minnesota into the Missouri River and is western Iowa’s largest interior stream. From Spencer, Iowa to Linn Grove, Iowa, the Little Sioux is a state Protected Water Area (44.8 river miles) due to the scenic beauty and native prairie habitats of the narrow valley. The distinctive character of the Little Sioux River’s narrow, steep valley is due to the location of Wisconsin ice which blocked drainage to the Mississippi. The upper part of the basin was forced to flow through the highest divide into the Missouri River drainage, creating the spectacular relief of the area (Hoyer 1980).

The Little Sioux watershed has numerous impaired waterways on the 303d list for 2010. Little Sioux itself is impaired from the state line to the confluence with Ocheyedon River at Spencer; from the east side of Spencer to the confluence with Willow Creek; and from Hwy 3 to Waterman Creek. Impairments are listed as bacteria and biological. Willow Creek is impaired due to low dissolved oxygen and ammonia. Ocheyedon River, Milford Creek and Mill Creek are all biological impairments, and finally an unnamed tributary to Pierson Creek has an unexplained fish kill.

### **Glacial Lakes/Prairie Potholes**

Iowa’s prairie pothole region has endured dramatic hydrologic changes over the past 150 years. Today, direct drainage no longer poses a major threat to many of Iowa’s remaining wetlands; however, many of these areas have experienced a significant decline in productivity, biodiversity, water quality and overall bird use during the past several decades. Major threats to wetlands in Iowa’s prairie pothole region include: non-point source pollution, silt accumulation, increased surface flows and drainage inputs, exploding rough fish populations and a general lack of infrastructure needed to adequately maintain and manage these sites. As the health and biological integrity of these wetlands continues to deteriorate, future restoration and enhancement efforts will only become increasingly more difficult and expensive. Thus, there is an urgent need to restore and enhance these sites today. As direct drainage threats have decreased, development threats along many of Iowa’s remaining shallow lakes and large marshes have increased dramatically.

Threats to these systems include altered hydrology in addition to outright drainage. If the watershed of a pothole wetland is fully cropped, but the wetland itself preserved, hydrology of the wetland will have been significantly altered in terms of inundation frequency, depth and duration. An altered watershed also causes sedimentation and nutrient loading. These threats affect species composition, and often pothole wetlands change from a diverse,

bulrush dominated emergent community to cattail dominance – cattails are highly tolerant of sediment, nutrients and an extreme hydrograph.

### **Calcareous Fens**

The calcareous fens are characterized by a combination of organic soils and saturated soils. The hydrology is alkaline, typically originating from ground water via seeps and/or springs. Fens in northwest Iowa arise from seepage and are classified as true fens (specifically as "rich" fens, denoting their high nutrient level). They are distinct from the non-alkaline fens of eastern Iowa, commonly classified as "hanging bogs" where groundwater seeps out of the hillside. (*cite Loeschke*). Fens represent some of the rarest wetland types in Iowa and contain plant remains dating back over 5,000 years. Over 200 different plant species can be found in fens, including 20 that are rare, endangered or threatened in Iowa. In northwest Iowa, complexes of hydrologically linked fens exist (e.g. Excelsior Fens in Dickinson County). If the delicate balance between the amount of water and chemical composition becomes disrupted at one location, the entire fen complex is affected.

### **Cultural Resources**

This part of Iowa is notable for a unique cultural resource – the ancient settlements of the Mill Creek Culture. Settlements dating back to A.D. 1000-1200 have been documented along the Little Sioux River and three tributaries – Brooke Creek, Mill Creek and Waterman Creek. One settlement, the Wittrock Indian Village located along Waterman Creek, is now a dedicated state preserve. The property was deeded to the Iowa Conservation Commission in 1937 by the Wittrock family, who recognized the importance of the site and kept it intact, plowing around it for agriculture.

The Mill Creek culture is the subject of much study and debate in Iowa, as researchers have not agreed upon the details surrounding the origin, existence and departure from this area. Evidence indicates that the Mill Creek culture followed a way of life completely different from those around them and before them, although it is generally agreed that they are part of a larger group of horticultural villages that started to appear around A.D. 1000 from northwest Iowa to central Dakota (Fishel, 1996, Appendix 4).

The planning team has concluded that cultural heritage, while not a traditional conservation target, is threatened by similar threats as other conservation targets, especially careless development, row crop conversion and altered hydrology in streamside sites.

## VIABILITY ASSESSMENT

Assessing the current condition of the biodiversity is critical in the development of conservation strategies. Where viability is high, the strategy is to prevent degradation. If the viability is poor, then restoration, or reintroduction might be necessary to sustain target viability. Integrity ratings are made using the best science available and often with vigorous discussion. Integrity ratings are fluid, and are likely to change as new information is obtained.

The planning team develops categories that define the relative condition in areas of size, ecological condition, and the landscape context for each conservation target. The team determines which category best reflects the current conservation target state at the planning area.

The assessment of viability of the conservation targets is based on three criteria:

- **SIZE** - This is a measure of the area or abundance of the conservation target's occurrence. For ecological systems and communities, size is simply a measure of the occurrence's geographic coverage. For species, size takes into account the area of occupancy and number of individuals. Minimum area needed to ensure survival or re-establishment after natural disturbance is another aspect of size.
- **CONDITION** – These ratings reflect an integrated assessment of the composition, structure and biotic interactions that characterize the occurrence. This includes factors such as reproduction, age structure, biological composition (e.g., presence of native versus nonnative species; presence of characteristic patch types for ecological systems), structure (e.g., canopy, understory, and groundcover in a forested community) and biotic interactions (e.g., levels of competition, predation, and disease).
- **LANDSCAPE CONTEXT** - This is an integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the element occurrence, and connectivity. Dominant environmental regimes and processes include herbivory, hydrologic and water chemistry regimes (surface and groundwater), geomorphic processes, climatic regimes (temperature and precipitation), fire regimes and many kinds of natural disturbance. Connectivity includes such factors as species having access to habitats and resources needed for life cycle completion, fragmentation of ecological systems and the ability to respond to environmental change through dispersal, migration, or re-colonization.

The viability of the selected conservation targets were each assigned a rank using a four-level scale<sup>1</sup>:

- **VERY GOOD** - The indicator is functioning within an ecologically desirable status, requiring little human intervention for maintenance within the natural range of variation.
- **GOOD** - The indicator is functioning within its range of acceptable variation, although it may require some human intervention for maintenance.
- **FAIR** - The indicator lies outside of its range of acceptable variation and requires human intervention for maintenance. If unchecked, the target will be vulnerable to serious degradation.

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<sup>1</sup> Definitions were taken from Version 5a of the Excel-based CAP workbook; current versions of the CAP Excel Tool workbook may be obtained from the Conservation by Design Gateway at <http://conserveonline.org/workspaces/cbdgateway/cap/resources/index.html>. The Conservation by Design Gateway is part of ConserveOnline ([www.conserveonline.org/](http://www.conserveonline.org/)).

- POOR - Allowing the indicator to remain in this condition for an extended period will make restoration or prevention of extirpation of the target practically impossible.

Table 4: Overall Viability Summary of the Little Sioux Watershed (updated Feb. 2012)

<b>Conservation Targets</b>		Landscape Context	Condition	Size	Viability Rank
<b>Current Rating</b>					
1	Northern tallgrass prairie	Poor	Fair	Good	Fair
2	Savanna	Poor	Fair	Fair	Fair
3	Kettle lakes/prairie potholes	Poor	Fair	-	Fair
4	Calcareous fen	Fair	Fair	-	Fair
5	Streams & assoc. riparian habitat	-	-	-	-
6	Migratory Birds	Fair	-	-	Fair
7	Cultural Resources	-	-	-	-
<b>Project Biodiversity Health Rank</b>					<b>Fair</b>

The combination of each viability criterion, stated above and shown in Table 4, results in the assignment of the overall viability rank for the conservation target. The criteria ranks shown are the output of viability assessments conducted by the project team. The “streams & assoc. riparian habitat” and “cultural resources” targets are unranked at this time because the team has not yet gone through available data regarding the viability of these targets in the project area. Viability of these targets is to be determined.

## THREATS ASSESSMENT

The threats assessment identifies and evaluates the current and potential activities that reduce the viability of the conservation targets.

Threats are composed of stresses and sources of stress (or “sources”). A stress is defined as a process or event with direct negative consequences on target viability (e.g., alteration of habitat structure). The source of stress is the action or entity that produces a stress (e.g., fescue as a pasture). The planning team must identify and rank the relative impacts of stresses and sources for each of the species and ecological systems. Guidelines for selection and ranking of stresses and sources are provided below.

The stress ranks and source ranks: 1) help elucidate the factors influencing targets and subsequently, the necessary conservation strategies, and 2) contribute to the analysis of threats for the planning area. The stress and source rankings are analyzed together via computer to provide threat ranks for the target.

Stresses are ranked based on the projected severity and scope of damage expected within 10 years under the current circumstances. Sources of stress are ranked based on the expected contribution of the sources and the irreversibility of the impact. All these aspects are combined into an overall threat rank for a particular source (i.e., season long grazing on fescue) to all conservation targets.

Stresses that are common to more than one conservation target and that are considered high priority stresses in the planning area include:

- Altered fire regime (typically lack of properly timed fire)
- Altered grazing disturbance regime (too much or too little)
- Altered habitat composition (exotic plants, woody encroachment and floristic quality)

The conservation targets are threatened by multiple stresses, which can interact to effect the viability of each target. Based on surveys, land manager interviews, and personal observations, we ranked the main sources of stress for each conservation target (Table x). These threats have direct and indirect impacts on identified conservation targets.

Table 5: Overall Threat Summary Of The Little Sioux Watershed

Threats Across Targets		Northern tallgrass prairie	Savanna	Kettle lakes/prairie potholes	Calcareous fen	Streams & assoc. riparian habitat	Overall Threat Rank
Project-specific threats		1	2	3	4	5	
1	Herbaceous invasive species	High	High	High	Medium	-	High
2	increased surface/subsurface drainage			Very High	-	-	High
3	Nutrient loading			Very High	-	-	High
4	Row crop conversion within watershed			Very High	-		High
5	Silt accumulation			Very High	-	-	High
6	Invasive species - woody	High	Medium	Medium	Medium	-	Medium
7	Inappropriate grazing	High	Medium	Medium	-	-	Medium
8	Lack of fire	Medium	High	Low			Medium
9	Inappropriate fish (e.g. carp, bullhead..)			High		-	Medium
10	Recreational and ex-urban development	Medium	Medium	Medium	-	-	Medium
11	Energy development (infrastructure)	Medium	Low				Low
12	Inappropriate logging		Medium				Low
13	Pesticide use	-	Medium		-	-	Low
14	Conversion of native veg to ag or energy crops	Low	Low		-	-	Low
15	Lack of trained fire practitioners & fire policy						-
16	Liability (fire insurance)						-
17	Long-term accumulation of anthropogenic P in landscape sinks and release to surface waters					-	-
Threat Status for Targets and Project		High	High	Very High	Medium	-	Very High *

LOW - Threat is likely to slightly impair the target over a portion of the planning area.

MEDIUM - Threat is likely to moderately degrade the target over some portion of the planning area.

HIGH - Threat is likely to seriously degrade the target over much of the planning area.

VERY HIGH - Threat is likely to destroy the target over much of the planning area.

High level threats that affect all the targets include:

- Herbaceous and woody invasive species,
- Inappropriate grazing, and
- Lack of fire.

It is notable that threats 2-5 (increased surface/subsurface drainage, nutrient loading, row crop conversion and silt accumulation) only affect the kettle lakes/prairie pothole target, but are considered very high level threats. This indicates that special attention should be focused on strategies to abate these threats, and may be a very different set of strategies than those aimed at the other targets. It should also be noted that the other aquatic-based target has not yet been evaluated – the threat ranking will likely change with the addition of an evaluation of threats to the stream systems. However, top threats are likely to remain herbaceous and woody invasive species.

## CONSERVATION VISION, GOALS AND STRATEGIES

Our vision for the project area is a mosaic of protected lands and private working lands managed for productive agriculture that promotes corridors of wildlife habitat, ecological integrity of streams, floodplains and grassland habitats, and preserves the cultural heritage of the valley.

We will achieve this vision through: developing a voluntary and cooperative stewardship strategy between natural resource professionals and private landowners that sustains the long term viability of native plants and animals, the integrity of ecosystem functions in a working lands landscape, the production of commodities and ecosystem services, and the human communities that depend on them.

Initial goals of the partnership are to address connectivity, invasive species management, long term ecological viability and community engagement. The following objectives were identified:

Objective 1: Restore the economic viability of pastures in the LSW

Targets enhanced: Northern tallgrass prairie, savanna, migratory birds

Threats abated: herbaceous invasive species (1), row crop conversion within watershed (4), invasive species – woody (6), inappropriate grazing (7), lack of fire (8)

Potential action steps: One-on-one contacts between land users and pasture experts  
Demonstration projects

Resources need include a team of pasture experts, incentive payments for private landowners, reliable and consistent staff or expert follow up, a full time coordinator – potentially funded through USFWS with administration of funding through RC&Ds.

Objective 2: Create an awareness of conservation opportunities within the LSW within 3-5 years

Targets enhanced: All

Threats abated: Outreach activities have the potential to partially abate all threats, however outreach strategies are most effective when the desired outcome is explicit. I.e. we wish to educate the public about conservation opportunities in the LSW, but **to what end?** What behavior are we trying to change? A small working group of the CAP team will form to address this and other details of an outreach plan.

Actions: Write and implement a “social marketing plan” which identifies the goals of the outreach and includes such activities as: identification and engagement of community leaders/keystone people; development and dissemination of publications (target audience: both layperson and landowners); small “neighborhood meetings”; education of all ages of school groups; education of community groups (Elks, Masons, etc.); identification of landowners and land managers; field days/workshops; citizen science programs; development of a friends group.

Resources needed include a coordinator, or local insider – either an individual or group.

Objective 3: By 2025, have 50% of targeted grasslands in the LSW free of woody invasives

Targets enhanced: Northern tallgrass prairie, savanna, kettle lakes/prairie potholes, calcareous fens, cultural resources

Threats abated: Invasive species – woody (6)

Actions: Identify targeted grasslands, educate landowners on ecological and economic benefits of invasives control, collaborate with partners on their respective roles in invasive species management, tree removal initiatives – on both conservation ownership and private ownership

Resources needed include staff time and cost share dollars, and public support

Objective 4: Reduce the stage and duration of peak flood events by \_\_\_% over \_\_\_\_ (time) of the Little Sioux River. (Bigger picture goal is to restore a more natural flood regime or hydrograph to the Little Sioux – you could use many indicators to show the restoration)

Targets enhanced: kettle lakes/prairie potholes; streams and associated riparian habitat.

Threats abated: nutrient loading (3), silt accumulation (5), long-term accumulation of anthropogenic P in landscape sinks (17)

Actions: Create a coarse watershed model to prioritize work; overlay with areas of biodiversity concern/T&E/nested targets; implement wetland restoration, floodplain easements, perennials, etc.; evaluate existing structures

## MEASURES OF SUCCESS

Conservation success is reliant upon meeting the goals of this conservation plan. Measures of success are indicators of the biodiversity health of the conservation targets in this planning area. These measures are categorized by viability enhancement and threat abatement approaches.

A fundamental question facing any conservation project team is: "Are our conservation strategic actions having the intended impact?" To answer this question, data is being collected on a number of indicators that gauge the status of critical threats and, in turn, whether the viability is improving.

*[measures can also measure non-biological parameters – i.e. landowner signups, farmland billings coming to Little Sioux, maybe do some results chains to explore measures that are already being measured... see examples of a variety of indicators below]*

INDICATORS	
<b>VIABILITY MONITORING</b>	
1. Condition of Tallgrass Prairie	- Effectiveness of restoration – core and private land - Acres of tallgrass restored - Response of plant community (FQI ranking) - Response of grassland bird suite - Number of private prairie remnants conserved
2. Fire regime	- Mean fire return interval for individual tracts - Percent of landscape under rotational fire management
3. Habitat structure for birds	- Presence and distribution of woody cover - Average size of continuous grassland block
<b>THREAT MONITORING</b>	
4. Extent of priority weed infestations	- Presence/absence - Size of weed occurrences
5. Season long grazing method	- Number of private landowners using alternative  - Acres converted to warm season pasture
<b>SOCIAL MONITORING</b>	
6. Environmental awareness	- Percent of landowners in planning area that know about the CAP
7. Community organization	- Number of people belonging to associations or groups
8. Occupation	- Percent of population engaged in livestock operations, natural resources, recreation and eco-tourism for livelihood

## **INFORMATION NEEDS/DATA GAPS/NEXT STEPS**

Items noted thus far:

Current extent of prairie habitats, and fen habitats. Inventory needs to be updated.  
Explore potential to use LiDAR and soils information to do this...

## LITERATURE CITED

CAP overview – TNC CbD gateway website  
Iowa Breeding bird atlas  
NatureServe Explorer website  
Loeschke fen report  
Iowa DNR website (T&E spp)

Leach, Mark K. and Thomas J. Givnish. 1999. Gradients in the Composition, Structure, and Diversity of Remnant Oak Savannas in Southern Wisconsin. *Ecological Monographs*, Vol. 69, No. 3 (Aug., 1999), pp. 353-374

Nuzzo, V. 1986. Extent and status of Midwest oak savanna: presettlement and 1985. *Natural Areas Journal* 6:6-36

Packard, Stephen J. 1988. Just a few oddball species: restoration and the rediscovery of the tallgrass savanna. *Restoration and Management Notes* 6: 13-20.

Curtis, J. T. 1959. *The vegetation of Wisconsin*. University of Wisconsin Press, Madison, Wisconsin, USA.

## APPENDICES

### Appendix 1. Global Conservation Status Definitions

Listed below are definitions for interpreting NatureServe global conservation status ranks (G-ranks). These ranks reflect an assessment of the condition of the species or ecological community across its entire range. Where indicated, definitions differ for species and ecological communities.

Rank	Definition
GX	Presumed Extinct (species)— Not located despite intensive searches and virtually no likelihood of rediscovery. Eliminated (ecological communities)—Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species.
GH	Possibly Extinct (species)— Missing; known from only historical occurrences but still some hope of rediscovery. Presumed Eliminated— (Historic, ecological communities)-Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration, for example, American Chestnut (Forest).
G1	Critically Imperiled—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	Imperiled—At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3	Vulnerable—At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4	Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	Secure—Common; widespread and abundant.
?	<b>Inexact Numeric Rank</b> —Denotes inexact numeric rank; this should not be used with any of the Variant Global Conservation Status Ranks or GX or GH.
G#/G#	<b>Range Rank</b> —A numeric range rank (e.g., G2G3, G1G3) is used to indicate the range of uncertainty about the exact status of a taxon or ecosystem type. Ranges cannot skip more than two ranks (e.g., GU should be used rather than G1G4).

**Appendix 2. Element occurrences of listed species in the Little Sioux Project area (from Iowa Natural Areas Inventory accessed on January 19, 2011).**

<i>Scientific name</i>	<i>Common name</i>	<i>Federal status</i>	<i>State status</i>
Agastache foeniculum	Blue Giant Hyssop		E
Ammodramus henslowii	Henslow's Sparrow		T
Amorpha nana	Fragrant False Indigo		T
Anodontoides ferussacianus	Cylindrical Papershell		T
Asclepias lanuginosa	Wooly Milkweed		T
Asclepias speciosa	Showy Milkweed		T
Asio flammeus	Short-eared Owl		E
Aster junciformis	Rush Aster		T
Astragalus adsurgens	Rattle Milk-vetch		S
Atrytone arogos	Arogos Skipper		S
Atrytonopsis hianna	Dusted Skipper		S
Berula erecta	Water Parsnip		T
Besseyia bullii	Kitten Tails		T
Botrychium campestre	Prairie Moonwort		S
Callirhoe alcaeoides	Clustered Poppy-mallow		T
Callitriche heterophylla	Water Starwort		S
Carex crawei	Crawe Sedge		S
Carex richardsonii	Richardson Sedge		S
Circus cyaneus	Northern Harrier		E
Crepis runcinata	Hawksbeard		S
Cypripedium candidum	Small White Lady's Slipper		S
Elatine triandra	Waterwort		S
Eleocharis pauciflora	Fewflower Spikerush		S
Emydoidea blandingii	Blanding's Turtle		T
Eriophorum angustifolium	Tall Cotton Grass		S
Erynnis baptisiae	Wild Indigo Dusky Wing		S
Euphyes dion	Dion Skipper		S
Gentianopsis procera	Small Fringed Gentian		S
Glaucoopsyche lygdamus	Silvery Blue		T
Haliaeetus leucocephalus	Bald Eagle		E
Hesperia dacotae	Dakota Skipper	C	E
Hesperia leonardus	Leonard's Skipper		S
Hippuris vulgaris	Common Mare's-tail		S
Juncus alpinus	Alpine Rush		S
Lampsilis teres	Yellow Sandshell		E
Lespedeza leptostachya	Prairie Bush Clover	T	T
Liochlorophis vernalis	Smooth Green Snake		S
Lobelia kalmii	Brook Lobelia		S
Lomatium orientale	Western Parsley		T

<i>Menyanthes trifoliata</i>	Buckbean		T
<i>Mimulus glabratus</i>	Yellow Monkey Flower		T
<i>Muhlenbergia asperifolia</i>	Alkali Muhly		S
<i>Notropis anogenus</i>	Pugnose Shiner		E
<i>Notropis heterolepis</i>	Blacknose Shiner		T
<i>Notropis texanus</i>	Weed Shiner		E
<i>Notropis topeka</i>	Topeka Shiner	E	T
<i>Oarisma powesheik</i>	Powesheik Skipperling		T
<i>Panicum philadelphicum</i>	Philadelphia Panic Grass		T
<i>Platanthera hyperborea</i>	Leafy Northern Green Orchid		T
	Western Prairie Fringed		
<i>Platanthera praeclara</i>	Orchid	T	T
<i>Poanes massasoit</i>	Mulberry Wing		T
<i>Poanes viator</i>	Broad-winged Skipper		S
<i>Potamogeton amplifolius</i>	Large-leaf Pondweed		S
<i>Potamogeton praelongus</i>	White-stem Pondweed		S
<i>Potentilla anserina</i>	Silverweed		T
<i>Potentilla pennsylvanica</i>	Pennsylvania Cinquefoil		T
<i>Problema byssus</i>	Byssus Skipper		T
<i>Rallus elegans</i>	King Rail		E
<i>Rhynchospora capillacea</i>	Beakrush		T
<i>Salix lucida</i>	Shining Willow		T
<i>Scleria verticillata</i>	Low Nut Rush		T
<i>Spiranthes romanzoffiana</i>	Hooded Ladies' -tresses		T
<i>Sterna forsteri</i>	Forster's Tern		S
<i>Stipa comata</i>	Spear Needlegrass		S
<i>Tomanthera auriculata</i>	Earleaf Foxglove		S
<i>Triglochin maritimum</i>	Arrow Grass		T
<i>Triglochin palustris</i>	Slender Arrow Grass		T
<i>Utricularia minor</i>	Lesser Bladderwort		S

**Appendix 3. Full descriptions of assemblages and species from NatureServe (NatureServe. 2010. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: January 13, 2011 ).**

Little Bluestem – Porcupine Grass Dry-Mesic Prairie

***Schizachyrium scoparium* - *Bouteloua curtipendula* - *Hesperostipa spartea* - (*Pascopyrum smithii*) Herbaceous Vegetation**

**Translated Name:** Little Bluestem - Sideoats Grama - Porcupine Grass - (Western Wheatgrass) Herbaceous Vegetation

**Unique Identifier:** CEGLO02377

**Classification Approach:** International Vegetation Classification (IVC)

**Summary:** This little bluestem, dry-mesic, prairie grassland community is found in the northern tallgrass prairie region of the United States. Stands occur on rocky, loamy south-facing slopes, with inclines ranging from 20 to 30 degrees. The vegetation, consisting of grasses and forbs averaging 25-50 cm tall, is moderately open with approximately 5-15% of the ground remaining bare. The most abundant species are *Schizachyrium scoparium*, *Andropogon gerardii*, *Bouteloua curtipendula*, *Pascopyrum smithii*, and *Hesperostipa spartea* (= *Stipa spartea*). Other typical grasses include *Elymus canadensis*, *Aristida purpurea* var. *longiseta* (= *Aristida longiseta*), *Buchloe dactyloides*, *Calamovilfa longifolia*, and *Sporobolus heterolepis*. Common forbs include *Amorpha canescens*, *Oligoneuron rigidum* (= *Solidago rigida*), *Ambrosia psilostachya*, *Echinacea angustifolia*, *Dalea candida* var. *candida*, Asteraceae spp., *Mimosa nuttallii* (= *Schrankia nuttallii*), *Penstemon grandiflorus*, *Ratibida columnifera*, *Astragalus crassicaarpus*, *Anemone cylindrica*, *Machaeranthera pinnatifida*, *Dalea candida* var. *oligophylla*, *Gaura coccinea*, and *Asclepias verticillata*. The shrubs *Symphoricarpos occidentalis*, *Yucca glauca*, and *Rosa* spp. may be scattered among the herbaceous species.

Northern Little Bluestem Gravel Prairie

***Schizachyrium scoparium* - *Bouteloua* spp. - *Hesperostipa spartea* Gravel Herbaceous Vegetation**

**Translated Name:** Little Bluestem - Grama species - Porcupine Grass Gravel Herbaceous Vegetation

**Unique Identifier:** CEGLO02499

**Classification Approach:** International Vegetation Classification (IVC)

**Summary:** This bluestem gravel prairie community type is found in the northern tallgrass prairie region of the United States and possibly adjacent Canada. Stands occur on gently to steeply sloping sites on glacial outwash, glacial beaches, or other glacial features that have a high proportion of sand and gravel, such as kames and eskers. Soils are often Mollisols but not deep, and they contain fine to coarse gravel, sand, and often larger rocks. Soil moisture is typically low due to the well- to excessively drained nature of the soils. This community is a grassland dominated by mid grasses. Dominants are *Bouteloua curtipendula*, *Bouteloua gracilis*, *Schizachyrium scoparium*, and *Hesperostipa spartea* (= *Stipa spartea*). Other common graminoids include *Andropogon gerardii*, *Bouteloua hirsuta*, *Calamovilfa longifolia*, *Carex inops* ssp. *heliophila*, *Sporobolus heterolepis*, and *Hesperostipa comata* (= *Stipa comata*). Forb diversity is moderate to high. Typical examples include *Artemisia frigida*, *Astragalus laxmannii* var. *robustior* (= *Astragalus adsurgens* ssp. *robustior*), *Echinacea angustifolia*, *Lygodesmia juncea*, *Potentilla pensylvanica*, and *Solidago missouriensis*. Shrubs are absent to widely scattered. Those present may include *Amorpha canescens*, *Rosa arkansana*, and *Symphoricarpos occidentalis*. Lichens and mosses often occur on bare soil and gravel.

Northern Cordgrass Wet Prairie

***Spartina pectinata* - *Calamagrostis stricta* - *Carex* spp. Herbaceous Vegetation**

**Translated Name:** Prairie Cordgrass - Western Bluejoint - Sedge species Herbaceous Vegetation

**Unique Identifier:** CEGLO02027

**Classification Approach:** International Vegetation Classification (IVC)

**Summary:** This prairie cordgrass wet prairie community occurs in the northern tallgrass prairie region of the United States and Canada. Stands occur in many shallow pond basins and lakes, as well as on terraces and floodplains of streams and rivers. The soils are deep, typically poorly drained, with clay or silty loam upper horizons that have a characteristic gley layer. The community is subject to seasonal inundation. The vegetation is dominated by fine-textured grasses, low sedges, and rushes, with a mixture of forbs. The most common species are *Symphyotrichum lanceolatum* var. *lanceolatum* (= *Aster lanceolatus* var. *lanceolatus*), *Boltonia asteroides* var. *latisquama*, *Calamagrostis canadensis*, *Carex pellita* (= *Carex lanuginosa*), *Carex praegracilis*, *Carex sartwellii*, *Carex stricta*, *Poa palustris*, and *Spartina pectinata*. Other species that are often present are *Apocynum cannabinum*, *Juncus balticus*, *Liatrix pycnostachya*, *Sonchus arvensis*, *Stachys palustris*, and *Teucrium canadense*.

Northern Mesic Tallgrass Prairie

***Andropogon gerardii* - *Hesperostipa spartea* - *Sporobolus heterolepis* Herbaceous Vegetation**

**Translated Name:** Big Bluestem - Porcupine Grass - Prairie Dropseed Herbaceous Vegetation

**Unique Identifier:** CEGLO02202

**Classification Approach:** International Vegetation Classification (IVC)

**Summary:** This mesic big bluestem prairie community is found in the northern tallgrass prairie region of the United States and Canada. Stands occur on black, friable, organic-rich soils and have surface horizons that are high in bases. During the warm season, soils are intermittently dry for long periods or have subsurface horizons in which salts or carbonates have accumulated. This is a grassland community with dense vegetation dominated by tall grasses. Forbs are abundant and often have high local diversity. Clumps of trees and tall brush can often be found along the boundary between wetlands and this community. Otherwise, woody vegetation is rare. *Andropogon gerardii*, *Sporobolus heterolepis*, and *Hesperostipa spartea* (= *Stipa spartea*), and occasionally *Sorghastrum nutans*, are the most abundant species in this community. *Amorpha canescens*, *Symphyotrichum ericoides* (= *Aster ericoides*), and *Solidago canadensis* are common forbs across this community's range. Western prairie fringed orchid

Powesheik Skipperling

***Oarisma powesheik*** - (Parker, 1870)

**Other Related Name(s):** *Oarisma poweshiek*

**Related ITIS Name(s):** *Oarisma poweshiek* (Parker, 1870) (TSN 706688)

**Unique Identifier:** ELEMENT\_GLOBAL.2.116340

**Element Code:** IILEP57010

**Informal Taxonomy:** Animals, Invertebrates - Insects - Butterflies and Moths - Butterflies and Skippers Powesheik Skipperling

**Global Status:** G2G3

**Global Status Last Reviewed:** 14Jun2007

**Global Status Last Changed:** 30Nov2002

**Rounded Global Status:** G2 - Imperiled

**Reasons:** Another extremely reduced, fragmented, management dependent, fire sensitive (possibly hypersensitive), tall grass prairies species. Probably around 50-100 occurrences that could be considered marginally viable with a few likely metapopulations that might

have better potential to persist. Threats are serious, including extreme apparently natural crashes, excessive prescribed burning, habitat loss to conversion to other uses, invasive plants and succession, and isolation of most populations. Probably many occurrences are of low viability and likely that some to many will not recover from the recent crash (the most recent check was negative at more than 10% of sites and some of the others have no recent information). This species has declined about 99% from habitat loss and is being negatively impacted to an overall unclear extent from prescribed burning. Recolonization potential for a substantial number of occurrences, possibly a large majority, is probably very low now. Some isolated occurrences will fail to persist in the long term, especially small ones where fires are frequent. This was probably originally mostly a landscape level species now reduced to scattered colonies in much of range. Whether this species should now be considered imperiled (G2) or merely rare (G3) can only be resolved by more up to date inventory work and a better idea of causes and severity fluctuations (mainly crashes). It is still extant but very localized in a substantial range in and adjacent to Minnesota.

**General Description:** See any butterfly guide covering eastern North America.

**Non-Migrant:** N

**Locally Migrant:** N

**Long Distance Migrant:** N

**Habitat Comments:** Habitats are usually more or less virgin prairie but it also occurs in fens and grassy lakeshores especially eastward (Michigan, Indiana). Sometimes noted as preferring wetter parts of prairies but this may be an artifact of frequent prescribed fires excluding them from most suitable habitat (Borkin, 1995). This issue is still unresolved as of Selby (2005). Habitat would be in part a function of larval foodplant and information on this topic is confusing.

**Food Comments:** Larvae apparently use several grasses and occasionally sedges. At least in Wisconsin, *SPOROBOLUS HETEROLEPIS* and *SCHIZACHYRIUM SCOPARIUS* appear to be major foodplants. However, in Michigan fens spike rushes (*Rynchospora*) appear to be the usual foodplants. Adults take nectar from flowers such as black-eyed susan and many other others. See Selby (2005) for details.

**Phenology Comments:** Larvae hibernate. Adults fly in late June and July in most places. Always univoltine.

Prairie Bushclover

***Lespedeza leptostachya*** - Engelm.

**Related ITIS Name(s):** *Lespedeza leptostachya* Engelm. (TSN 25904)

**Unique Identifier:** ELEMENT\_GLOBAL.2.141618

**Element Code:** PDFAB27090

**Informal Taxonomy:** Plants, Vascular - Flowering Plants - Pea Family

**Global Status:** G3

**Global Status Last Reviewed:** 29Feb2000

**Global Status Last Changed:** 27Feb2000

**Rounded Global Status:** G3 - Vulnerable

**Reasons:** Endemic to the tallgrass prairie region of the upper Mississippi Valley and rare throughout its 4-state range. There are about 32 extant populations, and many of these are small (<150 stems). Populations are restricted to remnants of the prairie that have persisted amid widespread conversion to cropland. Some of the limited amount of remaining habitat is threatened by agricultural expansion, herbicides, urbanization, and the lack of natural disturbances, especially fire.

**Basic Description:** A perennial herb with slender stems up to 1 m tall and with 3-parted compound leaves. Produces creamy-white to pink flowers arranged on slender terminal spikes. Open flowers are showy, but the plants often produce smaller, self-pollinating flowers that never fully open. Blooms mainly in mid-July.

**Habitat Comments:** Dry gravel prairies and dry-mesic prairies in Illinois (Steyermark and Swink 1955, Kurz and Bowles 1981), dry-mesic prairies in Minnesota (Smith 1981) and Iowa (Huston 1981), dry prairie and sandy prairie in Wisconsin (Tans and Read 1975). Characteristics of dry gravel and dry-mesic prairies in Illinois include steep, well-drained, usually calcareous soil sites (White and Madany 1978). Smith (1981) noted that five of six Minnesota sites are north or northwest-facing slopes of 10 to 15 degrees, all well drained (the sixth site was on level ground). Schwegman (pers. comm. with Sather) notes that *L. leptostachya* occurs in mesic microhabitats on Illinois sites.

The list of common associates is taken from Olson (1978), Smith (1981), Kurz and Bowles (1981), and Huston (1981): *Andropogon gerardii*, *A. scoparius*, *Bouteloua curtipendula*, *Sorghastrum nutans*, *Sporobolus heterolepis*, *Stipa spartea*, *Amorpha canescens*, *Anemone patens*, *Aster ericoides*, *A. laevis*, *A. ptarmicoides*, *A. sericeus*, *Baptisia leucophaea*, *Coreopsis palmata*, *Echinacea pallida*, *Euphorbia corollata*, *Heuchera richardsonii*, *Lespedeza capitata*, *Liatris aspera*, *Lithospermum canescens*, *L. incisum*, *Linum sulcatum*, *Oenothera serrulata*, *Phlox pilosa*, *Petalostemum candidum*, *P. purpureum*, *Psoralea argophylla*, *P. esculenta*, *Solidago missouriensis*, *S. nemoralis*, *S. rigida*, *Viola pedata*, *V. pedatifida*.

#### Northern Bur Oak Opening

##### ***Quercus macrocarpa* Northern Tallgrass Wooded Herbaceous Vegetation**

**Translated Name:** Bur Oak Northern Tallgrass Wooded Herbaceous Vegetation

**Unique Identifier:** CEGLO02158

**Classification Approach:** International Vegetation Classification (IVC)

**Summary:** This community type is found in the northern tallgrass prairie region of the upper midwestern United States and adjacent Canada. Stands occur on rolling to moderately sloping sites on glacial till or outwash. The soils range from clay loam to sandy loam. This community is characterized by scattered mature trees in a graminoid-dominated matrix. *Quercus macrocarpa* is the most abundant tree, although *Populus tremuloides* can be a common invader on northern sites. The herbaceous layer is dominated by *Andropogon gerardii*, *Sorghastrum nutans*, and *Sporobolus heterolepis*. *Schizachyrium scoparium* and *Hesperostipa spartea* (= *Stipa spartea*) are often found in drier areas and *Panicum virgatum* can be common in wetter patches. The shrub layer is variable and contains species such as *Amelanchier* spp., *Corylus americana*, *Cornus foemina*, *Prunus virginiana*, *Salix humilis*, and *Symphoricarpos occidentalis*.

#### Northern Tallgrass Calcareous Fen

##### ***Carex prairea* - *Schoenoplectus pungens* - *Rhynchospora capillacea* Herbaceous Vegetation**

**Translated Name:** Prairie Sedge - Common Threesquare - Needle Beaksedge Herbaceous Vegetation

**Unique Identifier:** CEGLO02267

**Classification Approach:** International Vegetation Classification (IVC)

**Summary:** This community type is found primarily in the northern tallgrass prairie region of western Minnesota, northwestern Iowa and eastern Dakotas, where calcium-rich groundwater emerges as springs. These springs are commonly associated with porous bedrock or coarse-textured deposits such as beach or outwash. The water is cold, anoxic, and circumneutral. These conditions promote the accumulation of peat. The vegetation is dominated by graminoids, but may contain small shrubs. Many species are inhibited by the water conditions and thus the vegetation cover is moderate. The predominant vegetation is 25-35 cm tall while some species grow to 75-85 cm. The most abundant species are *Calamagrostis stricta*, *Carex prairea*, *Carex sterilis*, *Eleocharis* spp., *Lobelia kalmii*, *Muhlenbergia glomerata*, *Muhlenbergia richardsonis*, *Parnassia glauca*, *Rhynchospora capillacea*, *Schoenoplectus pungens* (= *Scirpus pungens*), *Spartina pectinata*, and *Triglochin*

*maritima*. Shrubs that occur with the herbaceous species include *Betula pumila*, *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*), and *Salix* spp. (*Salix candida* is highly characteristic; others include *Salix X bebbii* and *Salix discolor*). Prairie herb associates include *Andropogon gerardii*, *Doellingeria umbellata* (= *Aster umbellatus*), *Cirsium muticum*, *Liatris ligulistylis*, *Lilium philadelphicum*, *Solidago nemoralis*, *Oligoneuron riddellii* (= *Solidago riddellii*), *Zigadenus elegans*, and *Zizia aurea*.

**Appendix 4. Further information and resources regarding the Mill Creek Culture, from [www.uiowa.edu](http://www.uiowa.edu), accessed December 10, 2010.**

**The Mill Creek Culture**

**by Rich Fishel**

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From A.D. 1000-1200 northwest Iowa was home to a highly distinctive and short-lived group of inhabitants whose arrival, existence, and disappearance has puzzled researchers for nearly 100 years. These people, now known as the Mill Creek culture, followed a way of life completely different from those before them. The uniqueness of this culture has created an interest unparalleled among many Iowa archaeologists.

The Mill Creek culture is part of a larger group of horticultural villages that start to appear around A.D. 1000 near the Missouri River from northwest Iowa to central South Dakota. These groups have been labeled by archaeologists as the Initial Variant of the Middle Missouri tradition. The 35 known Mill Creek villages cluster in two distinct areas in northwest Iowa: along the Little Sioux River and its three tributaries (Brooke Creek, Mill Creek, and Waterman Creek) and along the Big Sioux River and its tributaries in Plymouth County. The origins of Mill Creek are still being debated. Some argue that these beginnings lie within the Great Oasis culture, while other researchers favor a more generalized Late Woodland origin. While most Mill Creek sites are small, occupying 1 acre or less, several are marked by extensive midden deposits which sometimes accumulate to depths of six feet (2 m) or more. These middens, which can be correctly described as trash heaps, are laden with prolific amounts of broken pottery, animal bone, charcoal, and lithic material. Three of the Mill Creek sites are known to be fortified and show evidence of a large ditch encircling each site.

The Mill Creek inhabitants practiced a mixed economy, relying upon both horticulture and hunting as food sources. Maize was one of the most important foods grown, with chenopods (goosefoot), marshelder, and squash also being utilized. Large hoes manufactured from the scapula of bison were used to till the ground. The Mill Creek sometimes utilized a garden area composed of numerous mounds of earth, referred to by archaeologists as ridged fields. Bison, deer, and elk supplied the bulk of the meat resources, with water fowl, catfish, beavers, and squirrels also being hunted.

One intriguing aspect of the Mill Creek culture is their long-distance connection with people leading a lifestyle completely different from themselves. The Mill Creek had established trade relations with the Middle Mississippian culture of the eastern woodlands, specifically those living in western Illinois. These relations are seen by the occurrence of locally made copies of Middle Mississippian ceramic vessels found at several Mill Creek sites and by Mill Creek vessels found at the Eveland site, a Middle Mississippian village located in the central Illinois River valley. Bison scapula hoes, bird-wing fans, and bone bracelets, all of which are Plains-derived traits, also occur in Middle Mississippian sites in the central Illinois valley, while Middle Mississippian Long-Nosed God masks are found at several Mill Creek sites. Other possible items traded between the two cultures include marine shell beads, bison robes, bird feathers, and hawk and eagle medicine bags.

Whatever happened to the Mill Creek Indians of northwest Iowa? While no one knows for sure, most likely they moved up the Missouri River into South Dakota where they are known archaeologically as the Over Focus. Many researchers now believe that the Mandan and Hidatsa eventually developed from these Mill Creek roots.

But why the reason for this movement? Climate changes, depletion of natural resources, or the arrival of the Oneota into northwest Iowa have been suggested as possible causal factors for this relocation. One current hypothesis is that the Oneota, by moving into areas of central and eastern Iowa, severed the trade routes between the Mill Creek and the Middle Mississippians of Illinois. Feeling isolated and encroached upon by the Oneota, the Mill Creek simply left northwest Iowa and headed west, away from the Oneota.

Recent excavations at Mill Creek sites have been conducted at the Double Ditch site in O'Brien County and the Phipps site in Cherokee County. To learn more about the Mill Creek, see *Exploring Iowa's Past* by Lynn Marie Alex, *Mill Creek Ceramics: The Complex from the Brewster Site* by Duane C. Anderson, or *Chan-Ya-Ta: A Mill Creek Village* by Joseph A. Tiffany.

**Appendix 5 – Ranking Sheet for Little Sioux Conservation Action Plan developed by Priority Areas Sub-group February 2012.**

## Ranking Sheet for Little Sioux Conservation Action Plan Priority Areas

Landowner Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Phone Number \_\_\_\_\_

County \_\_\_\_\_

Township name \_\_\_\_\_

Section \_\_\_\_\_ Township \_\_\_\_\_ Range \_\_\_\_\_

Latitude \_\_\_\_\_ Longitude \_\_\_\_\_

Planning team members: \_\_\_\_\_

Landowner inquiry: Fee title \_\_\_\_\_ Easement \_\_\_\_\_ Restoration Cost Share Agreement \_\_\_\_\_ Length of C/S Agreement: \_\_\_\_\_ (10 year minimum)

Community types: (check all that apply)

Prairie

Savanna

Woodland

Wetland  Fen  Pothole  Riverine

Agriculture  Row crop  Pasture/hay

1) Is the property within the Little Sioux priority watersheds? \_\_\_\_\_

Yes 20

No 0

2) Is the property within the buffer area of the Little Sioux River? \_\_\_\_\_

Yes 10

No 0

3) Proximity to permanently protected lands \_\_\_\_\_

Adjoining	15	5 – 6 miles	5
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< 1 mile	10	6 – 7 miles	4
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1 – 2 miles	9	7 – 8 miles	3
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2 – 3 miles	8	8 – 9 miles	2
-------------	---	-------------	---

3 – 4 miles	7	9 – 10 miles	1
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4 – 5 miles	6	> 10 miles	0
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4) Contributions to state or federal threatened, rare, or endangered species	_____
<u>F</u> ederal species - <u>c</u> ritical.....	20
<u>S</u> tate species - <u>c</u> ritical.....	15
<u>G</u> reat.....	10
<u>M</u> inimal.....	5

Federal species - Critical: Site is known to be used by a federally listed threatened or endangered species, and will directly impact recovery or protection of that species.  
 State species - Critical: Site is known to be used by a state listed threatened or endangered species, and will directly impact recovery or protection of that species.  
 Great: Site is known to be in close proximity of a federal or state listed threatened or endangered species and with restoration will likely provide habitat for those species.  
 Minimal: Site is not in close proximity to documented federal or state threatened or endangered species site, but will provide a high quality habitat for migratory birds.

**Distance Criteria:**

- Plant: 0.25 mi.**
- Mollusk: 0.25 mi.**
- Amphibian: 0.75 mi.**
- Reptile: 1.0 mi.**
- Others: 5.0 mi**

Species checked by (check one):  Natural History Database  Visual+  
 + a visual will need to be documented with Natural History Database Forms

5) Tract size:	_____
>320 acres	15
160 – 319	12
100 – 159	10
50 – 99	6
10 – 49	4
<10	0

6) Do cultural/historical resources occur on the site?	_____
Yes	10
No	0

7) Future water quality benefits	_____
≥ 90% of site converted to native cover	10
75 - 89% of site converted to native cover	8
50 - 74% of site converted to native cover	6
25 - 49% of site converted to native cover	4
0 - 24% of site converted to native cover	2

8) Land cover on tract, percent of land in natural cover. \_\_\_\_\_

≥ 90%	in native cover	10
75 -89%	in native cover	8
50 -74%	in native cover	6
25 -49%	in native cover	4
0 - 24%	in native cover	2

9) Adjacent land use, percent of land in natural cover adjacent to the tract. \_\_\_\_\_

≥ 90%	in native cover	10
75 -89%	in native cover	8
50 -74%	in native cover	6
25 -49%	in native cover	4
0 - 24%	in native cover	2

10) Restoration potential of tract \_\_\_\_\_

High 20 – site has a high percentage of native vegetation with little need for active restoration (planting/brush management/tile removal) and will mainly require long term management and maintenance (fire/grazing plan/water management) with no invasive species problems

Medium 10 - site will require a moderate amount of restoration for seeding/brush removal/water control. Estimated restoration costs \$250 - \$750/acre, invasive species has not become a major problem.

Low 1 – site will require extensive restoration > 50% of the site in cropland, amount of restoration for seeding/brush removal/water control may exceed \$1000/acre, invasive species has become such a problem restoration maybe impractical.

11) Long term threats adjacent to tract \_\_\_\_\_

Wind develop	-10
Conversion to row crop	-10
Transmission lines	-10
Pipelines?	-10

12) Rare or unique attributes of the tract which should be considered  
e.g. adjacent to environmental education center which will have high visibility to the public

10 points

\_\_\_\_\_

Total 150 points possible

\_\_\_\_\_

13) Need something about being part of a larger contiguous habitat block

Appendix 6. Approximate acreages of protected lands in Little Sioux Watershed focal areas

<b>Elk Creek/ Hawk Valley</b>	<b>Total Acres: 104,833</b>	<b>Protected Acres: 11,535</b>
<b><i>11.00% Protected</i></b>		

<b>Unit Name</b>	<b>Owner</b>	<b>Manager</b>	<b>Acres</b>
FWS Easements	private	private	96.00
			66.00
			16.00
			142.00
			61.00
			39.00
			71.00
			155.00
NRCS Easements	private	private	106.60
			173.20
			121.60
			61.90
			96.60
			11.00
			116.80
			60.70
			60.20
			18.00
			209.10
			109.60
			65.80
89.80			
380.30			
Barringer Slough WMA	Clay CCB DNR	DNR - Wildlife DNR - Wildlife	105.52
			1.97
			1254.89
Barringer Slough WPA	FWS	DNR - Wildlife	33.12
			80.45
			157.66
Blue Wing Marsh WMA	DNR	DNR - Wildlife	426.26
Blue Wing Marsh WPA	FWS	DNR - Wildlife	40.98
			70.51
			165.74
D.U. Marsh WMA	DNR	DNR - Wildlife	228.94
D.U. Marsh WPA	FWS	DNR - Wildlife	48.78
Dan Green Slough	DNR	DNR - Wildlife	278.12

Dan Green Slough WMA	DNR	DNR - Wildlife	157.49
			56.84
Dan Green Slough WPA	FWS	DNR - Wildlife	77.92
			136.23
Dewey's Pasture Complex	DNR	DNR - Wildlife	78.89
			42.18
			45.42
			373.27
			39.76
			446.84
			653.21
			61.22
			11.66
			334.24
			53.80
			29.00
Dewey's Pasture WPA	FWS	DNR - Wildlife	90.39
			242.45
			182.44
Dickens Pit	Clay CCB	Clay CCB	39.79
Elk Lake Wetland Complex WMA	DNR	DNR - Wildlife	77.17
			49.00
Elk Lake WPA	FWS	DNR - Wildlife	130.74
Fen Valley WMA	DNR	DNR - Wildlife	155.54
			85.29
			314.49
	Palo Alto		
H.O. Helgen Slough	CCB	Palo Alto CCB	25.25
Hawk Valley WMA	DNR	DNR - Wildlife	0.63
			531.33
			100.92
	Palo Alto		
Huston Prairie	CCB	Palo Alto CCB	61.65
Little Sioux WMA	DNR	DNR - Wildlife	661.72
Lost Island Park	Clay CCB	Clay CCB	0.37
	Palo Alto		
Lost Island-Huston Park	CCB	Palo Alto CCB	38.97
	Palo Alto		
Rossiter Wildlife Area	CCB	Palo Alto CCB	11.17
Virgin Lake WMA	DNR	DNR - Wildlife	115.29
			2.33

Little Sioux Headwaters

Total Acres: 104,269

Protected  
Acres: 15,264

*14.64% Protected*

<b>Unit Name</b>	<b>Owner</b>	<b>Manager</b>	<b>Acres</b>
FWS Easements	private	private	28.00
			117.00
			44.00
			39.00
			46.00
			42.00
NRCS Easements	private	private	61.00
			207.20
			25.30
			64.40
			10.50
			76.40
			65.60
			152.50
			22.70
			135.00
			20.00
			70.20
			302.90
			37.20
37.50			
67.30			
73.40			
3.40			
154.60			
Cayler Prairie Complex	DNR	DNR - Wildlife	95.20
			697.46
Cayler Prairie St. Preserve	DNR	DNR - Wildlife	160.39
Cayler Prairie WPA	FWS	DNR - Wildlife	70.41
Center Lake Complex	DNR	DNR - Wildlife	20.55
			571.76
Diamond Lake WMA	DNR	DNR - Wildlife	597.38
Diamond Lake WPA	FWS	DNR - Wildlife	499.23
Dickinson Co. RR ROW St. Recreation Area	DNR	Dickinson CCB	28.50
			1.78
East Okoboji Slough WMA	DNR	DNR - Wildlife	21.19
Freda Haffner State Preserve	TNC	TNC	111.89
Garlock Slough WMA	DNR	DNR - Wildlife	333.27

			115.94
Garlock Slough WPA	FWS	DNR - Wildlife	152.13
			151.8
Givens Point Access	DNR	DNR - Wildlife	0.22
Hales Slough WMA	DNR	DNR - Wildlife	67.67
			152.71
			139.62
	Dickinson		
Horseshoe Bend Recreation Area	CCB	Dickinson CCB	185.91
Jemmerson Slough Complex	DNR	DNR - Wildlife	75.26
			1.98
			103.32
			31.77
			47.41
			107.20
			267.33
Jemmerson Slough WPA	FWS	DNR - Wildlife	57.28
			40.03
			310.8
			125.02
Kattleson Hogsback WPA	FWS	DNR - Wildlife	142.2
Kattleson-Hogback Complex	DNR	DNR - Wildlife	206.71
			276.21
			1410.88
Lower Gar Lake Access St. Recreation Area	DNR	DNR - Parks	11.28
Lower Gar Lake Complex	DNR	DNR - Wildlife	9.03
			15.66
			253.42
Minnewashta Access	DNR	DNR - Parks	1.36
Minnewashta Lake WMA	DNR	DNR - Wildlife	122.96
Santee Prairie WPA	FWS	DNR - Wildlife	107.51
			348.44
Spirit Lake Access	DNR	DNR - Wildlife	18.88
Spring Run Wetland Complex	DNR	Dickinson CCB	4.93
Spring Run Wetland Complex	DNR	DNR - Wildlife	68.25
			78.83
			32.62
			38.87
			77.72
			134.79
			2.10
			82.46

			558.51
			187.13
			373.82
			763.49
			116.81
			72.24
			350.43
			127.90
Spring Run WPA	FWS	DNR - Wildlife	111.97
			112.05
			80.26
			104.98
			4
			31.86
			45.19
			436.45
			63.35
			77.33
			1.15
			35.70
Upper Gar Lake WMA	DNR	DNR - Wildlife	37.98
Welch Lake WMA	DNR	DNR - Wildlife	66.58
			57.30
Welch Lake WPA	FWS	DNR - Wildlife	756.33

<b>Waterman/ Glacial Hills</b>	<b>Total Acres: 199,640</b>	<b>Protected Acres: 4890</b>
<b>2.45% Protected</b>		

<b>Unit Name</b>	<b>Owner</b>	<b>Manager</b>	<b>Acres</b>
NRCS Easements	private	private	94.70
			9.20
			584.50
			47.00
			40.70
			68.20
TNC Easements	private	private	50.85
Barnes Access	Cherokee CCB	Cherokee CCB	10.93
			0.59
Bertram Reservation	Clay CCB	Clay CCB	236.82
Brewer Prairie	Cherokee CCB	Cherokee CCB	5.51

Brooke Wildlife Area	Private	Buena Vista CCB	63.29
Brown's Prairie	TNC	TNC	187.06
Buena Vista County Conservation Park	Buena Vista CCB	Buena Vista CCB	300.04
Elk Wildlife Area	Buena Vista CCB	Buena Vista CCB	64.3
Gary Christiansen Wildlife Area	Buena Vista CCB	Buena Vista CCB	38.05
Hannibal Waterman Wildlife Area	Obrien CCB	Obrien CCB	153.72
Litka Park	Obrien CCB	Obrien CCB	9.03
Little Sioux Greenbelt	Cherokee CCB	Cherokee CCB	7.32
Lois Tiffany Prairie	TNC	TNC	80.00
Martin Park Area	Cherokee CCB	Cherokee CCB	244.8
McCormack Prairie	Obrien CCB	Obrien CCB	20.2
Negus Wildlife Area	Obrien CCB	Obrien CCB	15.83
Nelson Access	Cherokee CCB	Cherokee CCB	8.89
Nelson Trust	TNC	TNC	152.40
Old Dutch Fred Access	Obrien CCB	Obrien CCB	0.98
Prairie Heritage Center	Obrien CCB	Obrien CCB	32.85
Redtail Ridge Habitat Area	Cherokee CCB	Cherokee CCB	233.02
Riverside Little Sioux Access	Clay CCB	Clay CCB	2.08
Silver Sioux Recreation Area	Cherokee CCB	Cherokee CCB	160
Soo Access	DNR	DNR - Wildlife	17.39
Sue Jordahl Canoe Access	Cherokee CCB	Cherokee CCB	15.4
T.H. Steele Prairie St. Preserve	DNR	Cherokee CCB	39.83
Thompson WMA	DNR	DNR - Wildlife	118.86
Wanata St. Park	DNR	DNR - Parks	163.51
Waterman Creek WMA	DNR	DNR - Wildlife	79.25
Waterman Prairie Complex	DNR	DNR - Wildlife	0.97
			120.21
			603.55
			159.79
			468.82
Weale Wildlife Area	Obrien CCB	Obrien CCB	9.16
Wittrock Indian Village St. Preserve	DNR	DNR - Wildlife	5.30