CONSERVING THE BIOLOGICAL DIVERSITY OF THE DAKOTA MIXED-GRASS PRAIRIE

Mary Harkness
Minneapolis, MN
harknessms@gmail.com

Jennifer S. Hall
Ann Arbor, MI
jennifer_santi_hall@yahoo.com

Paula Gagnon
Portland, OR
jmaluap@yahoo.com

Phil Gerla
Univ. of North Dakota
81 Cornell St., Stop 8358
Grand Forks ND 58202
pgerla@tnc.org

Meredith Cornett
394 Lake Ave. S.
Duluth, MN 55805
mcornett@tnc.org

Brian Schreurs
Minneapolis, MN
schreurs.brian@gmail.com

Sarah Eichhorst
1101 West River Pkwy
Suite 200
Minneapolis MN 55414
seichhorst@tnc.org

May 1, 2010

This report may be cited as:
Harkness, Mary, Jennifer S. Hall, Paula Gagnon, Phil Gerla, Meredith W. Cornett, Brian Schreurs, and Sarah Eichhorst. 2010. Conserving the biological diversity of the Dakota Mixed-Grass Prairie. The Nature Conservancy, Minneapolis MN.

Funding for the completion of this report was generously provided by The Cox Family Fund for Science and Research.

This report and its appendices are available for download:
http://conserveonline.org/workspaces/dmgp

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1 ACKNOWLEDGMENTS

The Dakota Mixed-Grass Prairie ecoregional assessment is the product of the efforts of The Nature Conservancy and numerous partners, including government agencies, academic institutions local conservation organizations, and others. In particular, we thank the state Natural Heritage Programs in North Dakota (North Dakota Natural Heritage Inventory), South Dakota (South Dakota Natural Heritage Program), and Nebraska (Nebraska Game and Parks Commission) for providing key data used in this assessment. We also recognize significant contributions by the U.S. Fish and Wildlife Service Habitat, Population, and Evaluation Team (HAPET) (Prairie Pothole Region) and especially thank Neil Niemuth and Mike Estey for their assistance in incorporating modeling data and analyses for grassland bird conservation areas and waterfowl breeding areas. Rachel Seifert-Spilde, Cynthia Reed, and Gerry Steinauer conducted the Rapid Ecological Assessments used in developing and assessing the terrestrial conservation portfolio. Lawrence Igl provided a particularly helpful review during the final development of this report. The assessment benefited greatly from the previous experiences of neighboring ecoregions, and we thank Brian Martin and Amy Pearson for sharing their expertise. We are indebted to Jeff Carroll, who volunteered his time and GIS skills to complete the final maps for the report, assistance that came at an especially critical time. Finally, we thank Becky Abel, Steve Chaplin, Jonathan Higgins, and Mary Khoury for their early contributions to this planning effort. This effort spanned multiple years and represents work by two distinct groups of Conservancy leadership.

2 INTRODUCTION

This initial ecoregional assessment for the Dakota Mixed-Grass Prairie ecoregion was developed to guide conservation actions and inform conservation strategies for The Nature Conservancy (hereafter, the Conservancy) and other conservation and resource management agencies in the region over the next five to ten years.

The report provides an overview of the ecoregion, including the geographic setting, terrestrial, aquatic, and land use contexts. Through the assessment process, we identified conservation targets at the species, community and ecosystem levels for both terrestrial and aquatic habitats. Further, the document assesses the current condition and identifies major threats to the biodiversity of the ecoregion. The highest priorities for freshwater and terrestrial conservation are highlighted, as are the most promising strategies for an enduring conservation portfolio. In addition, this document touches on survey and research needs in the ecoregion.

By planning for and taking action at the site level, and by measuring the effectiveness of those actions, it will be possible to evaluate and improve our efforts to conserve the biological resources of the region.

3 ECOREGION OVERVIEW

3.1 Geographic Setting

The Dakota Mixed-Grass Prairie (DMGP) is one of 68 terrestrial ecoregions[1] in the continental United States. It occupies roughly 27 million acres (11 million ha) in the east-central portions of North Dakota and South Dakota, with a small portion of the ecoregion extending into northern Nebraska. This region of mixed-grass prairie is a transition zone influenced by the tallgrass prairies to the east, aspen parkland to the north, and shortgrass steppe to the west. A substantial portion of the DMGP intersects with the Prairie Pothole Region, arguably the most important area for breeding waterfowl in North America. The DMGP encompasses the northern portions of the Great Plains Steppe Province (Cleland *et al.* 2007). Figure 3.1.1 shows the counties and large rivers within the region.

The wetland-rich landscape of the DMGP is glacial and periglacial in origin, and ranges from relatively flat with washboard-like undulations (Hagen *et al.* 2005) in North Dakota and South Dakota to gently rolling hills in Nebraska (Schneider *et al.* 2005). Glacial moraines and potholes cover roughly 10% of the landscape (South Dakota Department of Game, Fish, and Parks (SDGFP) 2006).

The climate of the DMGP is semi-arid with cold winters. For example, the mean annual temperature in the South Dakota portion of the ecoregion ranges from 34 to 48°F (1 to 9°C), and the growing season lasts 110 to 155 days (SDGFP 2006). Average annual temperature in the Nebraska portion of the ecoregion ranges from 52 to 57°F (11 to 14°C) with a growing season

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[1] As defined by The Nature Conservancy; the Conservancy bases its terrestrial ecoregions in the U.S. on ecoregional map units developed by Robert Bailey and colleagues in the U.S. Forest Service. See http://www.fs.fed.us/rm/ecoregions/ for more information on USFS ecoregions.

ranging from 150 to 190 days. Average annual precipitation ranges from 25 inches (64 cm) in the southeast to 14 inches (35 cm) in the northwest.

Agriculture began to transform the landscape in the 1890s (Ringelman 2005). Prior to its fragmentation and alteration, the Prairie Pothole Region represented a portion of one of the largest grassland-wetland ecosystems on earth. High concentrations of seasonal and temporary potholes still persist throughout the northern 80% of the ecoregion. However, roughly 50% of the original wetlands in North Dakota have been drained for agricultural purposes, with 35% drained in South Dakota (Dahl 1990; Ringelman 2005).

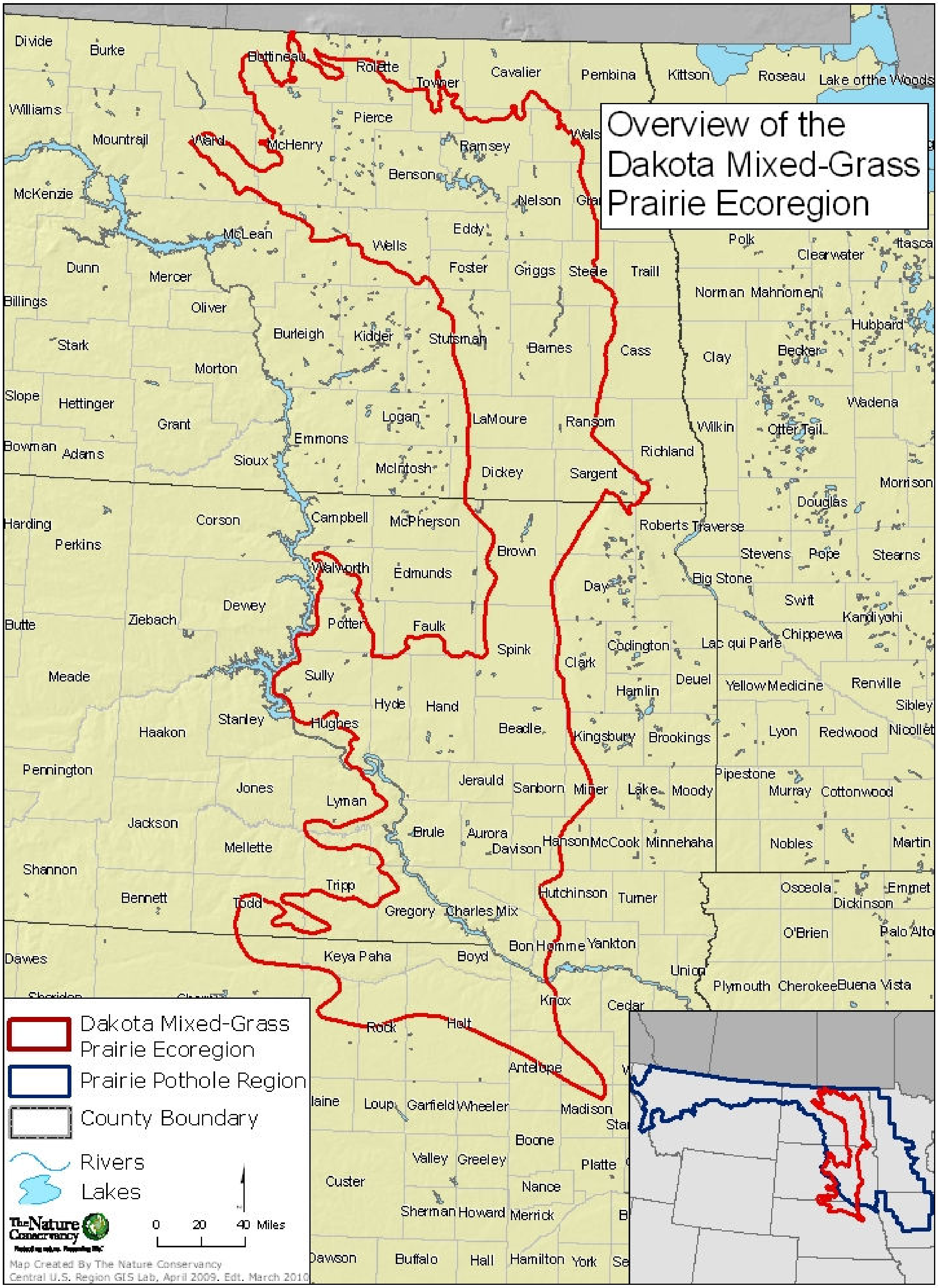

Figure 3.1.1 Overview of the Dakota Mixed-Grass Prairie Ecoregion

3.2 Terrestrial Context

Historically, vegetation consisted primarily of Great Plains grasslands, largely dominated by herbaceous vegetation Mixed-grass prairie in this ecoregion is dominated by both warm and cool season grasses and a number of sedges. Prairie junegrass (*Koeleria pyramidata*), green needlegrass (*Stipa viridula*), western wheatgrass (*Pascopyrum smithii*), needle-and-thread (*Heterostipa comata*), blue grama (*Boutaloua gracilis*), little bluestem (*Schizachyrium scoparium*), and needleleaf sedge (*Carex duriuscula*) are among the most common graminoids of the mixed-grass prairie (Hagen *et al*. 2005). Associated graminoids include Canada wild-rye (*Elymus canadensis*), mat muhly (*Muhlenbergia richardsonis*), plains reedgrass (*Calamagrostis montanensis*), spikemoss (*Selaginella kraussiana*) and buffalo grass (*Hierochloe odorata*). A diversity of forbs also occurs within mixed-grass prairie (e.g., pasque flower (*Anemone patens*), western wallflower (*Erysimum capitatum*), prairie smoke (*Geum triflorum*), Missouri milkvetch (*Astragalus missouriensis*), and lead plant (*Amorpha canescens*)). Woodlands were historically rare, but likely occurred in many riparian areas and on east-facing and north-facing bluffs and prominent hillsides. The dense riparian forests of today are likely an artifact of fire suppression.

Today, the native plant communities of the DMGP are highly fragmented. Nearly all of the landscape has been converted to agricultural uses (Figure 3.2.1), and remaining native grasslands are typically heavily grazed and invaded by a variety of exotic plant species. The historical fire regime has been disrupted, and hydrologic patterns of remaining wetlands have been altered by drainage.

Given the highly altered condition of the DMGP, many species of conservation need occur throughout the region, including a variety of grassland birds, waterfowl, mammals, invertebrates, and fish species. More details on species, communities, and ecosystems of conservation concern can be found in the State Wildlife Plans (North Dakota, South Dakota, and Nebraska), the Prairie Pothole Joint Venture Implementation Plan (Ringelman 2005), and in Section 7 of this plan.

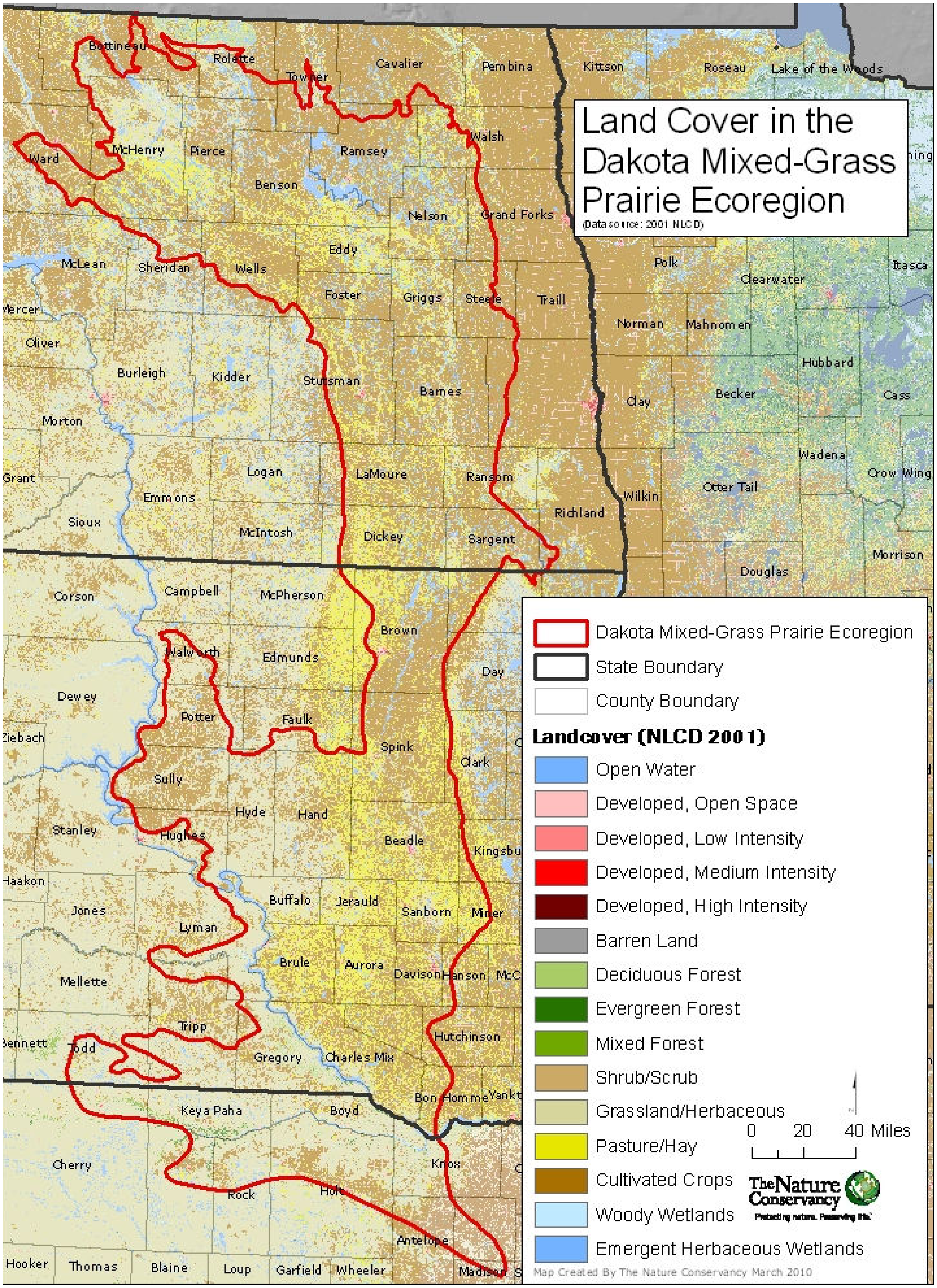

Figure 3.2.1 Land cover in the Dakota Mixed-Grass Prairie Ecoregion

3.3 Aquatic Context

Streams and rivers of the DMGP transect three major aquatic subregions: The Missouri, the Arctic, and the Southern Plains (Appendix 1). Boundaries of these units are based on fish zoogeography, physiography, climate, and drainage pattern history.

Large rivers in the ecoregion include the Missouri, Souris, James, and Niobrara, with headwaters in Montana, south-central Saskatchewan, central North Dakota, and western Nebraska, respectively (Figure 3.1.1). As a consequence of low rainfall in most years and generally warm, dry summers, all the rivers and streams in the ecoregion tend to have a very low runoff ratio, or discharge per watershed area. Natural flow patterns have been entirely disrupted on the middle Missouri and the Souris Rivers because of dams and impoundments. Less change has occurred on the James, Niobrara, and Loup Rivers. Streams in the Nebraska Sand Hills tend to have more stable base flow than streams elsewhere in the ecoregion because of their strong connection to the Ogallala aquifer; most are fed entirely by springs and seeps. Unlike other areas of the Ogallala aquifer, the Nebraska Sand Hills has not experienced dropping water levels because of the relatively small groundwater withdrawals (McGuire 2007). Elsewhere in the ecoregion, irrigation is important in areas of glacial outwash and coarse fluvial sediments. Excessive drawdown, disruption of environmental flows, and impairment of water quality has occurred locally.

For most years, peak discharge on the streams in the region occurs during March and April in response to snowmelt and spring runoff. Most streams exhibit base flow conditions from late summer through February; all but the largest streams and rivers may become intermittent during late summer months. Base flow occurs as a result of springs and seeps along streams and rivers, along with discharge from wetlands present in contributing watersheds. Many areas within the DMGP are non-contributing. The glacial terrain is geologically young, and coupled with semi-arid conditions, lacks hydrological integration. Except in the case of the Devils Lake basin, most non-integrated watersheds are small, with runoff and groundwater discharge conveyed to small, semipermanent lakes or wetlands.

Streams and rivers of the DMGP contain approximately 60 species of fish and 40 species of mussels and snails. Two species of fish, the pallid sturgeon (*Scaphirhyncus albus*) and Topeka shiner (*Notropis topeka*), are federally listed as endangered (USFWS, 2009), while nine other fishes appear on Nebraska, South Dakota, and North Dakota state lists as endangered species, threatened species, or species of greatest conservation need. These include sturgeon chub (*Macrhybopsis gelida*), sicklefin chub (*Macrhybopsis meeki*), lake sturgeon (Acipenser *fulvesans*), banded killifish, blacknose shiner (*Notropis heterolepis*), longnose shiner (*Notropis longirostris*), pearl dace (*Margariscus margarita*), finescale dace (*Phoxinus neogaeus*), and northern redbelly dace (*Phoxinus eos*). One mussel species (*Leptodea leptodon* – scaleshell) is officially recognized as globally imperiled (G1) and listed by the IUCN as near threatened.

Conversion of wetlands and grasslands has resulted in degradation of water quality in lakes, rivers and groundwater. In addition, flooding has increased in frequency and intensity along rivers and major tributaries - in part due to higher than average precipitation in some recent years.

3.4 Land Use Context

Ranching and farming are important land uses within the DMGP, most of which is in private ownership (Figure 3.4.1). For example, North Dakota ranks number one in the nation in production of barley and sunflowers. Wheat and honey production are also important in the region (Hagen *et al*. 2005). Throughout the region the number of active farms has declined, while the average farm size has increased steadily since the mid-1930s. Cattle production has followed a similar trend, peaking in North Dakota the mid-1960s and declining by as much as 60% since that time (Hagen *et al*. 2005). Rural communities in the DMGP are experiencing social stresses in large part due to depopulation and changing economies (Ringelman 2005).

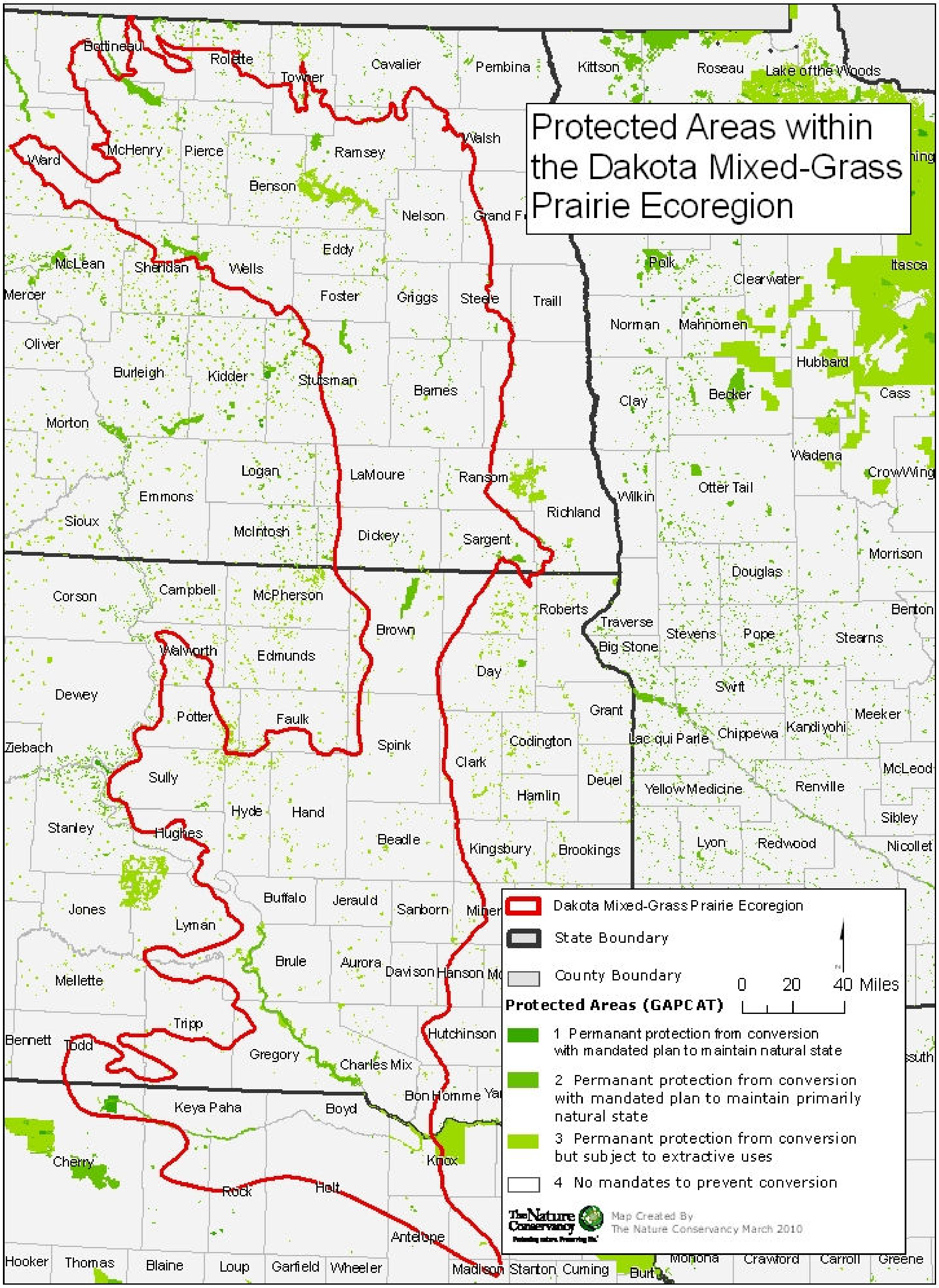

Figure 3.4.1 Protected areas within the Dakota Mixed-Grass Prairie Ecoregion

4 ECOREGIONAL ASSESSMENT PROCESS OVERVIEW

The Conservancy has developed and formalized a framework for approaching its conservation work, called **Conservation by Design** (Figure 4.1.1). It is an iterative approach consisting of setting conservation goals and priorities, identifying strategies to achieve the priorities, implementing actions based on the strategies, and measuring whether the priorities and goals were met.

4.1 Setting Priorities

Ecoregional assessments are the Conservancy's method for identifying priorities at the ecoregional scale: across a given ecoregion, where are the places that adequately represent the region's biodiversity and should be conserved in order to maintain the full suite of native biodiversity into the future?

To answer this question, the first consideration is the biodiversity of the ecoregion. Existing resources do not permit the individual evaluation of each of the thousands of plant and animal species found in a particular ecoregion. Therefore, the subset of biodiversity that is expected to represent all of the biodiversity of the ecoregion must be identified. These representative species, communities, and ecological systems serve as the focus of an ecoregional assessment and are known as **conservation targets** or simply **targets**.

Figure 4.1.1 Conservation by Design Process

To ensure that the conservation targets adequately represent the full range of biodiversity of an ecoregion, several factors are addressed. The Conservancy uses the "coarse-filter/fine-filter" approach to identify a representative subset of biodiversity. Ecological systems and plant communities are the "coarse filter" and if their integrity and health is adequately maintained, it is assumed that a majority of individual plant and animal species will also be conserved. However, some species may not be adequately captured by the coarse filter due to rarity, endemism, unusual habitat requirements, on-going severe decline, or other factors; they serve as the "fine filter." A second factor for selecting conservation targets is spatial scale: a suite of systems, communities, and species that collectively function across a wide range of spatial scales are included. Finally, multiple levels of biological organization are represented by addressing individual species in conjunction with communities and ecological systems.

Conserving a species or an ecological system across an ecoregion requires an understanding of 1) how many populations or examples are needed, 2) how those populations or examples should be distributed or stratified geographically in order to capture genetic and environmental variability, and 3) the minimum health of each population or example that is necessary to ensure a high probability of their long-term survival. The location of a particular species population or example of an ecological system is an **occurrence**. Occurrences specifically documented by state heritage programs are called **element occurrences**. The number and geographic distribution of occurrences needed to ensure adequate redundancy and representation are the **conservation goals** of the conservation targets. The biological health of an individual target occurrence is evaluated according to its size, condition, and landscape context and is described as the **viability** or **integrity** of the occurrence in question.

A range of spatial and non-spatial data is acquired, compiled and evaluated in order to determine 1) the occurrences of conservation targets across an ecoregion, 2) the viability of these occurrences, and 3) which occurrences may best meet the conservation goals. A range of methods may be used for these evaluations, but the end result is a suite of places that, if conserved, is expected to maintain the ecoregion's biodiversity into the future – the **ecoregional portfolio**. Additional data may be acquired to identify and assess stressors ("threats") that may negatively impact the health of the conservation targets within the ecoregional portfolio. The **conservation areas** or **areas of biodiversity significance** comprising the ecoregional portfolio and the associated threats assessment determine the Conservancy's conservation priorities in a given ecoregion.

Once ecoregional priorities have been identified, the next phases of the Conservation by Design approach begin: developing strategies and conservation action plans for high priority conservation areas, taking conservation action at these areas, and measuring the success of those actions. These three phases typically focus on a much more localized scale than the ecoregional assessment – either on a single conservation area or sets of similar conservation areas. Conservation targets and ecosystem threats can be addressed in a more comprehensive and detailed manner at individual conservation project areas. These next phases are vitally important because conservation action is implemented, measured, and ideally found successful. In addition, the finer-scale, more detailed **conservation action planning** permits the project-specific resolution of individual data gaps and shortfalls associated with the first iteration of the ecoregional assessment. Conservation planners may then use the new information to review and revise the ecoregion-level conservation priorities. Once sufficient new information becomes available, it is important to revisit the ecoregional priorities as a cohesive whole, rather than addressing them individually and in isolation from the rest of the ecoregion.

Background, methods, tools and other information on this overall conservation approach and on ecoregional assessments are provided on the **Conservation by Design Gateway** on ConserveOnline (http://conserveonline.org/workspaces/cbdgateway/).

In the DMGP ecoregion, the methods and scope of the ecoregional assessment process evolved over time as a result of multiple staff losses and reductions, as well as organizational restructurings over the course of the assessment. The assessment was completed in multiple phases under two distinct groups of Conservancy leadership.

4.2 Ecological Stratification Units

To capture the genetic and environmental variability of each conservation target across the ecoregion, the ecoregion is subdivided into smaller geographic units. The smaller units are defined by shared abiotic and biotic characteristics, such as climate, geology, soils, and vegetation. These units are used to stratify the representation of each conservation target across the ecoregion.

4.3 Terrestrial Ecoregional Sections and Descriptions

For terrestrial conservation targets, the U.S. Forest Service's (USFS) ecological sections (revised in Cleland *et al*. 2007) were used as stratification units. Three USFS map units for northern portion of the Great Plains Steppe Province were used as major stratification units for the DMGP ecoregional assessment. Portions of other USFS ecological sections intersect the DMGP ecoregional boundary, and all major stratification units and additional ecological sections are displayed in Figure 4.3.1. Originally published in McNab *et al*. (2007) and Cleland *et al*. (2007), summaries for each section are provided here:

4.3.1 Northeastern Glaciated Plains Section (332A)

The glacial geology of the Northeastern Glaciated Plains predominantly consists of level to undulating continental till and lake plains. Some areas have kettles, kames, and morainal features. Marine sedimentary rocks underlie the soils formed in glacial till. This section is characterized by prairie potholes. Although the current land cover is mostly agriculture, small pockets of remnant grasslands and aspen-birch forest occur throughout the section. (McNab *et al*. 2007).

4.3.2 Western Glaciated Plains Section (332B)

The glacial geology of the Western Glaciated Plains predominantly consists of level to undulating continental till plains. Glacial features, such as lake plains and moraines, also occur throughout this section. As with the Northeastern Glaciated Plains, marine sedimentary rocks underlie the soils formed in glacial till. Prairie potholes also occur in this section, and most of the original Great Plains grasslands have been converted to row-crop agriculture. (McNab *et al*. 2007).

4.3.3 North Central Great Plains Section (332D)

The topography of the North Central Great Plains is dominated by level to gently rolling till plains. Potholes occur throughout most of the section, with a well-defined, dendritic drainage system. Marine shale and much less abundant sandstone lie beneath the glacial sediments. As with the previous two sections, current land cover is mostly agricultural (McNab *et al*. 2007).

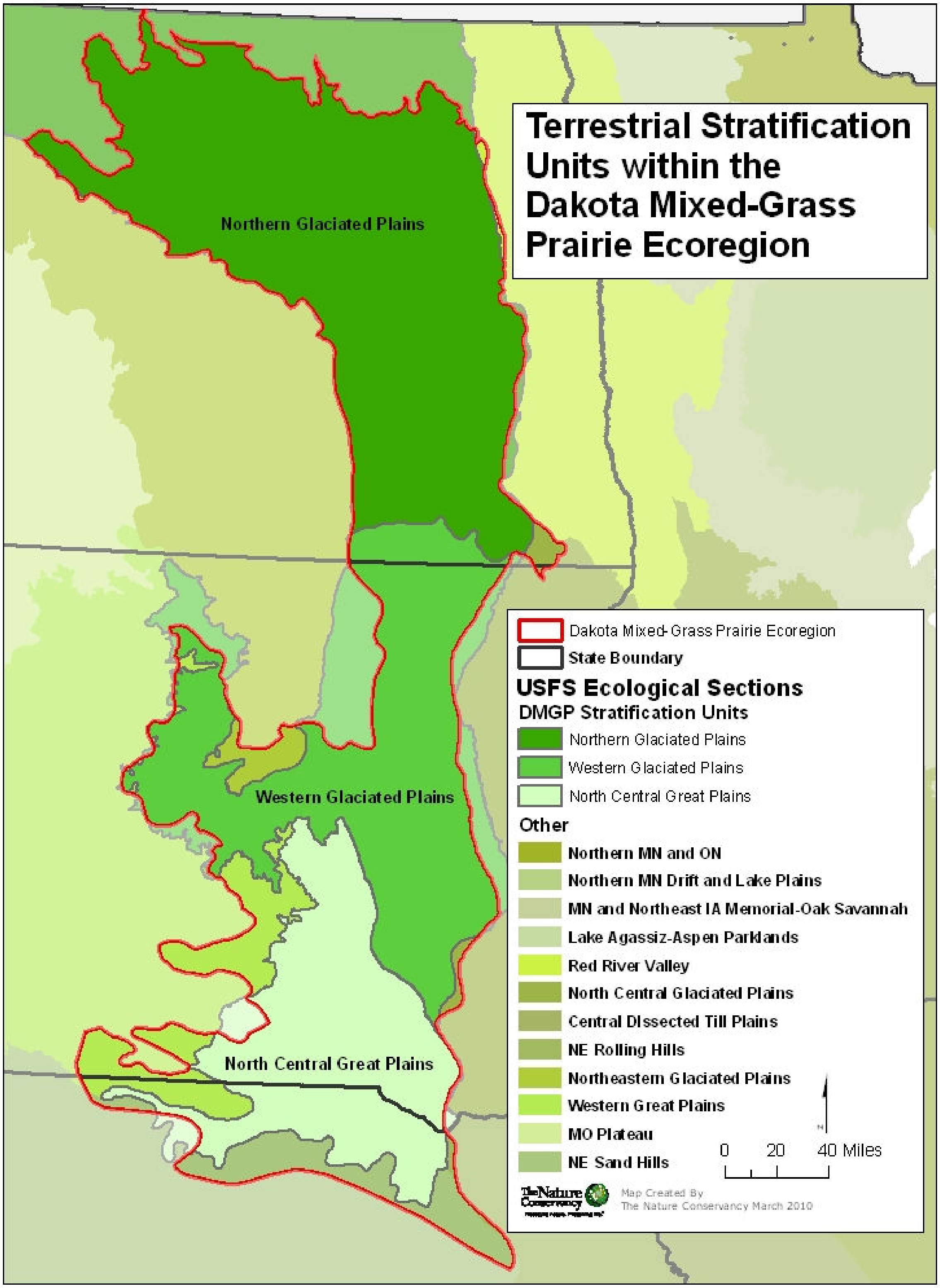

Figure 4.3.1 Terrestrial stratification units within the Dakota Mixed-Grass Prairie Ecoregion

4.4 Freshwater Ecological Drainage Units and Descriptions

The assessment area for the freshwater biodiversity of the DMGP is based on a combination of aquatic zoogeographic regions and watershed boundaries, rather than terrestrial ecoregional boundaries. The DMGP terrestrial ecoregion intersects three major aquatic subregions [as defined by the USFS (Maxwell *et al.* 1995) and by the World Wildlife Fund (Abell *et al.* 2000)]: the Missouri Subregion, the Arctic Subregion, and the Southern Plains Subregion. The DMGP crosses three freshwater ecoregions: the English-Winnipeg Lakes, the Middle Missouri, and the Upper Missouri (Abell *et al.* 2008).

Each aquatic subregion is further divided into Ecological Drainage Units (EDUs); EDUs are aggregations of 8-digit U.S. Geological Survey Hydrological Unit Codes (8-digit HUCs) that share finer-scale physiographic and zoogeographic properties. EDUs serve as stratification units for freshwater system and species targets. Six EDUs intersect with the terrestrial DMGP ecoregion: James River, Middle Missouri River, Devils Lake, Middle Souris River, Red River Basin-West, and the Sand Hills (Figure 4.4.1). A short description of each EDU follows. Although a description is included here, the Sand Hills EDU was addressed in the context of the Central Mixed-grass Prairie ecoregional assessment (see Steuter *et al.* 2003).

4.4.1 James River

The James River has its headwaters in central North Dakota and flows about 710 miles (1,140 km) south-southeastward through South Dakota before entering the Missouri River at Yankton. The small but long watershed, shallow depth, and narrow width between banks give the river the possible distinction of being the world's longest unnavigable stream. The river generally flows across level to rolling silty-clay glacial till, with occasional exposures of Cretaceous shale along deeply incised reaches and tributaries. In north-central South Dakota, the James River meanders across a large glacio-lacustrine plain. Uplands consist of mixed-grass prairie with semipermanent and seasonal pothole wetlands within the Missouri Coteau on the west and Prairie Coteau on the east. The watershed is characterized by a cold continental climate with hot, humid summers. Annual precipitation averages 14-24 inches (35-60 cm) and annual mean temperature ranges from 39-43° F (4-6°C).

The major tributaries to the James River include Pipestem Creek in North Dakota, and Elm, Mud, Wolf, Sand, and Firesteel Creeks in South Dakota. The only major dam and reservoir on the river is at Jamestown (Jamestown Dam), which forms Arrowwood Lake. The river also is impounded northeast of Aberdeen, South Dakota, to form the Columbia Road and Sand Lake Pools, both of which lie within the Sand Lake National Wildlife Refuge.

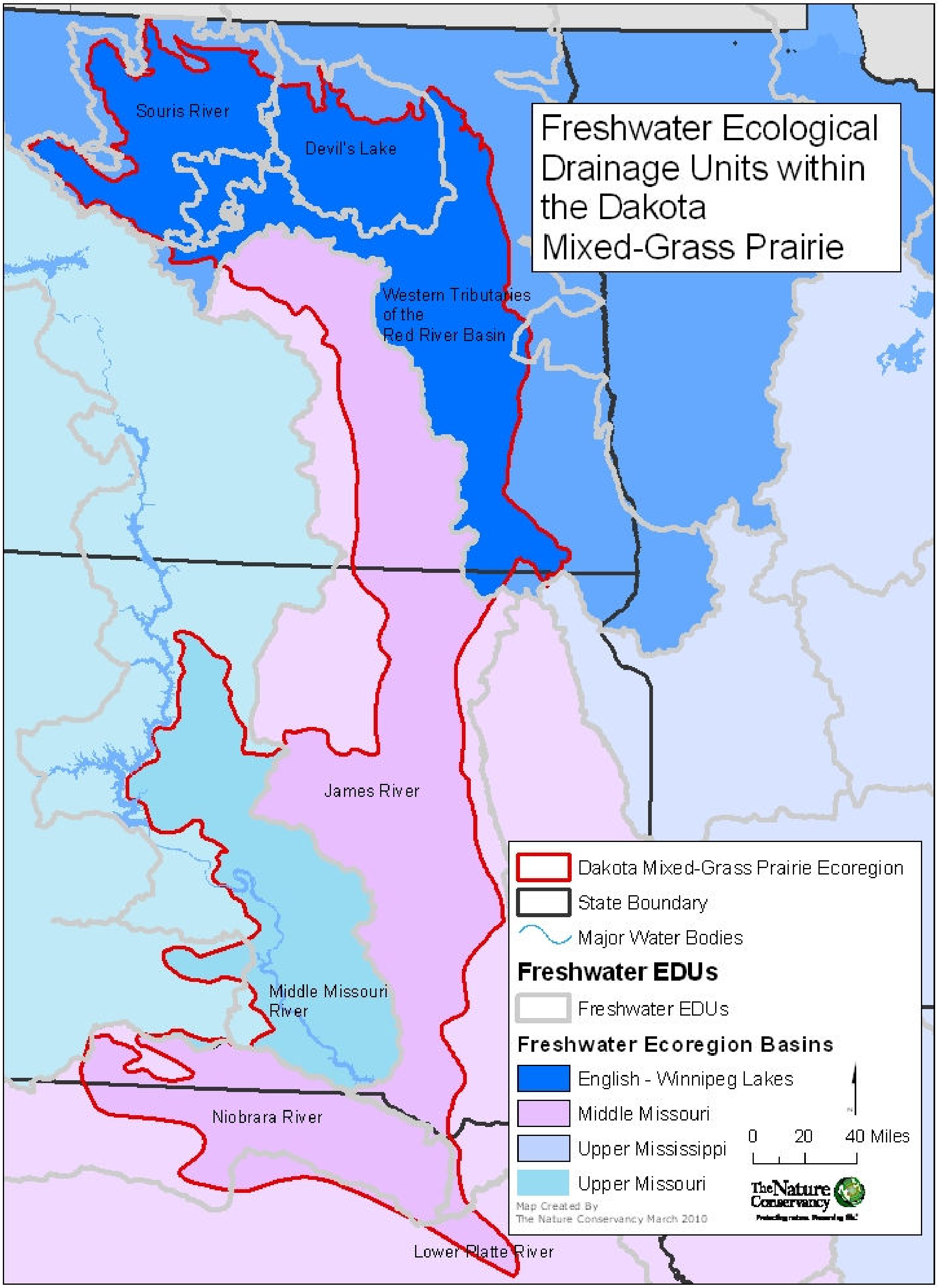

Figure 4.4.1 Freshwater ecological drainage units within the Dakota Mixed-Grass Prairie ecoregion

4.4.2 Middle Missouri River

The middle Missouri River is defined as the river's reach between the confluence with the Yellowstone River, near the northwestern corner of North Dakota, and the Fort Randall Dam between South Dakota and Nebraska. As such, this part of the river flows mostly beyond the western boundary of the DMGP. Generally only small tributaries, such as White Earth, Apple, Beaver, and Medicine Creeks, flow into the Missouri from the east; all the major tributaries lie to the west. The river in this reach creates a major physiographic boundary between glaciated terrain on the east and late Mesozoic / Tertiary sedimentary rocks exposed on the west (Clayton *et al*. 1980). Because it stretches from the extreme northwestern corner to the south edge of the DMGP ecoregion, the climate along this reach of the Missouri River ranges from coldest and driest to the warmest and wettest within the ecoregion.

The Garrison, Oahe, Big Bend, and Fort Randall Dams, completed during the 1950s (except for Big Bend, which was completed in 1966) create the large reservoirs that constitute Sakakawea, Oahe, Sharpe, and Francis Case Lakes, respectively. On this reach of the Missouri, only a small 50-mile (80-km) segment between Bismarck and Garrison Dam remains free flowing, but obviously affected greatly by altered flow. The dams were constructed for flood control, downstream flow modification, hydroelectric generation, and recreation.

4.4.3 Devils Lake

The internally drained Devils Lake basin covers an area of approximately 3,810 mi² (9,868 km²) in northeastern North Dakota. The lake has fluctuated between 1,398 feet (426 m) above mean sea level, when the lake is completely dry, to a maximum near 1,459 feet (445 m), which is the elevation at which the lake naturally drains southward into the Sheyenne River. Research indicates that lake levels have reached those extremes several times during the Holocene (Wiche *et al*. 1986).

The basin is underlain by a gently undulating till plain, characterized by areas of ground moraine and outwash of Late Wisconsinan age. Cretaceous and Lower Tertiary sedimentary rocks underlie the glacial sediments. The climate in the basin consists of cold continental winters with warm, often dry summers. Temperatures range from 37 to 45° F (4-7°C). An average of 17 inches (43 cm) of precipitation falls during the year, with most occurring from April through September.

The main hydrological features in the basin include the Mauvais, Big, and Little Coulees, which flow into Devils Lake from the northwest, and Edmore Coulee on the northeast. Other large lakes include Irvine, Alice, Dry, Morrison, and Sweetwater. During times of low water, Devils Lake forms a series of discontinuous basins, with Stump Lake the largest and generally separate. Water quality varies greatly depending on lake level, with salinities approaching that of sea water during the driest times.

Devils Lake flooding that began in the 1990s and continues to the present (2009) has destroyed hundreds of businesses and homes, and inundated thousands of acres of farmland. The state of North Dakota and the U.S. government have spent over $450 million dollars in flood mitigation efforts including moving roads, rail and power lines, and levee construction. In April 2008, North Dakota began operation of an outlet to allow water from Devils Lake to flow into the Sheyenne River. The accelerated use of this outlet continues to fuel international and regional contention concerning potential deleterious ecological consequences to Lake Winnipeg and the Red River basin (NDSWC 2009).

4.4.4 Sand Hills

The grasslands within the Sand Hills region in north-central Nebraska remain largely intact, consisting of stabilized sand dunes, the largest such formation in the western hemisphere. For the DMGP, we adopted the portfolio recommendations for the Sand Hills originally made in the Conservancy's ecoregional assessment of the Central Mixed-Grass Prairie (Steuter *et al*. 2003), since this watershed overlaps the two terrestrial ecoregions. A general description of the Sand Hills EDU follows for the convenience of readers.

The Sand Hills region is largely intact, not having been plowed at the time of European settlement, likely due to its aridity (WWF 2007). Although a subhumid climate occurs in the eastern portion, the climate trends toward semiarid in the west. Natural communities of the Sand Hills landscape range from wetlands and shallow lakes in the lowlands to the tops of dunes (330 feet; 100 m tall) with numerous "blow outs." Approximately twelve million acres (5 million ha) in size, the Sand Hills represents an important recharge area for the High Plains (Ogallala) aquifer (Bleed and Flowerday 1998).

The northern Sand Hills are drained by the Niobrara River. Tributaries of the Loup River drain the central and eastern portions of the region. In the west, interior small drainage basins are the norm. The Dismal, Middle Platte, Snake, Calamas, Upper Elkhorn, and Cedar are other streams of significance within the Sand Hills.

Rainfall in the Sand Hills ranges from 25 inches (64 cm; east) to 16 inches (40 cm; west) (Pool 1914). The majority (80%) of the area's precipitation occurs between April and September and peaks between April and June (Potvin and Harrison 1984).

4.4.5 Middle Souris River

The Souris River originates in Saskatchewan, passes through the north-central part of North Dakota, and then again crosses the international border into the Province of Manitoba where it joins the Assiniboine River. Its extensively cultivated river valley is flat and relatively broad, developed on ground moraine (especially in the west) and glacial lake sediment and outwash in the eastern part of the basin.

Large reservoirs have been constructed in both the U.S. and Canadian portions of the basin, including Boundary, Rafferty and Alameda Reservoirs in Saskatchewan, and Lake Darling in North Dakota. The basin also includes several federal wildlife refuges and small impoundments within the U.S.

Major tributaries to the U.S. reach of the river include the Des Lacs and Wintering Rivers, and Cut Bank, Willow, and Egg Creeks. Minot, the fourth largest city in North Dakota, straddles the banks of the Souris River. Water quality and environmental flow patterns have been negatively affected by impoundments, agriculture, and urban development.

4.4.6 Red River Basin – West

The Red River Basin – West EDU is characterized by a gently rolling landscape developed on glacial till and lake plains sediments. Drainage includes the western tributaries of the Red River; the Sheyenne River is an important system in this EDU. Historically, transitional tallgrass to shortgrass prairie occurred in the uplands.

The geomorphology of the Red River Basin – West EDU ranges from level to undulating till cut by glacial channels. It includes the western part of the Lake Agassiz plain and beach deposits. Underlying geology includes glacial till and lacustrine deposits. Outwash and alluvium occur in the fans and major river valleys. Areas of ablation potholes, moraines, and glacial lake plains overlie the Cretaceous and Paleozoic sedimentary bedrock (Bailey 1995; McNab and Avers 1994). The climate is cold and continental with warm summers. Evapotranspiration exceeds precipitation, which averages 15-20 inches (38-50 cm). Temperature averages 36-45° F (2-7° C) (Bailey 1995; McNab and Avers 1994).

5 DATA AND INFORMATION SOURCES

5.1 Untilled Landscapes and Rapid Ecological Assessments

To better understand the current condition of terrestrial ecological systems and communities in the DMGP ecoregion, field surveys were conducted in untilled landscapes during the summer and autumn of 2001 by staff ecologists from the North Dakota and Nebraska heritage programs, and an independent biologist for the South Dakota portion of the ecoregion. Untilled landscapes[2] were delineated for the North American Great Plains by the Conservancy's Midwest Conservation Science Center using Multi-Resolution Land Characteristics Landsat Thematic Mapper (TM) satellite imagery dating largely from 1992 and 1993 (Ostlie *et al.* 2005). In Nebraska, the untilled landscapes were delineated through the examination of classified TM satellite imagery, which was acquired in 1991 and 1993. The untilled landscapes in the DMGP served as a draft terrestrial ecoregional portfolio. The surveys of these landscapes in the DMGP, called Rapid Ecological Assessments (REAs), are cursory windshield or roadside observations used to characterize the untilled landscapes, hereafter generally referred to as "conservation areas." For all but the smallest landscapes, surveyors made observations from multiple locations and recorded the dominant terrestrial ecological systems and plant communities present, small patch communities present, the overall ecological condition and landscape context of the untilled landscape, presence of and extent of invasion by exotic species, potential threats to the ecological systems and plant communities, and the presence of exceptional biological or other features. These characterizations of the remaining natural and semi-natural areas throughout the ecoregion formed the foundation of the terrestrial ecoregional portfolio. The results of the three REAs were summarized in the following unpublished reports:

[2] Defined as large areas of contiguous native grassland that is less than 80% fragmented by urban/suburban development or agricultural land.

<u>North Dakota</u>

Natural community inventory within landscapes of the Dakota Mixed-Grass Prairie Ecoregion of the United States. 2001. Rachel Seifert-Spilde, Natural Heritage Inventory, North Dakota Parks and Recreation Department, Bismarck, North Dakota.

<u>South Dakota</u>

Rapid ecological assessments conducted on untilled landscapes in the Dakota Mixed-Grass Prairie Ecoregion of South Dakota (including small areas in North Dakota and Nebraska). 2001. Cynthia Reed, Botanist, Hot Springs, South Dakota.

<u>Nebraska</u>

Rapid ecological assessment of the Northern Mixed-grass Prairie Ecoregion (Nebraska Portion). 2002. Gerry Steinauer, Nebraska Game and Parks Commission, Aurora, Nebraska.

The REA data, in conjunction with other data described below, were used to evaluate the conservation areas and identify the subset to be included in the final terrestrial ecoregional portfolio.

5.2 Grassland Bird Conservation Areas and Waterfowl Breeding Areas

5.2.1 <u>HAPET Grassland Bird Conservation Area (GBCA) Models</u>

The U.S. Fish and Wildlife Service (USFWS) Habitat, Population, and Evaluation Team's (HAPET) GBCA models developed for the Prairie Pothole Region (updated 2008) were the primary datasets used for identifying important areas for bird conservation in the North Dakota and South Dakota portions of the DMGP. The GBCA concept is refined from the bird conservation area concept developed by Partners in Flight (Fitzgerald *et al.* 1998; Fitzgerald *et al.* 1999) and adapted for use with remote sensing data. Comprised of a core of compatible habitat for grassland birds, GBCAs are generally surrounded by a matrix of compatible and/or neutral habitat (e.g., agricultural land) with little hostile (e.g., forest, urban) land cover.

HAPET identified three types of GBCA cores to meet differing levels of area sensitivity in grassland birds and to address regional differences in opportunities for grassland preservation and restoration (Johnson et al. 2010). Type 1 cores contain a minimum of 640 acres (264 ha) of grassland followed by Type 2 cores (160 acres (66 ha) minimum), and Type 3 cores (55 acres (23 ha) minimum) (Johnson et al. 2010). For the DMGP ecoregional assessment, we focused on the larger, Type 1 cores (Figure 5.2.1) with Type 2 core areas informing the clustering of Type 1 cores and serving as buffers for the Type 1 cores. More information, data, and methodological details for HAPET GBCA modeling are available at (http://ppjv.org/hapet/hapet_grassland_birds.htm).

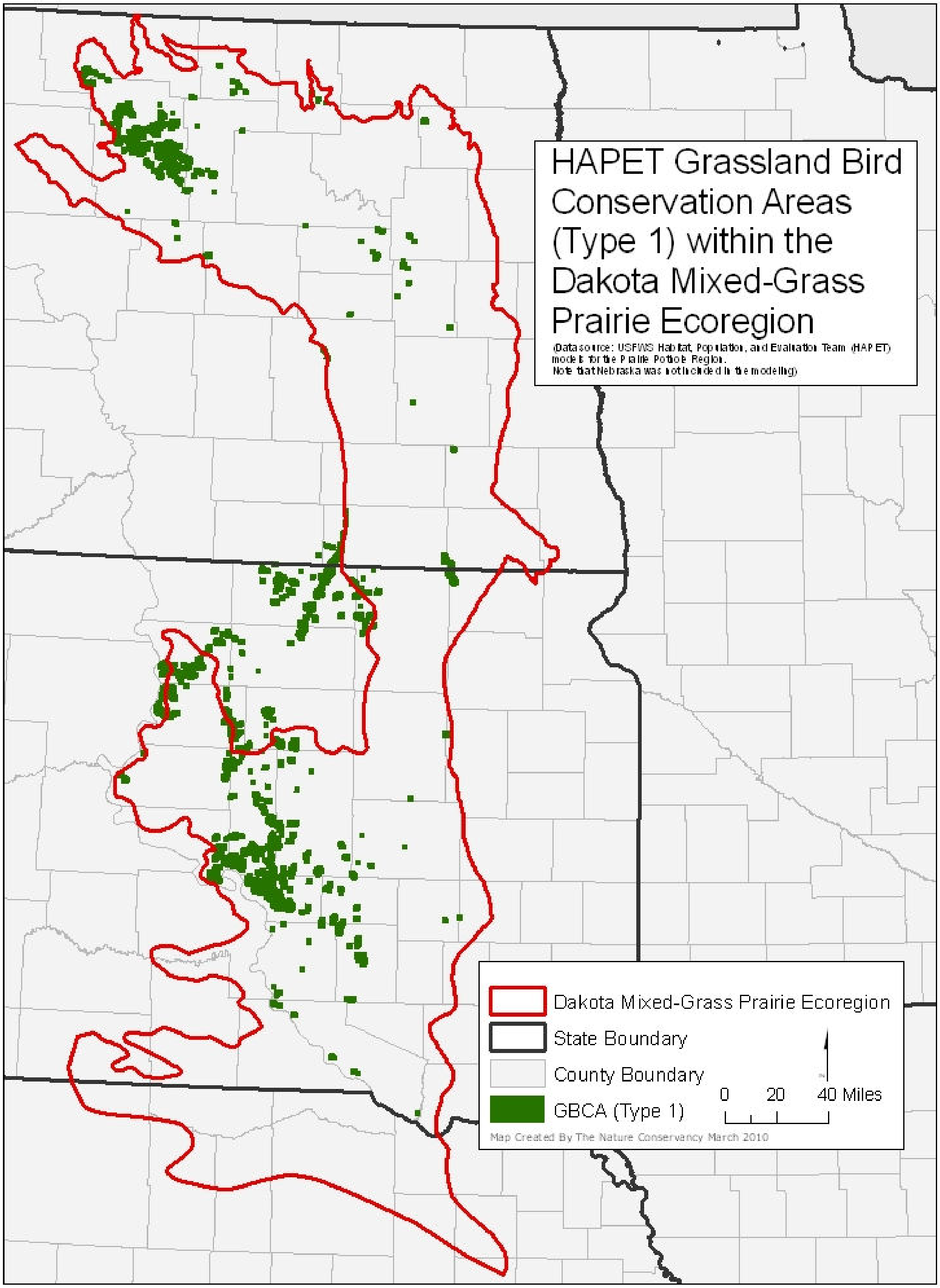

Figure 5.2.1 HAPET Grassland Bird Conservation Areas (Type 1) within the Dakota Mixed-Grass Prairie ecoregion

5.2.2 HAPET Waterfowl Breeding Area Models

Also known as "thunderstorm maps," the HAPET Waterfowl Breeding Area Model predicts nesting duck pairs for five upland nesting duck species. We used this model dating from 2002 to select priority conservation areas for waterfowl (Figure 5.2.2). The tool was developed as an accessibility model based on duck pair-wetland regression models and based on the distance that female upland nesting ducks generally travel from their territories to nesting sites. Models were constructed for an aggregate of the five most common upland-nesting waterfowl species: mallard, northern pintail, blue-winged teal, gadwall, and northern shoveler. The model development involved identifying potential number of breeding pairs for each duck species within 40-acre (16.5-ha) landscape units. The extent of the modeling includes the majority of the ecoregion, with the exception of Nebraska, Missouri River Breaks, and the Keya Paha Tablelands portions. The models represent the best available information for waterfowl. More information, data and technical details for the HAPET waterfowl breeding area modeling are available at the Prairie Pothole Joint Venture's Bismarck HAPET website: www.ppjv.org/hapet/hapet_bismark2.htm.

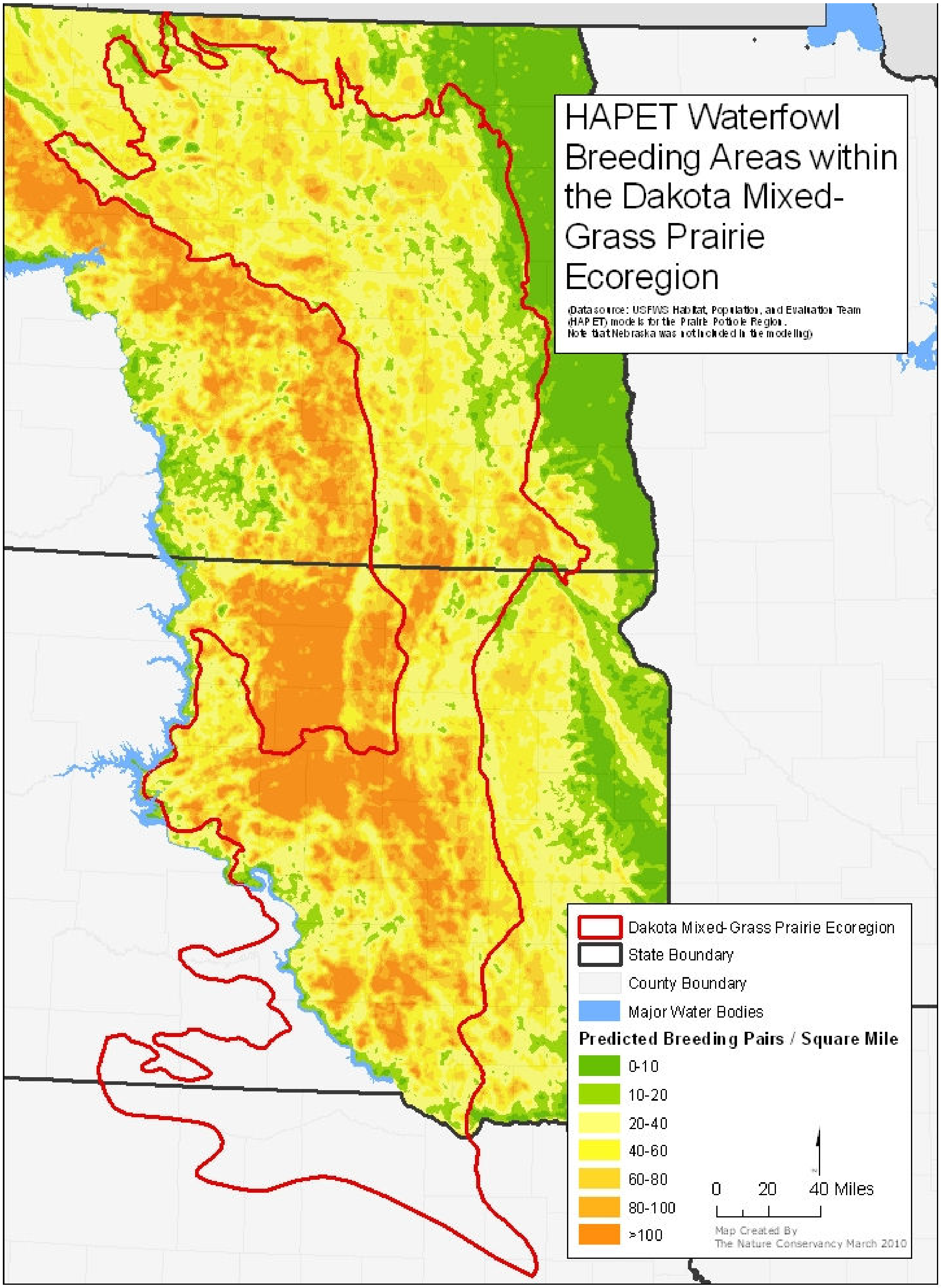

Figure 5.2.2 HAPET waterfowl breeding areas within the Dakota Mixed-Grass Prairie ecoregion

5.3 Heritage Element Occurrence Data

We obtained current Element Occurrence (EO) records for all species, communities and other features for the entire states of North Dakota, South Dakota, and Nebraska from their respective heritage programs in early January to early February 2008. Heritage program biologists conduct field surveys to inventory the native species and ecological communities and systems that occur within their state. Locations and condition of observed species, communities and systems are recorded as "element occurrences" and compiled in a standardized spatial data management system. Financial and human resources available to conduct initial inventories and follow-up surveys are generally limited at best; consequently, there are varying degrees of spatial, temporal, and taxonomic gaps in these observation data. However, element occurrence records are the most complete field-based data available for species and ecological communities. (More information on heritage programs and their data is available on NatureServe's website: www.natureserve.org/aboutUs/index.jsp).

Earlier versions of EO data were also obtained when the assessment was originally initiated. The EO records were reviewed at that time to identify the rare species that would serve as fine filter targets in the DMGP ecoregion. Biologists further reviewed the initial species list to include endemic, federally listed, and other species of concern. EOs were also reviewed to compile an initial list of plant communities and terrestrial ecological systems for the ecoregion. Finally, freshwater species EOs were used to help identify the freshwater portfolio for the ecoregion. The 2008 versions of these datasets were intended to be used to evaluate how well the terrestrial ecoregional portfolio captured non-avian terrestrial species and plant community targets. However, this effort was postponed due to further staff losses and concerns over whether the data are sufficiently comprehensive to draw firm conclusions regarding conservation goals.

5.4 2001 National Land Cover Database (NLCD)

Land cover data developed by the Multi-Resolution Land Characteristics (MRLC) Consortium were used for a range of ecoregion-wide vegetation and spatial analyses. The percentage of each untilled landscape in natural or semi-natural land cover was calculated and reviewed along with visual comparisons of 2006 NAIP imagery to estimate whether the landscape had undergone further significant conversion to row-crop agriculture. The NLCD data were also used to estimate the percentage of various groupings of land cover for the GBCAs and the waterfowl areas; the resulting figures were used to assist in the prioritization of the GBCAs and waterfowl areas. Because the freshwater evaluation took place in an earlier phase of the overall assessment process, the 1992 NLCD was used then.

5.5 National Agriculture Imagery Program (NAIP)

High-resolution NAIP imagery dating from 2006 was used in conjunction with Google Earth imagery and land cover class calculations to qualitatively review the condition of the conservation areas in 2008 and determine whether their condition had changed substantially.

5.6 Soil Survey Geographic Database (SSURGO)

SSURGO data from the Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture is a national data set representing the most detailed level of national soil mapping by the NRCS. Digitized versions of the original soil survey maps constitute the majority of this dataset, which meets national map accuracy standards. For the purposes of the DMGP ecoregional assessment, the soil cropping capability (Land Capability Class) was compared with unconverted land to evaluate the potential for additional agricultural conversion as part of the threats analysis.

5.7 Aquatic Ecological System Classification

In preparation for the ecoregional planning process, we also developed a hierarchical classification for the river and stream systems of the ecoregion. The classification we employed successively divided the hydrologic landscape into Aquatic Subregions, Ecological Drainage Units (EDUs), Aquatic Ecological Systems (AESs; also referred to as systems) and Macrohabitats (Higgins *et al*. 2005). This classification served as the organizing structure for our assessment of the freshwater ecological systems and species of the ecoregion. Details on the classification of DMGP rivers and streams are provided in Appendix 2.

5.8 Freshwater Species and Assemblage Data

A variety of digitally georeferenced data sets marking the locations of freshwater species and assemblages were obtained from academic institutions, state and federal agencies, and NatureServe between 2002 and 2009 (Table 6.8.1). We sought records of the occurrences of river and stream-dwelling fishes, crayfish, mussels, invertebrates, mammals, reptiles and amphibians obtained after 1995 using any survey or observation method. All data were transferred into a standardized data format and imported into a GIS. These data formed the basis of our assessment of aquatic target species occurrences and conservation goals attainment.

Table 5.8.1 Data sources for species occurrence records

Data Code	Taxa Group	Title	Source/Contact	Coverage
MN01	fish	PCAFish	Scott Nimela - MN PCA	9692 records at 831 stations throughout the St. Croix, Minnesota, and Upper Mississippi River (UMR) Drainages
MN02	mussels	MN Mussel Data (DNR)	Mike Davis - MN DNR	5337 records from 672 sites in the Cedar, Des Moines, Minnesota, St. Croix, and UMR systems
MN03	fish	Schmidt Dataset	Konrad Schmidt - MN DNR	33139 records from sites in Mississippi, St. Croix, Minnesota, and Des Moines River drainages
MN08	fish	Lake Surveys	Konrad Schmidt - MN DNR	65,536 records from Minnesota Department of Natural Resources Lakes database
MN13/UMR12	fish, mussel, crayfish, reptiles, amphibians, aquatic insects	MN Heritage Dataset	MN Natural Heritage Program	Statewide, 13606 records for element occurrences across the UMR
MN14	fish	Schmidt MS River Pool 1-9	Konrad Schmidt - MN DNR	1437 records from pools 1-9 on Mississippi river
ND02	fish	ND Fishes database	Steven W. Kelsch - UND	Statewide(ND)
ND03	fish, mollusks	ND Natural Heritage data	ND Natural Heritage	Statewide (ND)
ND05	fish	Koel Dataset	Todd M. Koel - NDSU	Red River Basin (ND)
NE05	fish, mussels and aquatic plants	NE Natural Heritage data	NE Natural Heritage	Statewide (NE)
SD01	fish	Backlund Dataset	Chad Kopplin - SD Aquatic GAP	Statewide (SD); 51 records from Upper Missouri River Basin of SD
SD02	fish	Dieterman Dataset	Chad Kopplin - SD Aquatic GAP	19 sites in Upper Missouri River Basin of SD
SD03	fish	Bailey and Allum Dataset	Chad Kopplin - SD Aquatic GAP	Eastern half of state (SD)
SD05/UMR12	fish, mussel, crayfish, reptiles, amphibians, aquatic insects	SD Natural Heritage data	Dave Ode - SD Natural Heritage Program	Statewide (SD)
SD07	fish	Topeka Shiner Locations from SD GAP	Steven Wall - SD Aquatic GAP	Statewide (SD)

5.9 Expert Meetings and Input

In addition to the data and models acquired, a number of expert input meetings were held in the early stages of the planning process. The bird and freshwater assessments particularly benefited from expert meetings.

5.9.1 Aquatic Expert Workshop

We obtained expert input throughout the planning process and held an expert workshop in November 2002 to compile a list of species of concern in the ecoregion and to identify locations in the ecoregion important to these species. The workshop was held November 13-14, 2002 at the North Dakota Heritage Center in Bismarck, North Dakota. Natural Heritage Program EO records, USFWS HAPET models, vegetation and topographic maps, and untilled landscape maps were displayed and available at the meeting. During the meeting, expert participants offered maps, survey data, and other knowledge that fed into a draft map displaying areas with viable breeding populations of one or more conservation bird species or aggregate targets. Conservation goals for each target were also established. A list of workshop participants and experts consulted appears in Appendix 3. In 2007, our approach evolved from an expert-based to a model-based assessment.

5.9.2 Aquatic Expert Workshop

Much of the information on freshwater biodiversity targeted in the DMGP assessment was gleaned from a meeting held with aquatic biologists and ecologists on November 19-20, 2002, in Aberdeen, SD. Over the course of two days, experts were queried on the conservation status, location, viability and threats to aquatic taxa and systems in the rivers and streams of the DMGP. They provided detailed information about aquatic taxa and systems of conservation importance at locations around the region. Experts developed target species and assemblage lists and identified conservation goals for the targets. They reviewed and provided suggestions for improving our river/stream classification system and offered comments on a proposed approach to select priority conservation areas for the DMGP. Information and suggestions offered at this meeting were adopted and incorporated into the portfolio assembly strategies. Additional experts reviewed these materials and provided comments on previous versions of this document.

6 STRENGTHS AND LIMITATIONS OF THE DMGP ASSESSMENT

This report identifies a potential conservation portfolio for the DMGP Ecoregion. We used the best available data and models to guide the selection of the portfolio. In addition this document reflects the input and review of numerous experts in fields ranging from wildlife conservation to ecology and hydrology. A number of excellent reports, such as the Prairie Pothole Joint Venture Bird Conservation Plans and State Wildlife Plans significantly informed our assessment, in terms of potential conservation targets, threats, strategies, and conservation areas. The freshwater classification provided a complete set of river and stream system targets as well as a comprehensive geographic coverage of their locations. In addition, we coordinated with a parallel planning process immediately to the west: an update to the ecoregional assessment for the Northern Great Plains Steppe Ecoregion.

Despite the above strengths, this assessment also had a number of limitations. First and foremost, the Rapid Ecological Assessments were conducted in 2001, were coarse by nature, and there were likely differences among surveyors even with standard protocols. Although condition was remotely reassessed in 2008 for each site with more current imagery (i.e., 2006 NAIP imagery in conjunction with Google Earth), the age of the assessment data was of concern, particularly in light of the potential for conversion to agricultural land.

In addition, the completion of the plan via a new project team having only two team members overlapping with the first team was clearly a disadvantage. Periodic losses and discontinuities in project team staffing in conjunction with organizational restructuring led to discontinuities in assessment methods, likely losses of expert-derived information, and a perhaps record level of inefficiency in the overall assessment process.

Prairie potholes are one of the defining features of the ecoregion, but they were not directly addressed in this assessment effort. Ecological systems containing potholes and waterfowl areas serve as coarse, interim surrogates for potholes in this assessment. A suggested process for comprehensively assessing prairie potholes is briefly outlined in "Next Steps" (Section 12.2) and more fully described in Appendix 4.

Although we made full use of existing data, detailed information on the location and viability of conservation targets was sparse for this ecoregion. There were unquantified but substantial geographic and taxonomic gaps in species and plant community occurrence records due to lack of resources for conducting biological inventories. Further, it was difficult to draw substantive conclusions about the presence, condition, and distribution of most species targets in the ecoregion based on the existing data. Similarly, a comprehensive spatial layer showing the location and extent of ecological systems was lacking; this data layer became available in 2010. Finally, critical threats such as invasive species, climate change, hydrologic alterations, fire suppression, and energy development were not spatially and/or quantitatively evaluated for the ecoregional portfolio, or for the ecoregion as a whole.

7 CONSERVATION TARGETS AND TARGET OCCURRENCES

Early in the assessment process, assessment team members identified a suite of coarse and fine filter conservation targets functioning at a range of spatial scales: terrestrial ecological systems, aquatic ecological systems, terrestrial plant communities, species assemblages, and individual species. Due to the shifts in the assessment project's staffing and scope, some of the original groups of conservation targets could not be evaluated as originally intended. However, all of the original targets are outlined in this section, with brief descriptions of the extent to which they were or should be assessed. In conjunction with the identification of targets, the assessment team also obtained or developed a variety of data sets to evaluate target occurrences as described below; the use of these data similarly evolved with the shifts in the assessment process.

7.1 Terrestrial Ecological Systems

Terrestrial ecological systems are the coarse filter for individual plant communities and individual terrestrial plant and animal species; if the ecological systems are adequately represented it is assumed that the full range of plant communities and most plant and animal species are also represented. There are sixteen ecological systems currently defined as "terrestrial" targets for the DMGP (NatureServe 2007), although some of these represent an intersection between terrestrial and freshwater systems:

- Northwestern Great Plains Canyon CES303.658
- Central Mixed-grass Prairie CES303.659
- Great Plains Prairie Pothole CES303.661
- Northwestern Great Plains Shrubland CES303.662
- Western Great Plains Badlands CES303.663
- Western Great Plains Cliff and Outcrop CES303.665
- Western Great Plains Dry Bur Oak Forest and Woodland CES303.667
- Western Great Plains Saline Depression Wetland CES303.669
- Western Great Plains Sand Prairie CES303.670
- Western Great Plains Tallgrass Prairie CES303.673
- Northwestern Great Plains Mixed-grass Prairie CES303.674
- Western Great Plains Open Freshwater Depression Wetland CES303.675
- Northwestern Great Plains Floodplain CES303.676
- Northwestern Great Plains Riparian CES303.677
- Western Great Plains Wooded Draw and Ravine CES303.680
- Northwestern Great Plains Aspen Forest and Parkland CES303.681

These were identified both by reviewing ecological system descriptions and their geographic distribution, and reviewing documented community EOs and identifying the ecological systems with which they are associated. NatureServe and heritage ecologists further reviewed and refined this list. The Northwestern Great Plains Mixedgrass Prairie and the Great Plains Prairie Pothole systems are the two ecological systems that historically dominated the ecoregion. The other systems form patches or other localized features within the mixedgrass prairie/pothole landscape, depending on local environmental conditions and/or geomorphology. The Central Mixedgrass Prairie system is peripheral to the DMGP ecoregion. Descriptions of each system type and a list of the plant associations found within each system are provided in Appendix 5.

Biologists conducting the rapid ecological assessments in the conservation areas recorded the dominant plant communities present, as well as estimating their viability. The individual plant communities are nested within the coarser ecological systems in NatureServe's hierarchical classification of systems and communities. By linking the documented plant communities to their affiliated ecological systems, the team was able to determine which ecological systems characterize the conservation areas. The documentation of ecological systems present within the conservation areas served as a coarse set of ecological system occurrences, with system viability similarly estimated from the documented plant community or site viability.

7.2 Terrestrial Plant Communities

There are 82 native plant communities as defined by the U.S. National Vegetation Classification (Grossman *et al.* 1998) that occur within the region, based on heritage EO records and expert review. All were initially selected as conservation targets for the DMGP (Appendix 6). The "matrix-forming" plant communities are not only adapted to, but require fire and grazing to persist. These two forces, interacting with regional climate, soils, and weather, particularly drought, produce a dynamic spatial and temporal mosaic of communities. Embedded within matrix communities are small and large patch communities usually associated with unique and localized soil-moisture conditions, geologic features, or other abiotic factors. In any updates to the DMGP assessment, it would be appropriate to narrow the list of plant community targets to rare types and small and large patch types that may not be adequately captured by their affiliated ecological systems. Representative and common plant communities may be assumed to be captured by their affiliated ecological systems and would not require individual attention. All plant communities were retained as targets in this assessment because the information on ecological systems and their occurrences was relatively limited or still in development.

Both the rapid ecological assessments and Heritage EO records (described earlier in Sections 6.1 and 6.3) served as occurrence data for plant communities. As noted previously, dominant plant communities present in each untilled landscape were recorded by surveyors along with notable large and small patch communities. As noted in the descriptions of these data sets, they do not provide a complete picture of the native plant communities remaining throughout the ecoregion, but the REA data provide an adequate summary of the dominant plant communities within the conservation areas.

7.3 Terrestrial Non-Avian Species

Species conservation targets were chosen based on global rarity (NatureServe global conservation status ranks G1-G3[3]), vulnerability, and endemism. These are fine filter targets that may not be represented even if the full suite of ecological systems and plant communities are adequately captured. Heritage EO records were used to develop an initial list of species targets; heritage staff biologists and others reviewed the list to further refine it (Table 8.3.1).

[3] NatureServe global conservation status ranks range from G1-G5: G1 = globally critically imperiled; G2 = globally imperiled; G3 = globally vulnerable; G4 = globally apparently secure; G5 = globally secure. More information on conservation status ranks is available on NatureServe's website at www.natureserve.org/explorer/ranking.htm.

Table 7.3.1 Terrestrial non-avian species targets in the DMGP Ecoregion

Target	Rationale for Selection
Invertebrates	
American Burying Beetle *Nicrophorus americanus*	G2G3; occurs in the South Dakota and Nebraska portion of the ecoregion, and listed endangered on the U.S. Endangered Species List, has exhibited dramatic range collapse in recent times (reduced to less than 10% of its original range and probably much less than 1% of its original occupied habitat), still extant in South Dakota but range severely reduced to 1000 square miles (621 km^2) in the south central part of the state (in the DMGP).
Dakota Skipper *Hesperia dacotae*	G2G3; occurs in North and South Dakota, very few populations exist across its former range, some populations are too small to persist even without any disturbance, species is dependent on native prairie and now has a restricted and highly fragmented range with threats at almost all sites, altered natural disturbance regimes may be contributing to the decline of the species
Regal Fritillary *Speyeria idalia*	G3; species is more threatened than global rank suggests due to recent and large- scale declines and range contraction, species is still extant in many prairie remnants but excluded or under stress from altered natural disturbance regimes, almost no high quality occurrences, most occurrences are rather isolated and therefore vulnerable to long-term loss from stressors such as altered disturbance regimes, contamination, and habitat fragmentation. Although the species may be locally vulnerable in North Dakota, there are some populations that appear healthy and secure throughout the southeastern third of the state (eastern subspecies may be faring less well than the western subspecies) (R. Royer, pers. comm., 2010).
Iowa Skipper *Atrytone arogos iowa*	G3; this taxon may already be extinct in North Dakota (R. Royer, pers. comm., 2010).
Ottoe Skipper *Herperia ottoe*	G3G4; this taxon historically has occurred almost entirely within western counties in North Dakota, but is declining even in badland counties where it was once abundant, clearly under some stress in North Dakota, perhaps generally (R. Royer, pers. comm., 2010).
Vertebrates	
Bailey's Eastern Woodrat *Neotoma floridana baileyi*	Occurs in the Nebraska portion of the ecoregion, ranked S2 (imperiled in Nebraska) and T3 (vulnerable globally)
Black-footed Ferret *Mustela nigripes*	G1; range is peripheral to the DMGP, listed endangered on the U.S. Endangered Species List. S1 (critically imperiled) in ND and SD, SH (possibly extirpated in NE). Recovery depends on captive breeding and reintroduction, which show signs of success (Patterson *et al.* 2003)
Swift Fox *Vulpes velox*	G3; S1 (critically imperiled in ND and SD), S2 (imperiled in NE). Has disappeared from about 60% of former range, threatened by habitat loss and degradation. Reintroductions have been successful in some areas.
Vascular Plants	
Hall's Bulrush *Scirpus hallii*	G2 (imperiled globally), found in the Nebraska portion of the ecoregion, habitat is highly threatened by disturbance from off-road vehicles, draining/filling of wetlands, herbicides, and grazing
Prairie Dunewort *Botrychium campestre*	G3 (vulnerable globally), naturally rare in most of this range, with a few areas of modest concentration and several isolated, disjunct populations, is extremely inconspicuous and difficult to locate, primary threat is the plowing of native prairies
Smooth Goosefoot *Chenopodium subglabrum*	G3G4
Western Prairie Fringed Orchid *Platanthera praeclara*	G2; historically widespread throughout the ecoregion, and listed threatened on the U.S. Endangered Species List, possibly extirpated in South Dakota, declines are due to conversion of prairie

Heritage EO records are the best available occurrence data in a single consistent format for these species targets. For the reasons noted previously, the EOs are likely an incomplete representation for the locations of species targets in the ecoregion.

7.4 Avian Species

The DMGP ecoregion is home to a great diversity of bird species. This assessment addressed avian targets in particular because of significant declines experienced by many grassland bird species and the overall importance of the prairie pothole system for a variety of avian species. In the initial scope of this assessment, individual bird species targets were selected by considering a number of different scoring and ranking systems and expert review (Appendix 7). Primary species targets selected through this process are listed in Table 8.4.1. Consideration was also given to a set of secondary species, listed in Table 8.4.2. These species were identified by at least one expert in workshops and during the review period, but were not included in the final set of primary avian targets.

The assessment team also initially included two species aggregation targets: waterfowl breeding areas and migratory stopover sites

Table 7.4.1 Primary bird conservation targets for the DMGP Ecoregion

Common Name	Scientific Name	Distribution
Baird's Sparrow	*Ammodramus bairdii*	peripheral*
Black Tern	*Chlidonias niger*	widespread
Burrowing Owl	*Athene cunicularia*	widespread
Chestnut-Collared Longspur	*Calcarius ornatus*	widespread
Franklin's Gull	*Larus pipixcan*	widespread
Greater Prairie-Chicken	*Tympanuchus cupido*	local
Horned Grebe	*Podiceps auritus*	widespread
Le Conte's Sparrow	*Ammodramus leconteii*	peripheral*
Marbled Godwit	*Limosa fedoa*	widespread
Nelson's Sparrow	*Ammodramus nelsoni*	widespread
Northern Pintail	*Anas acuta*	widespread
Piping Plover	*Charadrius melodus*	limited
Sprague's Pipit	*Anthus spragueii*	peripheral*
Willet	*Catoptrophorus semip*	widespread
Yellow Rail	*Coturnicops noveboracensis*	peripheral*

*to DMGP Ecoregion

Table 7.4.2 Secondary bird conservation targets for the DMGP Ecoregion (includes species identified by at least one expert reviewer)

Common Name	Scientific Name	Distribution
American Bittern	*Botaurus lentiginosus*	widespread
Bell's Vireo	*Vireo bellii*	peripheral
Clay-Colored Sparrow	*Spizella pallida*	widespread
Dickcissel	*Spiza americana*	Irruptive*
Ferruginous Hawk	*Buteo regalis*	widespread
King Rail	*Rallus elegans*	nested historically±
Loggerhead Shrike	*Lanius ludovicianus*	widespread
Northern Harrier	*Circus cyaneus*	widespread
Red-Headed Woodpecker	*Melanerpes erythrocephalus*	widespread
Sharp-Tailed Grouse	*Tympanuchus phasianellus*	widespread
Short-Eared Owl	*Asio flammeus*	widespread
Upland Sandpiper	*Bartramia longicauda*	widespread
Western Grebe	*Aechmophorus occidentalis*	widespread
Wilson's Phalarope	*Phalaropus tricolor*	widespread

* Common in some years but rare or uncommon in most years (in the DMGP); ± probably never common in this region

As the assessment wore on, the team recognized that available data (heritage EOs and expert-derived information) were not adequate for assessing the identified bird targets individually. Given the declines in grassland birds, the importance of the ecoregion to breeding waterfowl, and the availability of the USFWS HAPET models (described in Section 5.2) for these two bird groups, the team ultimately treated avian species as two general targets: grassland birds and waterfowl.

GBCA Type 1 core areas were treated as aggregations of grassland bird "occurrences," although they are actually models predicting grassland bird habitat. Similarly, the waterfowl breeding pair areas served as surrogates for occurrences of waterfowl. There are a number of assumptions underlying the use of these model data as "occurrences." First and foremost, we assume that coarse, landscape-level characteristics – in particular grassland and wetland habitat – influence the occurrence of grassland bird targets (Niemuth *et al.* 2005). The predictive ability of GBCAs has been successfully tested for some species. For example, HAPET examined the relationship between grassland habitat and occurrences of Northern Harrier in the 1995 and 1997 Breeding Bird Survey data and found that predicted presence overlapped significantly with a conceptual grassland bird habitat model applied to the same North Dakota Prairie Pothole landscape (Niemuth *et al.* 2005). We recognize that many other non-habitat factors influence the presence of target species throughout a landscape and that landscape habitat models are imperfect. In the absence of long-term data on individual species' location and distribution, the use of conceptual models to set conservation priorities makes the best possible use of existing data. In addition, in the absence of other data, we assume that both sets of habitat models will address at least a subset of migratory stopover needs for avian targets.

7.5 Freshwater Species and Assemblages

DMGP fine-filter freshwater targets include fish, mussel, crayfish, mammal, reptile and amphibian species or assemblages that are rare, endemic, declining, disjunct, wide-ranging, or on the periphery of their range (Appendix 2). Species targets are selected on an individual Ecological Drainage Unit (EDU) basis to recognize differences in the status or distribution of taxa across EDUs. Alternatively, species and assemblage targets may be assigned to a group of EDUs within a large drainage basin. Assemblage targets for the DMGP included characteristic native species assemblages that are rare or declining in the ecoregion (Appendix 2). A total of 61 species and assemblage targets were identified for EDUs that cross the DMGP (Table 8.5.1). Because the Souris EDU was added much later in the assessment process, species targets were not identified; this gap should be addressed in any updates to the freshwater portion of this assessment.

Table 7.5.1 Number of freshwater species and assemblage targets by Ecological Drainage Unit (EDU) for the DMGP

Target Type	Red River & Devil's Lake* EDUs	Middle Missouri River EDU	Sand Hills EDU	James River EDU
crayfish species	2	-	-	-
fish species	15	5	-	7
fish assemblage	1	4	2	4
herp species	5	-	1	1
invert assemblage	1	-	-	-
mammal species	1	1	1	1
mussel species	-	-	-	2
mussel assemblage	2	-	-	2
turtle assemblage	-	1	1	1

*Listed together in Appendix 2, but individual species targets did not correspond to the Devil's Lake EDU.

The data sets described earlier in Table 6.8.1 served as occurrence data for freshwater species and assemblages.

7.6 Freshwater Ecological Systems

In DMGP freshwater systems, coarse-scale targets are the Aquatic Ecological Systems (AES; system types) throughout the ecoregion. System types are groups of drainages that have similar physical habitat conditions, such as geology, stream size, flow permanence, flow network position, climate, and proximity to lakes – all factors known to influence the distribution of biota. Each system type is thought to represent a unique ecological setting, with a distinctive combination of geophysical processes, disturbance regimes, biological species composition, and physical conditions. System types are the intermediate-scale units in the hierarchical classification of DMGP rivers and streams (Appendix 1).

Every AES type in the DMGP is considered a conservation target. By including representative examples of each system type in the final conservation portfolio, we hope to ensure protection of the full range of river/stream ecological settings found in the DMGP, and the elements of biodiversity commonly found within them.

The development of the AES classification was completed through a series of spatial analyses; the resulting data layer showing the location and extent of the AES types served as occurrence data for these targets.

8 CONSERVATION GOALS

Conservation goals for targets are set with the hope of ensuring long-term viability, and maintaining genetic and ecological variation. The goal for each target should specify the number, distribution across stratification units, and minimum size of occurrences needed to conserve the element within the DMGP. Goals reflect an understanding of a suite of ecological and biological variables, including life history characteristics, threats to occurrences, key ecological processes, and disturbance regimes (TNC 1997, Groves *et al.* 2000a). Goals are also informed by the regional and range-wide distribution of the targets. For example, targets endemic to a single ecoregion are assigned a substantially larger numeric goal than those that occur in many regions because they are not found anywhere else. Similarly, targets that occur only peripherally in an ecoregion are assigned a smaller goal for that ecoregion because the bulk of their range is elsewhere.

In building a conservation portfolio for the DMGP, we adopted four guiding principles (Groves 2003) for the structure and composition of the portfolio sites:

> Representation – Conservation areas within the ecoregion should represent the biological features and the range of environmental conditions under which they occur.
>
> Resilience – Conservation targets occurring within lands and waters identified as priority conservation areas should be resilient to both natural and human-caused disturbances.
>
> Redundancy – To avoid extinction or endangerment caused by both naturally occurring stochastic events (e.g., disease, predation, floods, fires) and human-related threats, conservation targets should be represented multiple times within a system of conservation areas.
>
> Restoration – In areas where conservation targets are not sufficiently represented to meet conservation goals, planners should evaluate where occurrences of conservation targets that are not viable or lack ecological integrity may be feasibly restored to appropriate levels of viability and integrity within the ecoregion.

With the exception of the freshwater conservation targets, the assessment team generally used generic conservation goals due to the shifting scope and staffing of this assessment effort. The generic goals are not adequate and should be refined in subsequent updates to the DMGP assessment. Details on the conservation goals for each group of conservation targets are outlined below.

8.1 Terrestrial Ecological Systems

A detailed understanding of the historical extent, pattern, and supporting processes of ecological systems in the DMGP is needed to develop adequate numeric and distribution goals. Lacking that information, the assessment team considered using a generic goal of two system occurrences per stratification unit. However, the generic goal and the occurrence data do not specify the needed or actual areal extent, respectively. At a minimum, it is important to have an area-based goal for coarse-filter system targets. A solely numeric and distributional goal could result in an adequate number of occurrences that only totaled a few thousand acres; such a small total area for a defining ecological system would be far from adequate. An overall goal of representing 10% of the historical extent of the ecoregion's ecological systems was eventually applied in the DMGP. As more information is gathered about these targets, conservation goals should be refined to better reflect the conservation needs of the individual ecological systems. The summary of needed goal refinements outlined below for plant community targets also applies to ecological system targets.

8.2 Terrestrial Plant Communities

Plant community targets similarly were assigned generic conservation goals of three occurrences per stratification unit. Given the nature of the occurrence data and the varied regional distribution of the communities, these goals are far from adequate. For example, assume the generic goal of three occurrences per stratification unit for the characteristic Wheatgrass - Needle-and-Thread Mixedgrass Prairie plant community. Assume there are nine high-quality (A or B-ranked) occurrences distributed across the stratification units. However, each occurrence as mapped by the heritage programs may well be in the range of just a few hundred acres; assume a mid-point of 200 acres. Capturing nine 200-acre examples results in a total of only 1,800 acres of one of the defining plant communities of the ecoregion. Such a small total acreage divided across multiple occurrences is unlikely to be sufficient to ensure its long-term ecological health and survival. For plant communities requiring individual treatment, goals should be refined to specify minimum acreages needed to permit ecological processes within individual occurrences, minimum ecoregion-wide acreage totals, and numbers of occurrences needed in each stratification unit based on the individual community's distribution within each stratification unit. Not every community is evenly distributed across an ecoregion, and goals should reflect this as well. Goals are further informed by whether the community forms a matrix across the landscape or occurs in highly localized patches, as well as the community's geographic distribution relative to the ecoregion (endemic, widespread, or peripheral).

8.3 Terrestrial Non-Avian Species

The shifting staffing and scope of this assessment limited the team's ability to compile sufficient information regarding the number, size or distribution of these species in the DMGP ecoregion to confidently set species-specific goals. Generic goals of three occurrences per stratification unit were assigned; these should also be refined in future iterations.

8.4 Avian Species

Because they could not be assessed individually with available data, we did not develop specific, numeric goals for individual bird species targets. Given the degree of habitat loss and conversion that has taken place historically and the on-going population declines of many grassland and other bird species, we assume that the remaining natural or semi-natural habitat in the ecoregion is sufficient to support viable population levels for many species, but likely falls short of this goal for many target species of conservation concern. Therefore, we included all Type 1 core GBCAs and all waterfowl breeding habitat predicted to support >100 breeding pairs in stratification units 332B and 332D and 60 or more breeding pairs in 332A. Additional background on the team's application of the GBCA and waterfowl breeding pair models is included in Sections 9 and 11).

8.5 Freshwater Species, Assemblages, and Aquatic Ecological Systems

To ensure representation and redundancy, we sought to include occurrences of every species, assemblage and system type in the portfolio, and we established specific conservation goals for the amount and distribution of target occurrences we aimed to include in the ecoregional portfolio. The goal for systems targets was to capture at least one occurrence of each AES type in the portfolio network. Species and assemblage goals were defined on an individual basis, with the aim of delineating the number and spatial distribution of target occurrences required to ensure the persistence of that target for the next 100 years (Appendix 2). For example, experts identified *Macrhybopsis meeki* (sicklefin chub) as a species target and set its conservation goal at three occurrences within the James River EDU. To be counted as a valid occurrence of a target for the purposed of our conservation goals, experts defined a target occurrence location as a stream or river segment inhabited by a target species or used during its life history. Each target occurrence location should be in a spatially distinct watershed or basin.

To address our resiliency and restorative objectives, we included the most viable (and presumably most resilient) examples of our targets in the locations identified as Areas of Biodiversity Significance (ABS), a term that is synonymous with the term, "conservation area." We completed the freshwater portfolio with lower-viability restoration locations that provide connectivity and movement routes for aquatic biota. Details on the process of assembling the portfolio to meet the four objectives are provided in Section 11.

9 VIABILITY/INTEGRITY

Viability refers to the ability of an ecological system, community, population or species to persist over time (TNC 1996, TNC 1997, Groves *et al.* 2000a). Assessment of viability is a necessary step to identify the conditions under which the target occurrence will persist over time, and ultimately the areas of biological significance. By selecting conservation areas that include viable examples of conservation targets, we can ensure a high probability of conservation success. The standards for viability assessment set forth by Groves *et al* (2000a) include:

> To the extent practical, the long-term viability (100 years) of populations and occurrences of conservation targets is assessed with the three criteria of size, condition, and landscape context. No site should be included in the portfolio of sites unless the coarsest-scale

target at that site has been assessed as viable with these three criteria or can be feasibly restored to a viable status.

The application of the guidelines established by Groves *et al.* (2000a) for determining what constitutes a *viable* occurrence of a conservation target is problematic in the DMGP. Empirical evidence is available to assess population viability for only a few target species. At the ecological system and natural community scale, only broad conceptual guidelines exist, with direct evidence limited to the effects of patch dynamics on viability in forest systems. The structure, function and composition of Great Plains grasslands suggest resilience beyond temperate forest systems. Yet, the ecological processes that gave rise to the prairie operated at large spatial scales (e.g., climate, weather, grazing, fire, flooding, and migration). Of these, only grazing and fire can be actively managed in an attempt to scale them down to match remnant native prairie size. Possibly as important to the viability of remaining ecological systems and natural communities is the potential for compatible land uses to become unsustainable. The Global Climate Change assessment for the Great Plains suggests that land use change is more important than climate change as a force driving land cover changes (Ojima *et al.* 2002)

Similar planning efforts (e.g., TNC, Osage Plains/Flint Hills Prairie Ecoregional Planning Team 2000, Anderson 1999) have applied a concept called **minimum dynamic area** to the analysis of system viability. Because the viability of conservation targets is tied to the historic scale and frequency of large-scale processes (e.g., fire), it is important to consider the geographic area needed to ensure survival or re-colonization following these stochastic events. This concept has been termed minimum dynamic area (Pickett and Thompson 1978).

The scale and frequency with which the primary ecological processes historically occurred and the biological diversity of the systems are used to assess the minimum dynamic area. Estimates have been made that the area required for the continuation of ecological processes at their historic scale, while maintaining a mosaic of habitat in all structure classes for the full array of species in the region, is four or five times larger than the historic disturbance patch size. An estimate has also been made regarding the amount of area needed by bird and mammals using matrix community patches. This estimate has been made based on 25 times the mean female home range (Anderson 1999), or the area required for 200 individuals (The Nature Conservancy, Osage Plains/Flint Hills Prairie Ecoregional Planning Team 2000).

In attempting to assess the viability of terrestrial and freshwater targets throughout the DMGP, we considered three major factors, all of which contribute to the viability of any given target occurrence, whether it is a species, assemblage or AES (TNC 2000): size, condition and landscape context.

Size is the area or abundance of the conservation target's occurrence, relative to other known, and/or presumed viable, examples. For ecological systems and assemblages, size is simply a measure of the occurrence's patch size or geographic coverage. For target species and assemblages, size is a relative ranking based on the area of occupancy and number of individuals within the target occurrence.

Condition is the quality of the immediate habitat and biophysical conditions necessary to promote survival and reproduction. This includes factors such as the presence of invasive plants and animals, population age structure, physical structure (e.g., bank structure or local point source input), and biotic interactions (e.g., levels of competition, predation, and disease).

Landscape context is the quality of the landscape factors required to provide appropriate conditions for habitat maintenance, genetic exchange, migration and escape from disturbance. Factors might include the dominant environmental regimes and processes that establish and maintain the target occurrence (e.g., hydrologic regimes, surficial and groundwater chemistry, geomorphic processes, climatic regimes) and the degree to which targets have lateral and longitudinal movement (i.e., connectivity). Connectivity includes such factors as species targets having access to habitats and resources needed for life cycle completion, fragmentation of ecological assemblages and systems, and the ability of any target to respond to environmental change through dispersal, migration, or re-colonization.

9.1 Terrestrial Ecological Systems and Plant Communities

The REA surveyors ranked the condition and in some cases, the connectivity of the conservation areas and their associated plant communities. The size of the conservation areas (as calculated in a GIS) served as a coarse surrogate for the size of the ecological systems found within them. These qualitative rankings and acreage calculations served as the viability assessments for the terrestrial ecological systems and plant community occurrences documented in the REAs. For lack of better information, the surveyors' assessment of viability of the plant communities and ecological systems is assumed to indicate the viability of all terrestrial systems and plant communities in the conservation areas. However, the areas evaluated in the REAs were so extensive and the evaluations so general that this assumption should be clearly recognized and, preferably, tested.

9.2 Terrestrial Non-Avian Species

Heritage Program element occurrence ranks served as coarse viability ranks for individual occurrences. Many occurrences are not ranked, and the rankings may not adequately reflect the size or landscape context of the occurrence. We consider this lack of rankings a data gap in this iteration of the plan.

9.3 Avian Species

Individual bird species occurrences were not assessed for viability; the occurrence records do not adequately reflect bird populations in the ecoregion. We assumed that the level of fragmentation and amount of grassland used as criteria to develop Type 1 GBCAs, in conjunction with their size, would provide adequate habitat to support viable populations of grassland birds in the ecoregion. However, for the southwestern-most portion of the ecoregion, we lacked GBCA data. In this instance, we used the 2001 NLCD and grassland fragmentation analysis results (85% or more unfragmented) to identify GBCA-like polygons. The size and fragmentation of these polygons similarly were assumed to be sufficient surrogates for direct assessment of grassland bird population viability. Similar assumptions were made with the waterfowl breeding pair model; if the predicted habitat were adequately managed or conserved, it could support viable populations of waterfowl species in the ecoregion.

9.4 Freshwater Species, Assemblages, and Aquatic Ecological Systems

The viability assessment for freshwater species was designed to provide information on the status of aquatic system composition, structure and function at expert-identified target occurrences in the ecoregion. It was a qualitative assessment of target status based on expert field experience and knowledge. Prior to beginning work on the DMGP freshwater portfolio, no consistent, comprehensive assessment of aquatic system viability, threats and integrity to these systems had been conducted. However, extensive work had been done to understand the types of anthropogenic factors that impact these systems and the species composition of many stream and river reaches in the ecoregion. This work informed the development of our measures of aquatic system quality.

9.4.1 General Integrity Assessment Process for Freshwater

Our goal through these assessments was to acquire standardized information on the relative quality and suitability of aquatic systems for conservation protection as well as to understand the ecoregion-level condition of aquatic systems and the kinds of threats that may need to be addressed for effective conservation of these systems. We also aimed to use methods and metrics that were simple, applicable to a wide variety of systems, and efficient.

As noted previously, we considered three major factors, all of which contribute to the viability of any given target occurrence, whether it is a species, assemblage or AES (TNC 2000): size, condition and landscape context.

During the experts meetings in Bismarck, ND and Aberdeen, SD (2002), participants assigned a rank of Very Good, Good, Fair or Poor to each viability factor for each target occurrence they identified. During the portfolio selection process, viability assessment information was used to rate and select portfolio sites.

9.4.2 Specific Landscape-Scale Aquatic Ecological System Integrity Assessments

To provide consistent, quantitative information about AES integrity across the ecoregion, we assessed the relative magnitude of various stressors to aquatic systems using digital landscape-scale information in a GIS. For each AES, we calculated five metrics:

- percent of system covered by non-natural land cover, excluding urban areas and roads (Data source: National Land Cover Database - USGS 1992)
- percentage of system covered by urban and road land cover (Data source: National Land Cover Database - USGS 1992)
- number of dams per linear kilometer of stream length (Data source: National Inventory of Dams - USACE 1999)
- average stream sinuosity (Data source: National Hydrography Data - USGS 1999)
- number of point source polluters per linear kilometer of stream length (Data source: BASINS - USEPA 2001)

Landscape integrity data were used to inform the portfolio selection process and provide greater information on threats to and potential conservation strategies needed at portfolio sites.

10 THREATS

Already a highly altered ecoregion, the DMGP continues to be subjected to numerous stressors that threaten the viability of conservation targets at all scales. These threats include, but are not limited to: major land conversion (biofuels/corn ethanol production), alternative energy development (e.g., wind), climate change, invasive species (terrestrial and aquatic), ecologically incompatible grazing practices, fire suppression, and water withdrawals.

A general summary of the major threats to conservation targets in the DMGP is provided below. Descriptions of the two ecoregional portfolio-specific threats assessments follow. The threat of additional conversion to cropland was assessed for the terrestrial, grassland bird, and waterfowl portfolios. Expert-identified threats to aquatic target occurrences were documented in the freshwater assessment. The results of both of the specific threats assessments were used to refine and/or prioritize the ecoregional portfolio areas.

10.1 Threats Overview

10.1.1 Land Conversion

Although the vast areas of the DMGP have already been converted to agricultural uses, conversion still threatens remaining habitats with reasonable cropping capability (Higgins *et al.* 2002). For further discussion about the use of cropping capability information to prioritize the terrestrial portfolio, please see Section 11.1.1 (below). Particular conversion pressures arise for grassland and wetland habitats due to alternative energy development. Genetically modified crops and longer growing seasons (i.e., climate change) also pose a threat, because some crops now can be planted where historically they were incompatible (Higgins *et al.* 2002).

Bioenergy - Fargione *et al.* (2009) presented evidence that conversion of grassland habitat throughout the Prairie Pothole Region has accelerated since 2005 and that enrollments in the Conservation Reserve Program (CRP) are likely to continue to decline between 2007 and 2012(~0.76 million acres in South Dakota and ~1.70 million acres in North Dakota). They note that the loss of grassland habitat will result in the consequent loss of many benefits for wildlife and water quality unless planning factors in long-term needs for habitat and other ecosystem services (Fargione *et al.* 2009).

Wind Energy **-** According to the Wind and Wildlife map (internal website hosted by The Nature Conservancy) the wind energy potential within the DMGP is considerable. On a scale of 1 (poor) to 7 (superb) for wind energy development potential, lands within the DMGP generally rank between 3 and 5 with a few areas as high as 6. Areas with highest conservation value (e.g., portfolio sites) also tend to have higher potential for wind development.

The threat of conversion due to wind energy development must be considered relative to other forms of habitat conversion, particularly bioenergy. For example, McDonald *et al.* (2009) compare projected land use intensity (for 2030 km^2 per terawatt-hour annually) and found that corn ethanol is approximately 80% more intensive than wind energy development. They also note that approximately 95% of the impact area for wind turbines results from fragmented habitats, direct mortality of birds and bats, and avoidance behaviors, while <5% of the impact results directly from clearing of land (McDonald *et al.* 2009).

Proper siting may increase the compatibility of wind energy development with biodiversity conservation. Nonetheless, the high likelihood of expansion and the area required to support wind turbines will prove challenging to conservation interests in the region (McDonald *et al.* 2009).

10.1.2 Climate Change

The threat of land conversion in the DMGP is linked to the threat of climate change. Alternative energy development plays a role in efforts to lower carbon emissions and will be influenced by U.S. federal policy, such as the potential for a cap-and-trade regulations system in the United States (McDonald *et al.* 2009). Regardless of anticipated changes in land use, however, climate change is also expected to have a direct impact on remaining conservation areas and will likely interact with numerous other stressors (e.g., invasive species and grazing regimes).

A variety of Global Circulation Models suggest that the northern Great Plains will experience significant warming over the next century. Precipitation patterns are more uncertain, but the trend is projected to be both hotter and drier for portions of the Great Plains (Ojima *et al.* 2002). Longer and earlier growing seasons must also be considered. Consequences of this warming and drying trend are likely to be severe for a number of the DMGP's conservation targets.

For example, the broader Prairie Pothole Region produces between 50% and 80% of the ducks of the North American continent (Johnson *et al.* 2005). Wetland modeling simulations suggest the most productive habitat for waterfowl breeding might shift under a drier climate from the center of the Prairie Pothole Region (North Dakota, South Dakota, and southeastern Saskatchewan) to the wetter eastern and northern fringes, areas currently less productive or where most wetlands have been drained (Johnson *et al.* 2005). The findings of this work bring into question the long-term viability of waterfowl production areas in the DMGP and suggest that maintaining healthy duck populations over the long term may require advance planning across ecoregional boundaries to the north and east. Although additional data and modeling projections are not yet available for other wetland-dependent bird targets throughout the Prairie Pothole Region, similar trends are a possibility. Future planning efforts for bird conservation must take this work into account.

10.1.3 Invasive Species

Although this assessment did not conduct a thorough review of the breadth and severity of invasive species across the ecoregion, it was generally acknowledged during expert workshops that invasive, non-native species threaten the area's biological diversity. A number of invasive plant species occur throughout the ecoregion, and more are poised to invade. Invasive species already prevalent in the area include smooth brome, Kentucky bluegrass, spotted knapweed, leafy spurge, and crested wheatgrass. Land managers struggle to keep such species in check, although most acknowledge that eliminating invasive species altogether is unrealistic. Most managers strive to minimize encroachment by invasives already on-site, but focus on preventing future invasions of particularly threatening species. On land, insects (e.g., emerald ash borer) and diseases (e.g., West Nile virus) that are novel to the region also pose a threat (Sovada *et al.* 2007). In aquatic ecosystems, invasive plants, vertebrates and invertebrates may contribute to excessive competition for resources and a decline in native biological diversity.

10.1.4 Ecologically Incompatible Grazing Practices

Throughout the DMGP region, grazing by livestock is an economic activity that is potentially compatible with conservation. However, site productivity, stocking rates, and rotation lengths that are carefully designed to fit a given site's ecological capacity are important and vary with climatic conditions from year to year. Sustainable grazing systems represent a spectrum of options from which landowners can choose. However, current practices tend to focus more on short-term returns rather than long-term sustainability.

10.1.5 Altered Fire Regimes

Although the historical fire regime of the DMGP is unknown, fire is presumed to have been one of a few driving ecological processes within the ecoregion. Nonetheless, whether fires were historically primarily of "natural" vs. human origin is debatable. Most ecologists agree that some combination of fire and grazing likely perpetuated the vast prairie ecosystems that dominated the landscape prior to European settlement. Today, unless a fire is ignited by a prescribed burn crew, the policy is one of suppression. The highly fragmented nature of the landscape also reduces the likelihood that a fire will spread from one place to another.

Given the dearth of historical fire regime information, and the realities of today's landscape, determining when, where, and how often we should burn will continue to elude land managers as long as we try to base our responses on past fire regimes. Mitigating an almost-certainly altered fire regime instead requires first that desired ecological outcomes be defined – both at the site and landscape-level (e.g., reverse brush encroachment, minimize smooth brome dominance, reduce litter layer, and increase structural diversity). Burn plans are then written to achieve these goals, and follow-up monitoring determines whether our approaches must be adapted based on whether our objectives were achieved.

10.1.6 Water Withdrawals

For freshwater and wetland targets – species, natural communities, and systems – incompatible water management in the form of groundwater withdrawals and dam operations are significant threats. Although there is no question that water use and management are necessary to support human populations and activities throughout the region, a thorough examination of current and future demands can reveal new strategies or configurations that might be more compatible with sustaining biodiversity.

10.2 Terrestrial, Grassland Bird, and Waterfowl Threat Assessment

Whatever the underlying factors, conversion to agricultural land is a major threat to grasslands and wetlands throughout the region. We conducted an analysis of cropping capability[4] for the

[4] We used SSURGO's general Land Capability Classification, which rates the potential of the soil to be cropped. See http://soils.usda.gov/technical/handbook/contents/part622.html for a list of the classes and their definitions.

soil information obtained through SSURGO. The vulnerability of each portfolio site to land conversion was assessed through this lens. We matched our assessment methods to those conducted for the Northern Great Plains Steppe Ecoregion directly to the west (B. Martin, Pers. Comm., 2009):

- Land capability classes 1-3: High potential for conversion
- Land capability classes 4 and 5: Medium potential for conversion
- Land capability class 6: Low potential for conversion
- Land capability classes 7 and 8: No potential for conversion

Class 6 is generally poorly suited to agriculture, but if it can be irrigated, it can become class 2 in some instances. Class 5 is regularly converted to agricultural use, at least in Montana. For context, Class 3 and higher are considered highly erodible. Technically, to farm these classes a soil conservation plan must be filed with the Natural Resources Conservation Service per the Sodbuster Provision of the 1985 Farm Bill. However, enforcement of this provision is difficult. (B. Martin, Pers. Comm., 2009).

10.3 Freshwater Threat Assessment

The freshwater threats assessment was designed to identify the suite of factors affecting expert-identified target occurrences and the relative magnitude of these stressors. At the freshwater experts meetings, attendees listed the top three threats to the integrity of target occurrences. Threat assessment data were used to inform the portfolio selection process and identify potential conservation strategies for portfolio sites. In addition, the frequency with which experts identified several stresses as significant threats for freshwater targets is summarized in Table 11.3.1. However, this assessment was conducted prior to the recognition of alternative energy development and climate change as major sources of stress.

Table 10.3.1 Threat categories and frequency of occurrence at 38 expert-identified locations of freshwater target occurrences (2002)*

Threat	Code	Frequency
Incompatible Agriculture and Forestry	A	**0.45**
Crop production practices	A1	**0.16**
Livestock production practices	A2	0.11
Grazing practices	A3	**0.26**
Forestry practices	A4	0
Other	A5	0
Incompatible Land Development	B	0
Primary home development	B1	0.03
Secondary home/resort development	B2	0.00
Commercial/industrial development	B3	0
Road/utility development	B4	0.03
Conversion to agriculture or silviculture	B5	0.03
Other	B6	0.03
Incompatible Water Management	C	0
Dam construction	C1	0
Construction of ditches, dikes, drainage or diversion systems	C2	0.05
Channelization of rivers or streams	C3	0.11
Operation of dams or reservoirs	C4	**0.29**
Operation of drainage or diversion systems	C5	0.03
Excessive groundwater withdrawal	C6	**0.32**
Bank stabilization	C7	0.03
Large woody debris removal	C8	0.03
Other	C9	0.03
Point Source Pollution	D	0
Industrial facility discharge	D1	0
Wastewater treatment plant discharge	D2	0
Landfill	D3	0
Other	D4	0
Resource Extraction	E	0
Mining	E1	0
Oil or gas drilling	E2	0
Commercial harvesting	E3	0
Poaching or collecting	E4	0
Other	E5	0
Incompatible Recreation	F	0
Recreational vehicles	F1	0
Overfishing, collecting or hunting	F2	0
Other	F3	0
Land/Resource Management	G	0
Fire suppression	G1	0

Threat	Code	Frequency
Incompatible management of/for select species	G2	0.03
Other	G3	0
Biological	H	0
Parasites/Pathogens	H1	0
Invasive/Alien species	H2	0.45

*Frequency values represent the percent of sites in which a threat was listed among the top three threats facing the targets at that site. All values greater than 0.15 appear in bold lettering. *Note omission of alternative energy development and climate change as major threats given the date this summary was conducted.*

11 ECOREGIONAL PORTFOLIO

Given the nature of the available data, the conservation targets, and the conservation goals, the assessment team developed four ecoregional portfolios: a terrestrial portfolio based on the early untilled landscapes, a grassland bird portfolio based on the GBCA model, a waterfowl portfolio based on the waterfowl breeding pair model, and a freshwater portfolio based on the Aquatic Ecological Systems. The methods for assembling and prioritizing each of these four individual portfolios are described below, followed by a description of the methods for integrating all four sets of conservation areas and prioritizing the integrated portfolio.

11.1 Terrestrial Areas of Biodiversity Significance

11.1.1 Terrestrial Portfolio Assembly

Given the degree of alteration of the DMGP ecoregion and the comprehensive mapping of all remaining untilled areas throughout the ecoregion, it was appropriate to treat the untilled landscapes as a preliminary terrestrial portfolio that would be evaluated to determine how well it met the conservation goals of the ecoregional targets. Heritage element occurrence records were intersected (in a GIS) with the conservation areas to determine which plant community and species targets had been documented in each landscape. The REA-based records of plant communities and ecological systems in conservation areas were compiled in a tabular database. A listing of all the known terrestrial ecological systems, plant communities, and species targets (both avian and non-avian) documented in each untilled landscape is included in the conservation area summaries (Appendix 8). Ideally, the viable occurrences of these targets within the conservation areas would be counted within each stratification unit to determine how well each conservation area met the conservation goal for each target; conservation areas that were not necessary to meet one or more conservation goals could be eliminated. (Given the highly altered nature of the DMGP ecoregion, it is likely that very few, if any, landscapes would have been dropped from the portfolio.)

Due to the limitations of the conservation goals, the assessment team instead simply summarized the presence of all target occurrences within all conservation areas. The conservation areas were refined into a final portfolio based on more general biological considerations than specific conservation goals. Although nearly every landscape is impacted by some degree of grazing and invasive species, every landscape also contained at least one minimally viable ecological system or plant community. Lacking appropriate conservation goals aside from 10% of the area for ecological systems and given the nearly complete conversion of the ecoregion to row crop agriculture or other non-native vegetation, all landscapes were retained as conservation areas for the terrestrial ecoregional portfolio except for Lebanon Hills and Burkmere Prairie Potholes. Those areas are located almost entirely outside of the ecoregion.

A map of terrestrial conservation areas (Figure 11.1.1) displays 52 areas, ranging in size from 2,614 acres (1,080 ha) (New Germantown Prairies, North Dakota) to over 450,000 acres (185,950 ha) (Lower Brule and Crow Creek Reservations, South Dakota). The total area of all sites is approximately 4 million acres (1.5 million ha) or 15% of the ecoregion. Terrestrial conservation area descriptions, including lists of targets documented within each (as of 2008), are provided in Appendix 8.

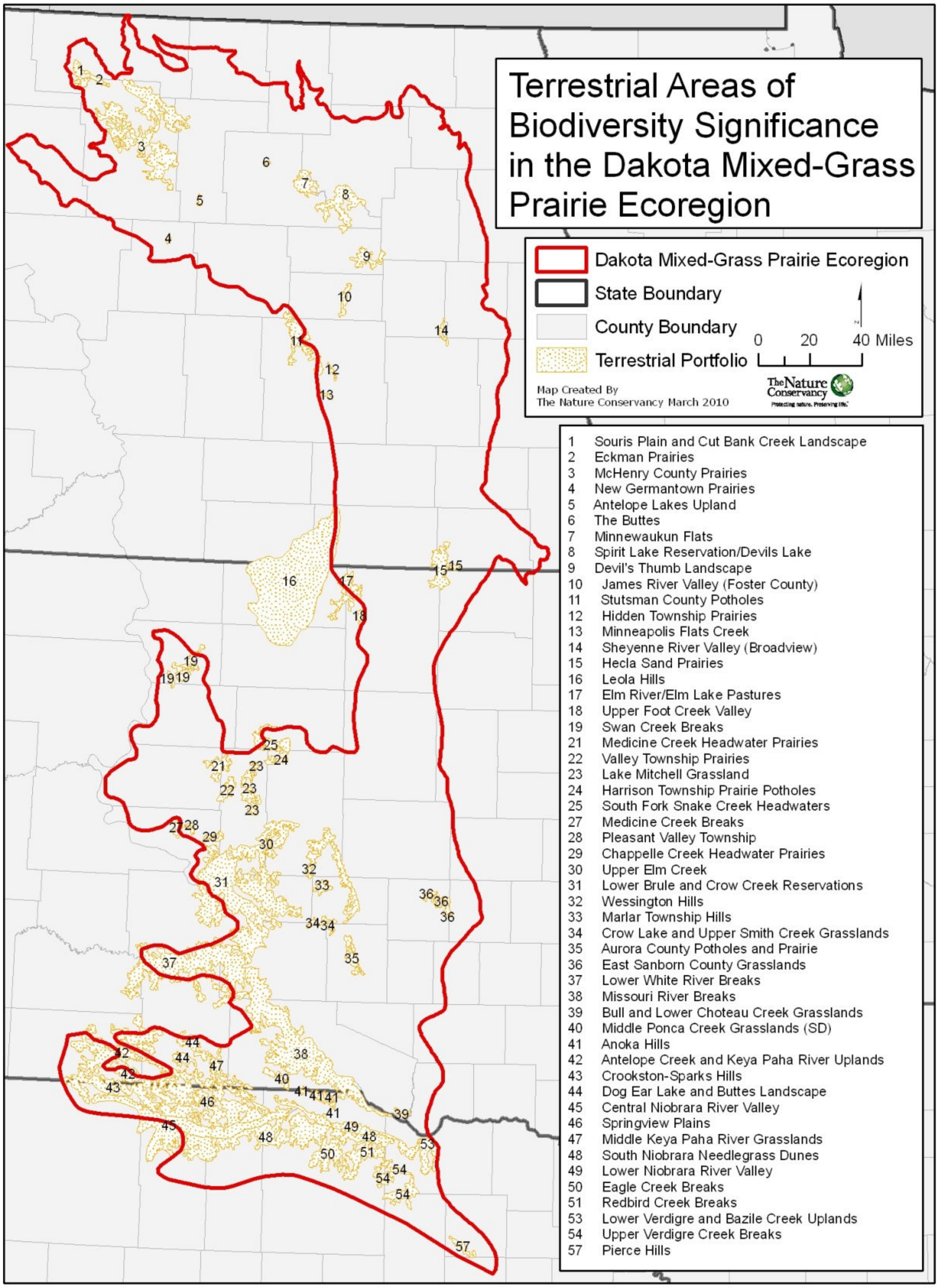

Figure 11.1.1 Terrestrial areas of biodiversity significance (conservation areas) in the Dakota Mixed-Grass Prairie ecoregion

11.1.2 Terrestrial Portfolio Prioritization

Our initial prioritization was based on the viability/quality rankings and related comments recorded by the biologists who conducted the REAs, in conjunction with the size of the landscape. Larger landscapes that were described as being in relatively better condition were higher priority. However, the descriptive information from the field surveys was variable in detail and quality and difficult to compare. Therefore, the 2001 National Land Cover Dataset (NLCD) was used to refine the prioritization.

The 2001 NLCD was used to calculate the number and percentage of area in each land cover class for each untilled conservation area. To prioritize the conservation areas, we considered the number of acres of natural cover present in each landscape in conjunction with the field survey information. Areas with more area of natural cover were generally ranked higher. Where field survey comments indicated, the rank suggested by the acres of natural cover was adjusted up or down. Rather than an ecoregion-wide prioritization, the rankings were assigned *within each stratification unit* to ensure adequate representation of conservation targets across the ecoregion (Figure 11.1.2). For example, all conservation areas in section 332A (the northern stratification unit) were only compared to each other, not to conservation areas in sections 332B or 332D. Note that if we had not prioritized within each stratification unit, all high priority landscapes would have been concentrated in a relatively small area in the southern and western part of the ecoregion.

Table 12.1.1 lists the original cutoffs for each priority rank (very high, high, medium, and low) within each stratification unit. The cutoffs for each priority ranking were manually determined within each stratification unit. They were initially set so that there would be a small number of very high, high and medium priority landscapes in each stratification unit, and so that the numbers of landscapes in each priority class would be roughly similar across stratification units.

Table 11.1.1 Thresholds for each priority rank within each stratification unit

Section 332A thresholds	**Section 332B thresholds**	**Section 332D thresholds**	
Acres in natural cover	**Acres in natural cover**	**Acres in natural cover**	**Priority class**
>50,000	>90,000	>300,000	Very High
20,000 – 50,000	25,000 – 90,000	100,000 – 300,000	High
10,000 – 20,000	9,400 – 25,000	20,000 – 100,000	Medium
<10,000	<9,400	<20,000	Low

In section 332B, the rankings were adjusted more to account for quality differences recorded by the field surveyor in 2001 and as a result, they are not fully consistent with the thresholds listed in the table above. For example, Swan Creek Breaks was noted as being of "rather good quality" and therefore was moved into the Very High category. Similarly, Hecla Sand Prairies was noted to be particularly poor in quality and consequently was assigned a lower priority than indicated by its area in natural cover. Priorities were later revised based on overlap with freshwater, grassland bird, and waterfowl portfolio areas.

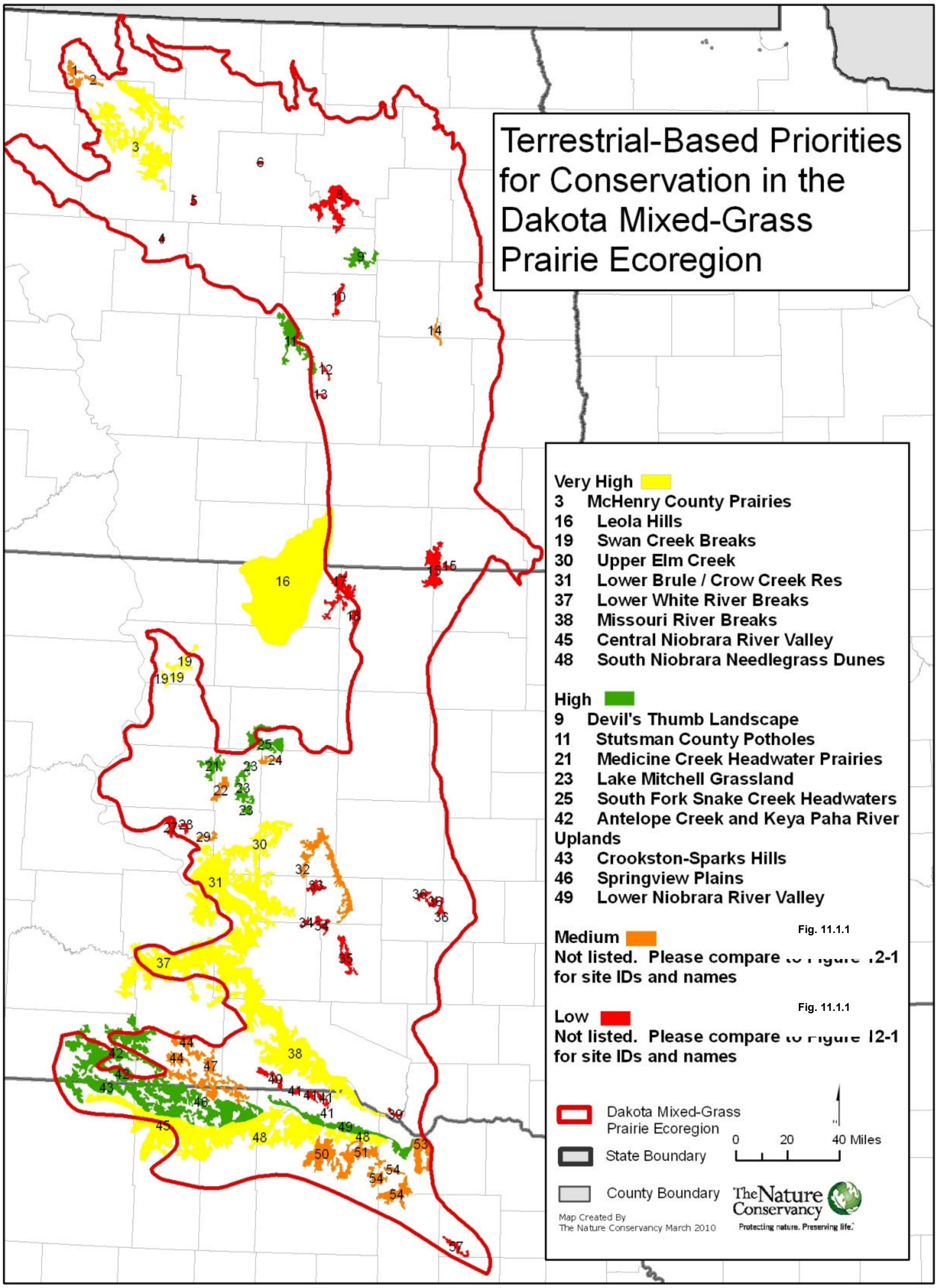

Figure 11.1.2 Terrestrial-based priorities for conservation in the Dakota Mixed-Grass Prairie ecoregion

While the absolute acreages of the Very High and High priority areas suggest a certain priority rank order, all of these areas are important for conservation, and programmatic considerations (e.g., potential for partnerships, community interest/support, funding availability) will determine which high priority areas receive conservation resources. Therefore, a numeric priority rank was not listed. However, in reviewing all of these areas, it was clear that some Medium and Low-ranked areas were of lower quality than other Medium and Low-ranked areas. The team wanted to ensure these differences in quality were documented in the numeric rank ordering. In the event that resources were to become available to address these lower-priority sites, it would be preferable from a biodiversity perspective to address the higher-ranked Medium- and Low-priority areas before the lower-ranked Medium- and Low-priority areas.

The degree of threat of land conversion in each untilled landscape was the final consideration for prioritizing the terrestrial conservation areas. For each untilled landscape and cropping capability class, we reviewed the number of acres in classes 1-6 in DMGP. For the most part, the conversion potential did not change priorities. In 332A, areas with higher potential for cropping are already high priority for conservation on the basis of natural cover. Similarly, areas with low cropping potential are low priorities for conservation. In 332B, the cropping capability trend *broadly* parallels conservation priority trends, with some exceptions. For example, in one case for which cropping potential was very high, the site was a low priority based on other criteria, so the cropping Class did not elevate its priority (East Sanborn County Grassland). The relationship between conservation priority and cropping potential was variable in the southernmost stratification unit (332D). However, the risk of land conversion was generally not high enough to raise the conservation priority of already high or medium priority landscapes, nor low enough to lower the priority of such landscapes.

11.2 Avian Areas of Biodiversity Significance

11.2.1 Avian Portfolio Assembly

HAPET Type 1 GBCAs were manually clustered based on the surrounding Type 2 cores. The clustering was documented in GIS and the resulting clustered Type 1 GBCA polygons serve as the grassland bird ecoregional portfolio (Figure 11.2.1).

Similarly, the waterfowl breeding pair polygons were manually clustered. In the southern part of the ecoregion (stratification units 332B and 332D), areas predicted to support >100 breeding pairs were considered areas of waterfowl biodiversity significance. In the northern stratification unit (332A), areas predicted to support 60 or more breeding pairs were selected as conservation areas for waterfowl.

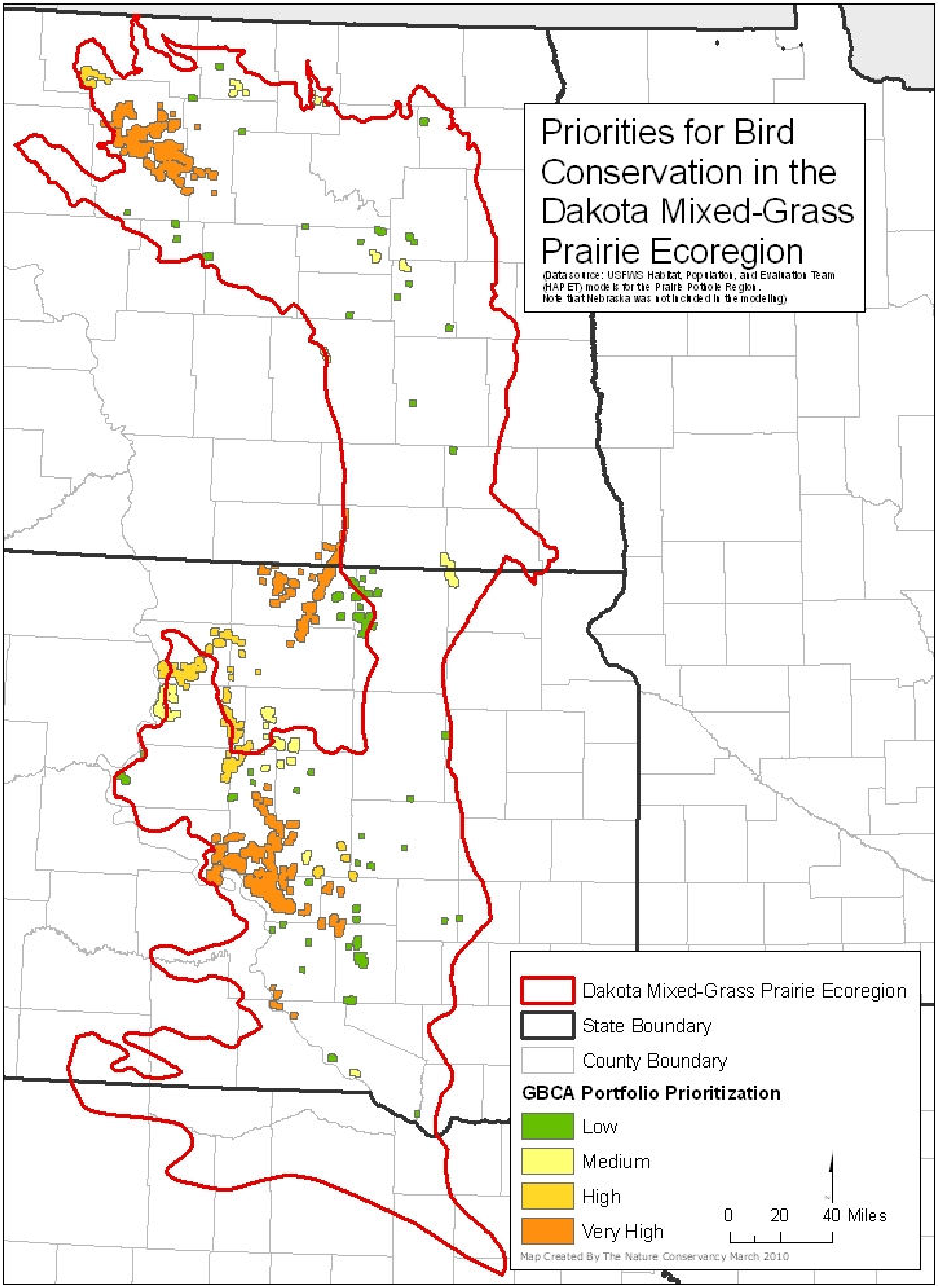

Figure 11.2.1 Priorities for grassland bird conservation in the Dakota Mixed-Grass Prairie ecoregion

11.2.2 Avian Portfolio Prioritization

The 2001 NLCD was used to calculate the number and percentage of area in each land cover class for each grassland bird conservation area. For GBCAs, we considered the total area of *native* grass cover present in each landscape; places with more area in native grass were ranked higher. As with the terrestrial portfolio, rankings were assigned *within each stratification unit*, to ensure adequate representation of grassland bird habitat across the ecoregion (Figure 11.2.1). For example, all GBCAs in section 332A (the northern stratification unit) were only compared to each other, not to GBCAs in sections 332B or 332D.

Table 12.2.1 lists the cutoffs for each priority rank (very high, high, medium, low) within each stratification unit. The cutoffs for each priority ranking were manually determined within each stratification unit. They were set so that there would be a small number of very high, high and medium priority GBCAs in each stratification unit, and so that the numbers of GBCAs in each priority class would be roughly similar across stratification units.

Table 11.2.1 Thresholds for each priority rank within each stratification unit

Section 332A thresholds	**Section 332B thresholds**	**Section 332D thresholds**	
Acres in native grass	**Acres in native grass**	**Acres in native grass**	**Priority class**
>25,000	>150,000	>10,000	Very High
10,000 – 25,000	75,000 – 150,000	9,000 – 10,000	High
5,000 – 10,000	15,000 – 75,000	5,000 – 9,000	Medium
<5,000	<15,000	<5,000	Low

Priorities were later revised based on overlap with terrestrial or freshwater portfolio sites; if a GBCA had substantial overlap with an important terrestrial or freshwater portfolio site, its priority rank may have been increased accordingly

11.3 River and Stream Areas of Biodiversity Significance

11.3.1 Freshwater Portfolio Assembly

The process of selecting rivers and streams for inclusion in the DMGP conservation portfolio paralleled that of terrestrial portfolio assembly process: we selected coarse and fine filter targets, established conservation goals, and then assembled a network of rivers, streams and watersheds that most efficiently and effectively met our conservation goals.

For the major basins (middle Missouri and Red Rivers) intersecting the ecoregion, the river/stream conservation portfolio was assembled using AESs as the basic building blocks of the map. This work took place in 2002. In 2006, the terrestrial ecoregion boundary was revised to include a significant portion of the Souris River basin, creating a substantial data gap in the existing stream/river portfolio for this ecoregion. The preliminary filling of this gap is described later in this section.

Prior to beginning the selection process for the major basins, we created a database that included available information about target occurrences, threats and viability for each AES. Each AES was attributed with the following data:

- species and assemblage target types found within the system;
- AES type code;
- landscape quality metrics, including percent natural cover, percent non-natural cover, percent urban/road cover, average stream sinuosity, density of dams, density of point source polluters.

In addition, where an AES encompassed a location at which experts provided detailed information about target occurrences (Figure 11.3.1) the AES was attributed with two additional pieces of information:

- expert ranking of the relative viability of the target occurrences;
- expert identification of the threats to the targets.

Based on the data compiled, each AES was assigned a portfolio category using the criteria outlined in Table 12.3.1. Portfolio categories A, B and C denote systems which house the best examples of species and assemblage target occurrences. Portfolio categories D through F denote AESs that serve as the highest-quality examples of system targets. Systems that could be assigned to multiple portfolio categories were given the lower alphabetical letter. For example, one AES might house a high-quality occurrence of target species X (therefore earning a rating of portfolio category A), and also have been identified as a high-quality example of system type y (portfolio category D). The AES would be assigned the portfolio category of A.

After assigning each AES to a portfolio network category, our next step was to assemble a DMGP portfolio network that met our conservation goals by selecting a group of AESs from among the systems assigned to portfolio categories A through G. Usually, this is an iterative process, in which we progressively add systems to the network based on their conservation value, and periodically assess our progress toward achieving our conservation goals. However, we quickly learned that our conservation goals could not be met using only a subset of the systems identified in priority categories A through G. Because there were so few high quality examples of species, assemblage and system target occurrences in the DMGP, it was necessary to include *all* systems that fell into portfolio categories A through G in our portfolio network.

In 2008, a series of stream reaches and small watersheds were added to represent freshwater biodiversity in the Souris watershed, which constitutes only a very small part of the ecoregion. These stream reaches and small watersheds were added on the basis of their representation of various aquatic habitats, overlap with terrestrial portfolio sites, and relatively high proportion of intact terrestrial habitat present within them. Biologists with the USFWS, ND Game and Fish, and ND Department of Health who are familiar with the Souris mainstem reviewed and refined these selections, making a few additions on the Souris River mainstem. These data were not included as part of the original GIS and statistical analysis, and are therefore not enumerated in the tables that follow.

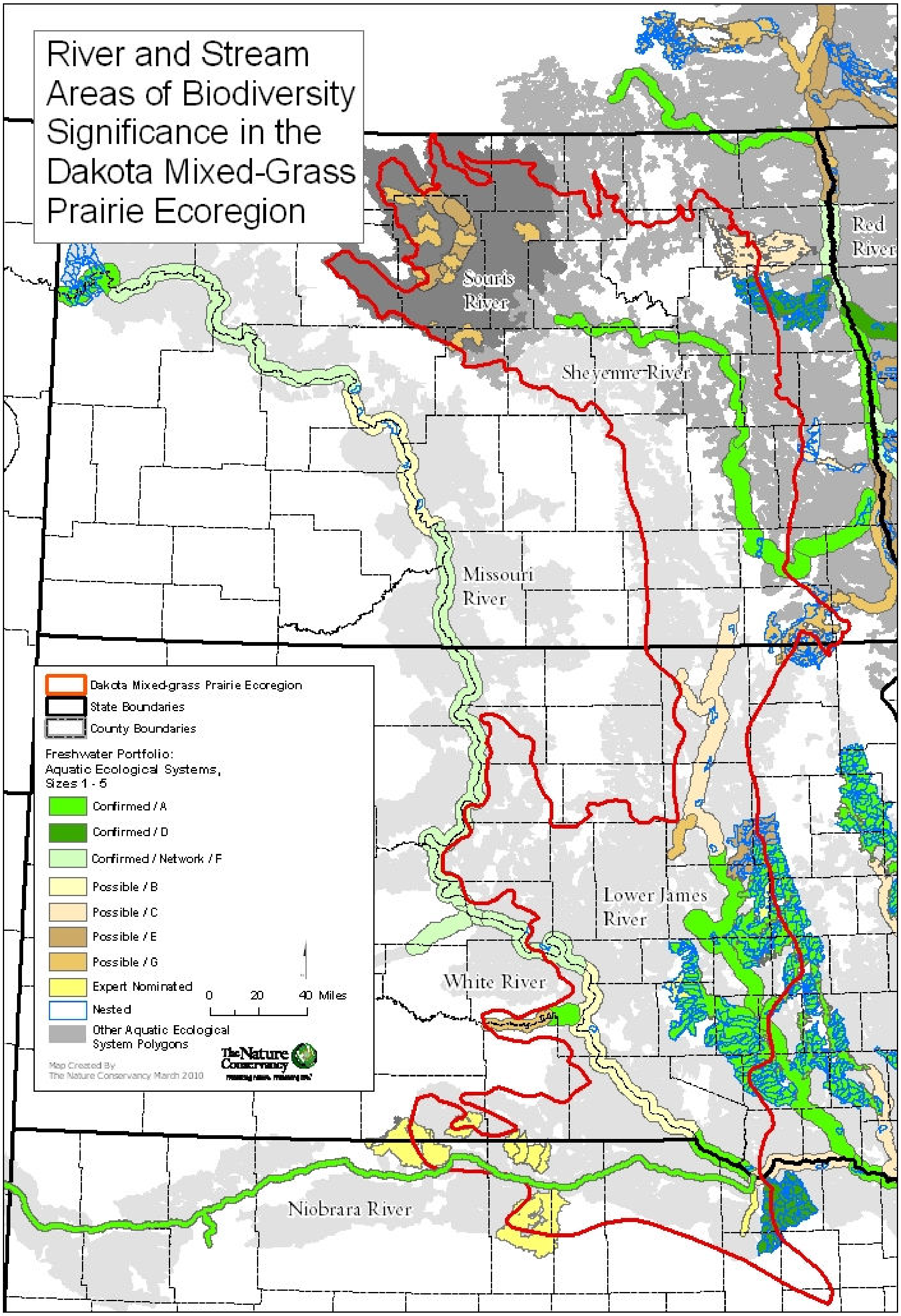

Figure 11.3.1 River and stream areas of biodiversity significance in the Dakota Mixed-Grass Prairie Ecoregion

After assembling the portfolio network, systems were assigned to one of two Area of Biodiversity Significance (ABS) classes based on their portfolio category (Figure 11.3.1). *Confirmed ABSs* (ABSs assigned portfolio categories A, D and F) are those AESs that encompass the most viable occurrences of targets in the ecoregion and represent the most important places for conservation and protection of targets. They also provide connectivity and movement corridors between and among ABSs (including terrestrial and aquatic ABSs). Confirmed ABSs form the core elements of the full network of systems included in the NTPE river/stream conservation portfolio. Confirmed ABSs were primarily those nominated by experts and identified as having the highest quality occurrences of target elements.

The remaining portfolio areas are considered *possible ABSs* (portfolio categories B,C,E and G), and include systems that provide a variety of functions in the conservation network and serve multiple conservation goals, including supporting lower quality target occurrences, or representing unique system types and restoration opportunities.

The criteria and methods used to assemble the portfolio network were developed through review and discussion at the expert meetings. They were designed to promote achievement of the conservation goals using the most efficient and viable arrangement of AESs.

Table 11.3.1 Portfolio network categories and ABS classes for the DMGP*

Portfolio Network Category and ABS Cass	**Description**	**Source of information for rating**	**Selection Details**
A (confirmed ABS)	Systems with very high and high quality occurrences of target species/assemblages	Expert opinion and/or biotic indicators	systems containing target occurrences that were expert-rated as "Good" or "Very Good" for any of the three target viability metrics
B (possible ABS)	Systems with fair to poor quality occurrences of target species/assemblages	Expert opinion and/or biotic indicators	systems containing target occurrences that were expert-rated as "Fair" or "Poor" for any of the three target viability metrics
C (possible ABS)	Systems with high frequency but unknown quality of target species/assemblage occurrences	Post-1995 Survey data and expert opinion	systems with the highest number of target occurrences in any of these categories: all mussel targets, all fish targets, all herpetofauna targets, all invertebrate targets, all assemblage targets and all species and assemblage targets combined; or expert-nominated systems with target species occurrence data but no quality information attributed to the target occurrences
D (confirmed ABS)	Very good and good quality examples of AES types	Expert opinion	expert-nominated systems with "very good" or "good" site viability ratings
E (possible ABS)	Fair, poor and unrated quality examples of river/stream system types	Expert opinion	expert-nominated systems with "fair," "poor," or "unknown/unrated" site viability ratings
F (confirmed ABS)	Systems that connect aquatic ABSs	GIS Analysis	systems that provide movement corridors connecting confirmed ABSs
G (possible ABS)	Systems belonging to AES types that are unrepresented in portfolio categories A through F but have high landscape quality indicators	GIS analysis/ landscape quality metric	systems that represent unique types that were not captured in previous categories but have a high proportion of natural cover for their system type
X	All other systems		Systems that did not meet any of the above criteria

*Each AES was assigned to one category, and the portfolio network was assembled by selecting AESs from each category until the conservation goals were met.

Details about the areas of biological significance selected for inclusion in the portfolio network are provided in Appendix 1, Table A1.3.

11.3.2 Setting Priorities for Freshwater Portfolio

After the stream and river portfolio was updated to include the Souris River watershed, we developed an integrated approach to assigning priorities for freshwater conservation. First, we identified the major likely freshwater priorities, both regional and ecoregional, in approximate order of importance.

The likely priorities were developed based on both biological and logistical considerations. First, we examined the quality and status of recorded in the original freshwater assessment, which attempted to select a suite of systems that capture and link the most viable occurrences of target species, assemblages, and AES types in the DMGP. We further considered whether the Conservancy is active in terrestrial areas nearby, and degree of overlap with terrestrial priority areas. Note that after the additional exploration of the Souris River watershed, the team opted to exclude the Souris since only a small portion of a much larger river system overlapped the ecoregion.

The following proposed freshwater priorities were finalized in 2009 and appear in an ordered estimation of what is most important based on condition, level of biological diversity, and degree of overlap with the terrestrial portfolio (Figure 11.3.2):

- **Ecoregional** priorities (Figure 11.3.2):
    1. **Niobrara River**: Importance and quality for freshwater makes this a top priority regardless of any relationship to terrestrial landscapes, and its overlap with equally important terrestrial biota makes it even more important.
    2. **Sheyenne River**: Importance and quality for freshwater makes this a top priority regardless of any relationship to terrestrial landscapes, the small terrestrial area that overlaps the Sheyenne does not affect the Sheyenne's relative priority.
    3. **Lower James River Valley** (or Basin): This includes the Firesteel basin and tributaries on the western side of the Prairie Coteau, included on the basis of condition as assessed in the freshwater planning effort.
- **Regional** top priorities (Figure 11.3.2):
    1. **Middle Missouri River**: Although it only overlaps the ecoregion from Lake Sharpe in South Dakota downstream to just above Lewis and Clark Lake, which lies well above the James River's confluence with the Missouri River, it has already been identified as a priority for the Conservancy as a whole. The Conservancy has committed significant resources to biodiversity conservation in this major ecosystem.
    2. **White River** will be a top priority for the **NGPS** ecoregion. Only its lower-most reach is in the DMGP and therefore regional because it covers two terrestrial ecoregions.

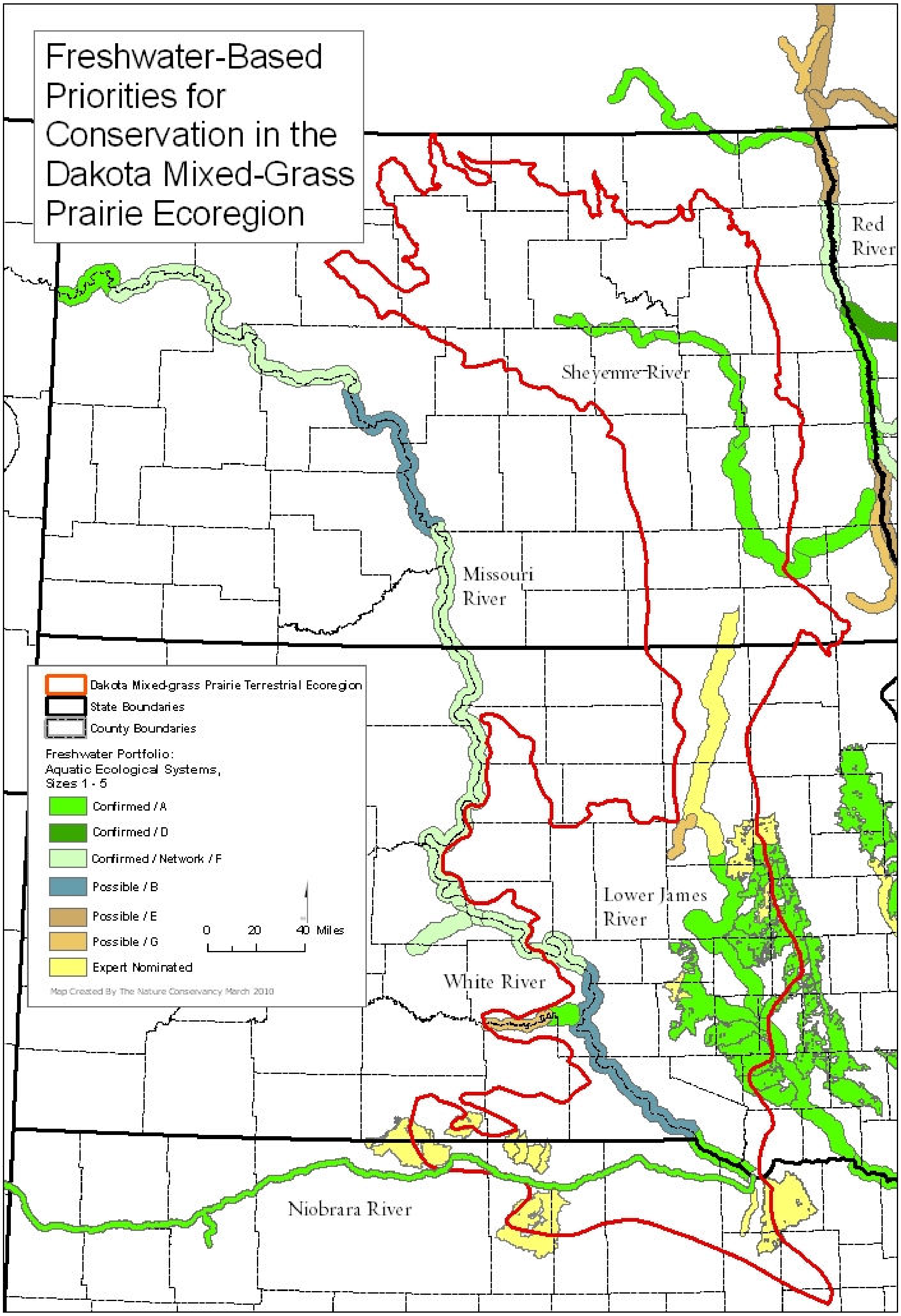

Figure 11.3.2 Freshwater-based priorities for conservation in the Dakota Mixed-Grass Prairie ecoregion

11.4 Integrating Terrestrial, Avian and Freshwater Areas of Biodiversity Significance

Integration of the terrestrial, avian, and freshwater portfolios involved an iterative process of reviewing spatial relationships (degree of overlap) among all four portfolios (terrestrial, freshwater, grassland bird, and waterfowl). These areas were each reviewed individually, rather than using GIS to do a spatial merge of the four portfolios. We considered the terrestrial and freshwater portfolios to be "primary," along with piping plover nesting sites. Grassland bird areas were considered to be a secondary portfolio, with waterfowl areas following as a tertiary portfolio. A complicated map resulted from this exercise (Figure 11.5.1), and we quickly decided that further prioritization was needed. We identified the subset of high priority terrestrial and freshwater landscapes having substantial overlap. These areas are displayed in Figure 11.5.2 and represent the highest priority for investing new or additional conservation resources.

11.5 Prioritizing Areas of Biodiversity Significance

Two major landscapes have a high degree of overlap between terrestrial and freshwater portfolio areas, as well as some overlap with grassland bird and waterfowl areas (Figure 11.5.2):

1. **Niobrara** (terrestrial, freshwater, GBCA) (includes Central Niobrara River Valley, South Niobrara Needlegrass Dunes, Lower Niobrara River Valley)
2. **McHenry County Prairies / Souris River complex** (terrestrial, freshwater, GBCA, waterfowl)

These two landscapes are among the very highest conservation priorities in the entire ecoregion.

Other high-priority areas had varying and somewhat lesser degrees of overlap; in some cases, they had no significant overlap, but were the highest priority in their portfolio and therefore are included here (Figure 11.5.2):

1. **Sheyenne River** (Very High freshwater, only tiny overlap with terrestrial and GBCA)
2. **Upper Elm Creek** (Very High terrestrial, significant GBCA overlap)
3. **Swan Creek Breaks** (Very High terrestrial, significant GBCA overlap)
4. complex of **Medicine Creek, Valley Township, Lake Mitchell, Harrison Township, and South Fork Snake Creek** (High and Medium, with very substantial overlap with both GBCAs and waterfowl)
5. **Lower James River** (little overlap other than waterfowl, but high priority for freshwater)

A relatively small proportion of the Missouri River ecosystem intersects with the DMGP ecoregion. However, it is a regional priority for the Conservancy, which has already committed substantial resources to its conservation. Although it goes well beyond this ecoregion, it is recognized here as a regional priority area. A series of terrestrial and grassland bird portfolio areas overlap with the freshwater reach that was included in the freshwater portfolio for this ecoregion:

1. **Missouri River** and overlapping terrestrial and grassland bird polygons (**Lower Brule** and **Crow Creek**, **Missouri River Breaks**)

See tables in Appendix 1 for short descriptions and characteristics of these freshwater conservation priorities.

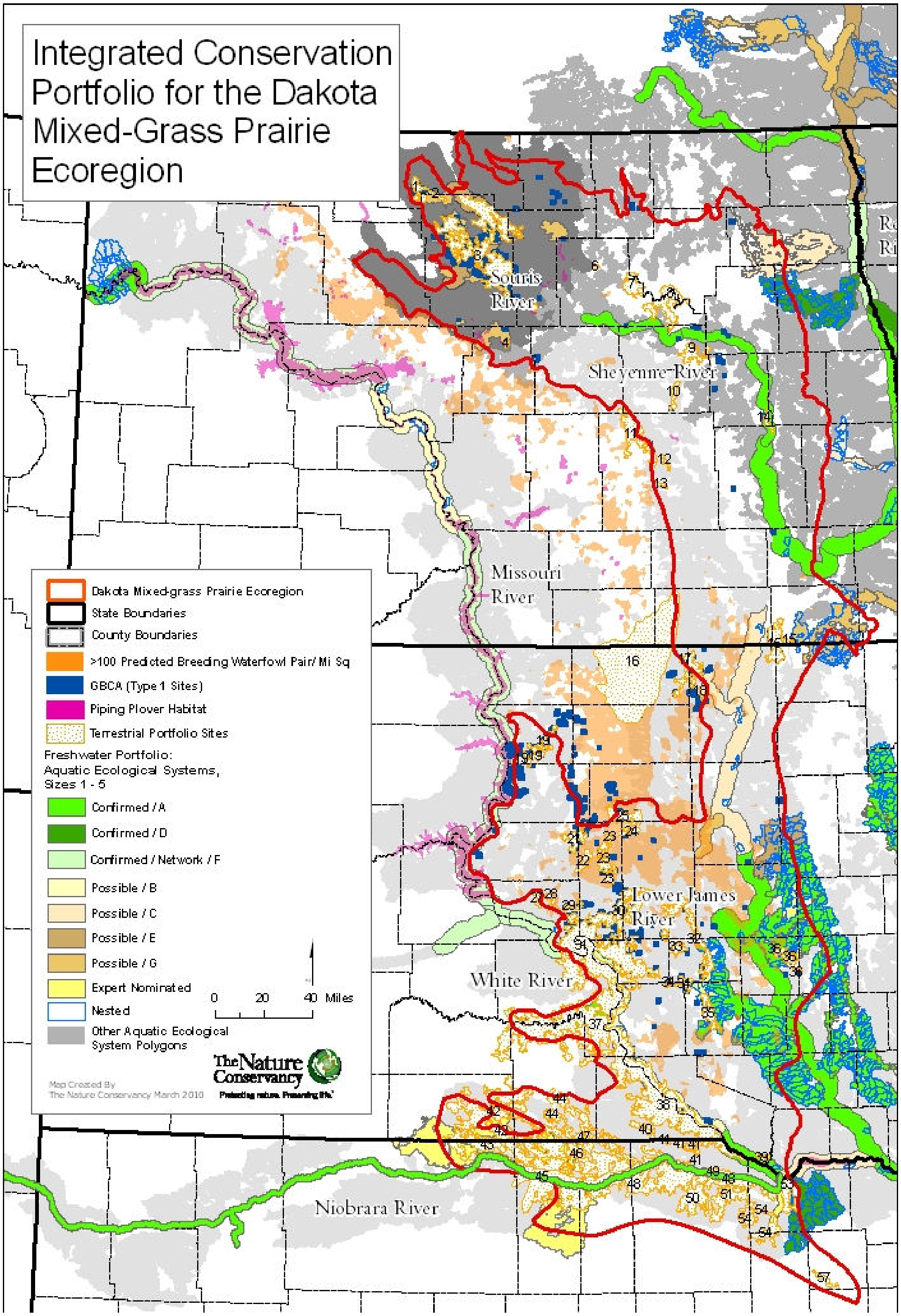

Figure 11.5.1 Integrated conservation portfolio for the Dakota Mixed-Grass Prairie ecoregion

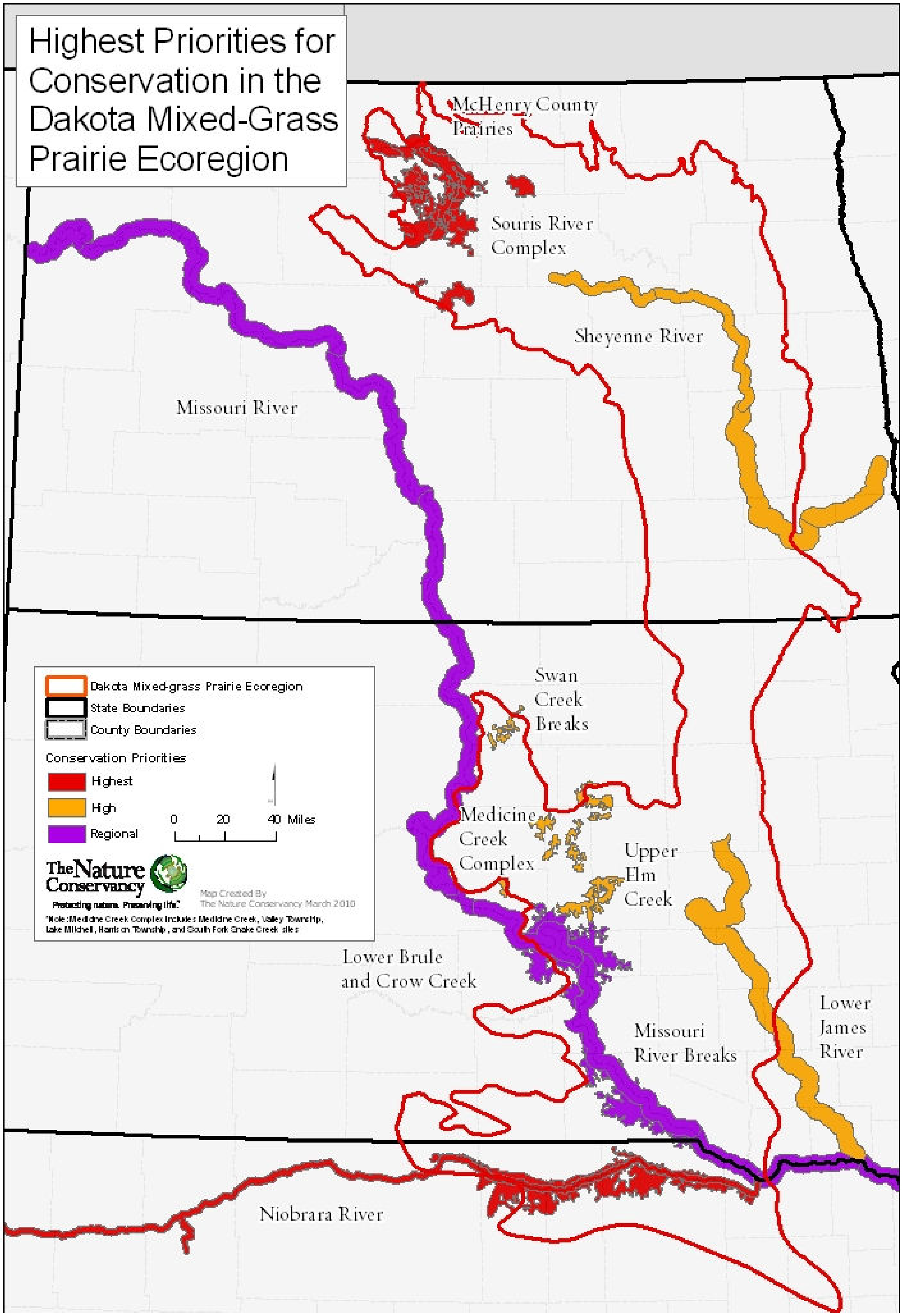

Figure 11.5.2 Highest priorities for conservation in the Dakota Mixed-Grass Prairie ecoregion

11.6 Progress toward Conservation Planning Goals

A critical element of an ecoregional assessment is the evaluation of how well the ecoregional portfolio meets the conservation goals of all the species and system targets. In the following paragraphs, we detail how we measured our progress toward and success in meeting our representation and redundancy goals for species, assemblages, and systems.

11.6.1 Terrestrial

Overall, the portfolio of conservation sites was successful in capturing at least one example of each target for 75% of targets. Whether the portfolio succeeded in meeting conservation goals was difficult to assess. For birds, other animals, and plants we refrained from setting numeric goals at all due to data limitations. For plant communities, only a handful met the goal of occurring in all three ecological sections. In the case of terrestrial communities, only one matrix-forming community was identified and served as a proxy for the other system types assumed to be associated with it. Because roughly 15% of the ecoregion was captured by the portfolio in its terrestrial portfolio, a provisional 100% was assigned to this category given that the goal was 10% of the original area. Table 12.6.1 provides a summary of each category of conservation target and details the success of the portfolio in capturing viable examples of the targets.

Table 11.6.1 Measuring success of conservation areas in capturing viable examples of targets

	total number of targets	at least one example in ecoregion	percent	number targets meet or exceed goal	percent
TERRESTRIAL SYSTEMS	14	14	100%	14	100%
COMMUNITIES	82	48	59%	7	8%
BIRDS	14	14	100%	N/A	N/A
OTHER ANIMALS	8	7	88%	N/A	N/A
PLANTS	5	5	100%	N/A	N/A
TOTAL TARGETS	124	92	-		

Despite the best efforts of the planning team to gather occurrence information for the conservation targets, there is clearly an underestimation of the number of targets captured by the portfolio. Conservation area planning, future iterations of this regional plan, and research and surveys by other parties should gather additional information about these areas, hopefully gaining a better picture of the targets that occur within each of these areas. However, it was agreed that due to the level of fragmentation of this ecoregion, there is little hope of meeting all conservation goals without extensive restoration efforts.

11.6.2 Aquatic

As described in Section 8.5, among our primary goals was to include a minimum of one occurrence of each AES type in the portfolio network. Ninety-six unique AES types occur across the EDUs that constitute the DMGP. In the James River and Red River West EDUs, we captured at least one example of every AES type, and in some cases, multiple examples of each system type. However, in the Devils Lake, Middle Missouri, and Sand Hills EDUs, and Souris, we were unable to include representative examples of each AES type in the portfolio. Experts identified very few high quality systems in these EDUs, and our landscape-scale integrity assessment did not reveal any systems with high landscape quality metrics. We chose not to represent some system types in the portfolio network rather than select examples of these system types that were of very low or unknown quality.

By number, smaller systems (headwaters and creeks) make up the bulk of the portfolio network. But larger systems (large and big rivers)are proportionally better represented; almost all large and big river occurrences are included in the network by virtue of their role in providing connectivity and unique habitat for target species (Table 12.6.2).

Table 11.6.2 Aquatic Ecological System (AES) goals met by the portfolio network

AES Size Class	total number of AESs in all EDUs	total number of AES types in all EDUs	number of AESs captured in portfolio network	number of AES types captured in portfolio network	proportion of AESs captured in portfolio network	proportion of AES types captured in portfolio network
Headwater (Size 1)	3274	24	326	17	0.10	0.71
Creek (Size 2)	938	21	96	13	0.10	0.62
Small River (Size 3)	220	19	35	12	0.16	0.63
Medium River (Size 4)	38	13	22	11	0.58	0.85
Large River (Size 5)	19	19	17	18	0.89	0.95

In Section 10, we also described the goals established for representation and redundancy in target species and assemblages. During the DMGP experts meetings, participants established target species and assemblage conservation goals in terms of the minimum number of "occurrences" we aim to capture in the portfolio network (Appendix 1). Experts agreed that ideally these occurrences would be viable populations observed within the past five years and each occurrence would be located in separate drainages or watersheds within an EDU.

Assessing the degree to which we met our species conservation goals was challenging, given the limitations of our database. Despite more than 300 target location records, many species were unrepresented in our database, and only a limited number had records dating from the past ten years. Records of assemblage locations were even more rare or dated. And expert viability assessments were missing for the vast majority of target locations. To assess the number of target occurrences captured by our portfolio network, we needed to devise a more practical, measurable definition of a target occurrence.

For the purposes of providing a cursory assessment of our progress toward attaining the conservation goals, each system in which a target was observed since 1994 was considered a target occurrence. A target occurrence was counted as captured if the AES in which it resided was included in the portfolio network. An AES could only be counted once for each target; multiple records of a target within a system did not qualify as separate target occurrences even if the records were spatially or temporally distinct. Headwater (size 1) and creek basins (size 2) nested within small river systems (size 3) were not included in this analysis so as not to double-count target occurrences.

Admittedly, this approach was likely to capture and count many non-viable (or no longer existent) locations of targets. But because it grouped spatially and temporally distinct records within a system and recognized occurrences only at the system scale, we felt it would minimize overestimates of the number of occurrences captured, and thereby minimize overstatements of our progress toward achievement of our goals.

In total, conservation goals were met for 22 of the 51 (43%) DMGP freshwater target species and assemblages (Table 12.6.3; Appendix 2). Of 39 species and assemblages for which we had spatial occurrence records, 37 (95%) were represented at least once in the portfolio network. Targets not captured included taxa that have very limited occurrences or groups that are under sampled. Our ability to meet goals was most notably hampered by the limited amount of data for many mammals, mussels, crayfish and herpetofauna.

Table 11.6.3 Freshwater species and assemblage goals met by portfolio network

Target Type	Total number of targets	Percent of targets that met goal	Percent of targets for which at least one occurrence was captured in portfolio network	Percent of targets absent from database
crayfish	2	50%	50%	50%
fish	22	36%	77%	14%
fish assemblage	8	88%	100%	0%
herpetofauna	7	14%	43%	57%
invert assemblage	1	100%	100%	0%
mammal	2	50%	50%	50%
mussel	2	0%	50%	50%
mussel assemblage	5	40%	80%	20%
turtle assemblage	2	50%	50%	50%

12 STRATEGIES AND NEXT STEPS

Successful implementation of this plan will hinge on the ability of the Conservancy and partners to develop specific strategies to abate existing and future threats to the biological diversity of the region. Depending on the circumstances, strategies for tackling these threats may be area-specific and implemented within individual areas, or may be more regional in scope and require implementation at broader levels.

Threats to biological diversity occur at multiple scales and frequencies. Some threats may act over large geographic scales and others may occur at a local scale, yet be pervasive across a large number of conservation sites. In the former, site-specific threat abatement activities will not be successful and coordinated regional or national activities are therefore a necessity. In the latter, site-specific activities may be successful, but a regional approach may prove more efficient. Each of these is an example of multi-site strategies for the abatement of threats that might be effective.

One of the overriding messages that should be drawn from this conservation plan is that even if all of the proposed portfolio sites are conserved, we will still fall far short of meeting our conservation goals. Even with additional inventory in the region and follow-up conservation actions, we would only be likely to fully conserve about half of the ecological systems and native plant communities. This fact is of great concern to conservationists.

Given that most land in the region is privately held, truly effective conservation strategies must be designed with incentives for landowners in mind. Strategies that benefit both local economies and biological diversity will result in the greatest impact. From a biodiversity conservation perspective, most terrestrial ABSs require a moderate to very high degree of active management (improved grazing practices, prescribed fire, and invasive species control) in order to retain or attain adequate ecological integrity. Achieving conservation success at any one of the areas in this portfolio will require a high degree of commitment and additional resources by the Conservancy and/or other conservation-oriented entities. Ideally, private landowners could be encouraged to implement grazing and related land management practices that both meets their economic goals and enhances the native biodiversity. However, biofuels and generally growing demand for commodity crops may make it very difficult to balance biodiversity values with economic priorities. Further, land prices in the region are on the rise due to changes in the commodities market. Therefore, traditional land acquisition from willing landowners is an increasingly expensive and challenging strategy.

12.1 New Conservation Strategies Needed

The need for new conservation strategies is clear. Although conservation payment increases should be considered part of the overall strategy, this strategy would likely only address a fraction of anticipated habitat loss throughout the region. A higher-impact strategy might include using emerging markets for biomass to increase the proportion of income to farmers. This could be carried out by increasing the amount of perennial grassland either restored or maintained for wildlife values (Fargione *et al.* 2009). Considering as a backdrop the full array of ecosystem services generated by native and restored grasslands (e.g., water quality, carbon storage, biomass feed stocks), incentives can then be considered that may encourage producers to grow wildlife-friendly biomass for bioenergy (Fargione *et al*. 2009). Ensuring that short-term biomass yield and biodiversity values are balanced in this endeavor will be the grand challenge.

12.1.1 Large-scale Restoration

Restoration has the potential to improve the biological diversity of the region. For the purposes of this report, we have defined **restoration** as an enhancement of the viability of a conservation target by modifying its size, condition, or landscape context. Although some believe that restoration means simply "letting nature takes its course," the culture of the region suggests a more hands-on course of action. As such, we recommend a focus on proactive strategies designed to expand the functional size of native plant communities, reintroduce ecological processes, remove ecosystem threats, and/or link isolated landscape fragments together with native vegetation.

12.1.2 Grass Banking

Many additional strategies that sustain both biodiversity and local economies may be considered, although each state has its own laws related to land ownership issues such that approaches would need to be place-based and customized. For example, **grass banking** is already being implemented on a small scale (e.g., Leola Hills, Missouri Coteau). Scaling this practice up could greatly enhance sustainability. In this case, a public entity might purchase a property from willing sellers, restore it, and develop needed features (e.g., water sources, fencing) and a draft management plan. Lands could be open to hunting if cattle are removed in the fall. Such an approach would provide beginning ranchers a way to launch their enterprises even if they do not own their own grazing lands at first (Chaplin 2009).

12.1.3 Grazing Easements

Grazing easements could provide an additional opportunity, but again may be more appropriate in some situations than others. An entity might purchase a conservation easement for an agricultural property and cost-share grassland restoration on the site. The landowner could continue to manage and gain economic benefits from the property (e.g., grazing and haying), but a mutually agreed on sustainable management plan would be required. Lands would remain open to the landowner and/or lessees for hunting (Chaplin 2009).

12.1.4 Coordinated Land Management

Given the diverse private ownerships with interspersed public conservation lands, **coordinated land management** may be a beneficial approach for both conservation and economic reasons. As examples under this scenario, adjacent landowners within a landscape cooperate on setting overall landscape objectives and strive to manage for a diversity of forage heights, combine resources to accomplish prescribed burns, prevent the spread of a particular set of weeds, and/or give certain pastures the opportunity to rest every few years (Chaplin 2009).

12.1.5 Strategies for Freshwater Ecosystems

As a special note on aquatic ecosystems, the above strategies that address stresses derived from crop production activities and grazing practices would be among the most widely effective and important measures conservation organizations could employ in this ecoregion. Among the types of agriculture activities causing impairment to aquatic systems are: non-point source pollution (of sediments and agricultural nutrients and chemicals), water diversions and withdrawals, and filling and draining. Conservation activities such as riparian buffer enhancement, conservation easements, and producer education have proven to be effective tools in mitigating these problems. Many conservation organizations and county, state, provincial, and federal programs are actively addressing these resource concerns and pursing these strategies in the ecoregion.

For example, the Natural Resources Conservation Service in South Dakota, in partnership with local, state, and other federal agencies, provides technical and financial assistance for individual landowners to voluntarily conserve natural resources on privately owned agricultural land. Utilizing established conservation programs and practices, NRCS assists landowners to identify and address the soil, water, air, plant, animal, and human resource concerns associated with agriculture (Cindy Steele, pers. comm., 2002).

Also, it seems that conservation strategies aimed at mediating the effects of invasive/alien species are among the top strategies necessary to aquatic system integrity in this ecoregion. Again, multiple public agencies and private organizations within the ecoregion are already active in addressing these issues. The DMGP Ecoregional Assessment may provide some guidance on targeting specific areas to address some of these issues and consistency in applying these programs among counties or regions.

12.2 Next Steps

As a first step, **data gaps should be filled** and a detailed **assessment of the critical threats** facing each conservation area should be conducted to aid planners in the prioritization of conservation activity (i.e., conservation action plans). For example, data from other sources, such as the North American Breeding Bird Survey, might fill in some gaps for more common, but high priority, bird species. In addition, examining threats at the ecoregional scale can provide information about threats common across the entire planning area.

An evaluation should be conducted to determine how well **GBCA**s and **waterfowl areas** provide habitat for individual species identified as targets in this assessment. The assumption that conserving these areas will also conserve bird species of concern is central to the DMGP ecoregional assessment.

A part of this local planning and implementation, an effort must be made to anticipate the potential **impacts of climate change**. At the ecoregional level, and at the conservation area level, a thorough understanding of the range of possible outcomes for conservation targets in a climate-change era is critical for assessing how best to respond to climate change. Adaptation strategies for climate change will be essential to sustaining biodiversity throughout the DMGP.

As noted in Chapter 9 on assessing conservation goals, the DMGP would benefit from a concerted effort to **set numeric conservation goals**. Such an effort would itself entail many steps. First, review the current heritage EO data and determine if they are sufficiently comprehensive. If so, they can be used to assess how well the ecoregional portfolio represents terrestrial species and community targets and meets their conservation goals. The following assessments for those conservation targets with comprehensive EO data can then be conducted:

- Overlay the conservation areas with EOs of ***target*** species (either G1-G2 or G1-G3, plus any endemics or others identified as species targets)
- Count the number of target species EOs present in the conservation areas, ranked C or better, and observed since 1990. (Ideally include a second count that includes observations back to 1980.) Summarize the count totals for each target species, by stratification unit.
- List and count the total number of species with at least 3 occurrences documented within conservation areas in each of the three stratification units. In other words, determine which species and how many species met the generic conservation goals of three occurrences per stratification unit.
- For target species with unmet goals, count and tag additional EOs that are C-ranked or better, 1990 or more recent, and **outside** of the conservation areas.
- Repeat this assessment for all community EOs.
- Repeat this assessment for individual bird species targets, but instead compare to goals identified by experts (if available) in the bird experts workshop.

Finally, given the importance of prairie potholes in the DMGP, a follow-up analysis for assessing, reviewing, and prioritizing potholes is recommended. Such an analysis would allow consideration of potholes in hydrologically connected groups rather than isolated individual wetlands. We noted that adequate representation of potholes will likely require inclusion of potholes outside freshwater or untilled landscape portfolio polygons. In the current report, we used HAPET's waterfowl breeding polygons as a surrogate, but a more thorough analysis with more recent data is warranted. To conduct the more rigorous assessment, we recommend using the National Wetland Inventory to identify the full suite of polygons. Following this, Aquatic Ecological System (AES) polygons or 12-digit HUCs may be used to create ecological-hydrological groups. Priorities could then be set based on overlap with AES, surrounding matrix, overlap with terrestrial conservation areas, representation, and other considerations. Appendix 4 gives more detail on a suggested process for implementing this pothole analysis.

13 Data Products and Formats

This report and its appendices are available for download at http://conserveonline.org/workspaces/dmgp . In addition, a limited number of spatial data sets are available upon request. These include shapefiles for terrestrial conservation areas, aquatic conservation areas, and the highest priority conservation areas (integrated portfolios). To access the electronic data, please contact us through the above link, or call our office in Minneapolis (612-331-0750).

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