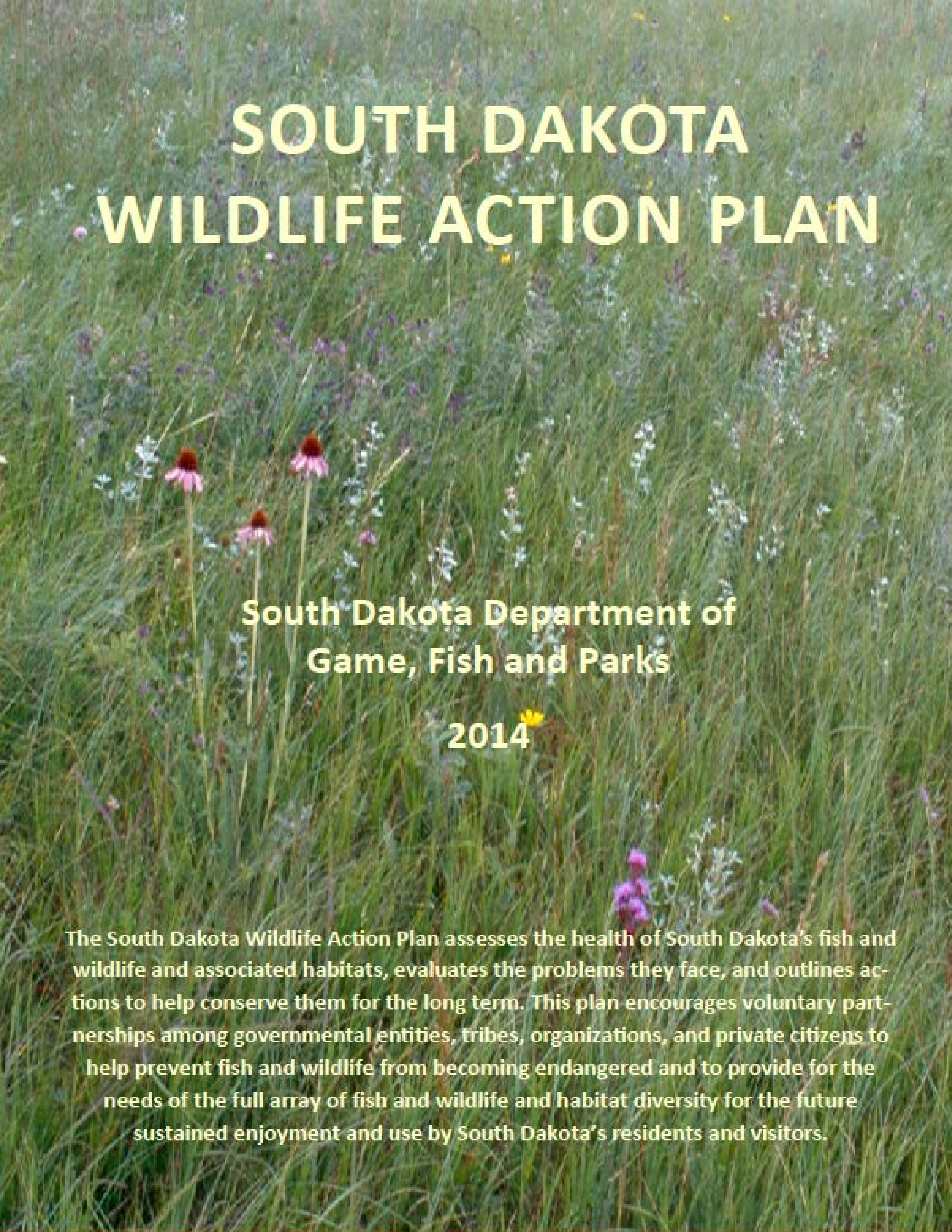

SOUTH DAKOTA WILDLIFE ACTION PLAN

South Dakota Department of Game, Fish and Parks

2014

The South Dakota Wildlife Action Plan assesses the health of South Dakota's fish and wildlife and associated habitats, evaluates the problems they face, and outlines actions to help conserve them for the long term. This plan encourages voluntary partnerships among governmental entities, tribes, organizations, and private citizens to help prevent fish and wildlife from becoming endangered and to provide for the needs of the full array of fish and wildlife and habitat diversity for the future sustained enjoyment and use by South Dakota's residents and visitors.

Formatting Note: This document is formatted to print on 8½ by 11 inch paper with the exception of some figures and tables that are sized 11 by 17 inches. The larger format is necessary to adequately illustrate detail on certain complex figures and to display comparison data for the 18 major land resources areas in South Dakota.

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EXECUTIVE SUMMARY

Background:

The South Dakota Wildlife Action Plan uses a science-based approach to assess the health of South Dakota's fish and wildlife and associated habitats, evaluate the problems they face, and outline actions to help conserve them for the long term. This plan encourages voluntary partnerships among governmental entities, tribes, organizations, and private citizens to help prevent fish and wildlife from becoming endangered and to provide for the needs of the full array of fish and wildlife and habitat diversity for the future sustained enjoyment and use by South Dakota's residents and visitors. The Plan provides a strategic framework to allow cooperators to identify and implement priorities at various scales, whether linked to habitats or fish and wildlife species.

The South Dakota Wildlife Action Plan was revised to maintain eligibility for certain federal funding sources and to make use of new information on species and habitats in South Dakota. The revision process presented an opportunity for a comprehensive evaluation of fish and wildlife and associated habitats. Because availability of data differs for different ecosystems, discussions in this plan are separately presented for aquatic ecosystems and terrestrial and riparian-wetland ecosystems. The emphasis of the described approach for terrestrial and riparian-wetland ecosystems is to encourage voluntary actions among conservation partners, agencies, tribes, and individuals to provide habitats that occurred prior to European settlement of South Dakota, with the expectation that this approach will accommodate the needs of the majority of species. The concept of using an historical reference is based on the fact that the array and distribution of ecosystems across South Dakota shaped and sustained the region's biological diversity and that most fish and wildlife species in South Dakota today resulted from historical ecosystems on the Great Plains. Aquatic species are proposed to be accommodated through conservation opportunity areas that consider known and expected species occurrences and other important facets of aquatic ecosystems.

Changes from 2006 Plan:

Significant changes in the revision include:

- new information on species and habitats incorporated;
- terrestrial ecosystem boundaries shifted to Major Land Resource Areas (MLRAs), a classification developed by the Natural Resources Conservation Service (NRCS) and consistent with the ecosystem-based approach of the plan;
- a separate ecological framework, adapted from the aquatic National Aquatic Gap Analysis Program of the Missouri River (MOGAP) project, used in the aquatic portion of the plan;
- climate change impacts considered;

- terrestrial and aquatic Conservation Opportunity Areas (COAs) proposed to encourage voluntary ecosystem restoration with an emphasis on the occurrence of species of greatest conservation need and intact native habitats;
- the most relevant information, particularly related to methodology, streamlined, with background information placed in appendices; and
- Web tools developed that use the plan's biological information as building blocks for broader uses and continued engagement of the public and conservation partners.

Species of greatest conservation need:

One-hundred and one animal species were identified as species of greatest conservation need to help assess the successful implementation of the plan. Criteria included species that are state or federal listed or under consideration for federal listing as threatened or endangered species; species for which South Dakota represents an important part of the remaining species' range; and a variety of characteristics that may make a species vulnerable.

Unless the information is irrelevant or unavailable, SGCN profiles include a distribution map based on the best available information, and descriptions of protection status, distribution, key habitat, conservation challenges, habitat and non-habitat conservation actions, relevant current monitoring programs, relevant State Wildlife Grant projects, research and monitoring priorities, and pertinent recovery or conservation plans. Three species previously listed as SGCN; the Bear Lodge jumping mouse, Blanding's turtle, and paddlefish; were not included on the revised list. Additional species were selected based on input and justification from species and taxa experts.

This section includes a discussion of conservation goals for SGCN and two examples (case studies) to assist the reader in understanding where to find information about each SGCN within the Plan.

Planning approach for terrestrial and riparian-wetland habitats:

The overall planning approach is a coarse filter/fine filter strategy to assure that terrestrial and riparian-wetland habitat needs are met. The terrestrial/riparian-wetland approach establishes a baseline condition (historical reference) at a time prior to European settlement. This represents the coarse filter. Additional, species-specific actions (fine filter) supplement the ecosystem-based approaches. The terrestrial approach identifies native ecosystem diversity components that provide for the needs of plant and animal species that evolved and are adapted to these environmental, climatic, and disturbance patterns. Such an approach is preferable to single-species management and recovery actions that require significant funding and staff time. A critical consideration in the terrestrial approach is an understanding of natural disturbance regimes, such as fire, flooding, and grazing patterns, which acted upon habitats.

MLRAs are defined by characterizing underlying soil and topography in landscape patterns, using information on soils, water, climate, vegetation, and land use. Within the terrestrial ecological systems in South Dakota, grass-shrub systems make up 82% of the state, and much of the plan's methodology evaluates these predominant systems.

Climate, fire, grazing, black-tailed prairie dogs, beaver, and flood events are the primary natural disturbance processes that influenced ecosystem diversity prior to European settlement. The plan describes two drivers of ecosystem diversity – ecological sites and disturbance states. The plan adopts the NRCS definition of an ecological site, which is a potential-based landscape classification system that identifies abiotic conditions that influence disturbance patterns and the potential plant communities at a site.

The riparian-wetland ecological site classification combined several existing classification systems. Four hydrogeomorphic (HGM) classes and 7 hydrology sub-classes are identified. The framework for describing the range of disturbance states for an ecological site is a state and transition model. For grass-shrub ecological sites in South Dakota, the primary disturbance mechanisms were fire and grazing by bison and black-tailed prairie dogs. Eight disturbance states are identified in the plan.

Plant community descriptions provide a framework for developing appropriate ecosystem restoration activities. Ecosystem restoration is promoted to return habitats to historical conditions and disturbance regimes as the benchmarks for comparison to current conditions. Projected climate change effects by 2099 to individual plant species are considered, because of the likelihood that plant species distributions will shift in response to changing climate. A sample plant community description is provided to demonstrate this Web tool, which was developed as part of the revision process and will be hosted on SDGFP's website.

Planning approach for aquatic habitats:

For aquatic species, a variety of data sources helped identify COAs to meet the needs of aquatic species. The aquatic approach also used a coarse and fine filter approach. The aquatic approach included identifying aquatic species of greatest conservation need (SGCN) and identifying areas with the highest known and probable SGCN occurrences. This information was combined with selection of areas with the highest probability of conservation success and areas that represented unique watershed types for aquatic COA consideration.

The MOGAP hierarchical framework was adapted for the South Dakota Wildlife Action Plan from several sources, resulting in the classification and mapping of riverine ecosystems at 8 levels. Four of these levels – subregions, ecological drainage units, aquatic ecological system-types (AES-types), and valley segment types, were used in the COA selection process. AES-types were chosen as the mapping level at which COAs were assigned.

Conservation challenges overview for terrestrial and riparian-wetland habitats:

Major conservation challenges to terrestrial ecosystem diversity are direct habitat conservation and indirect habitat alteration through the spread of nonnative species and the suppression of natural disturbance processes. Climate change projections were combined with an understanding of ecosystem processes and species needs to evaluate potential impacts. An analysis of land conversion by ecological sites within MLRAs is presented. The impact of altered disturbance regimes, including fire suppression and interaction of fire and grazing animals, is described, within the added context of projected climate change. The current tendency toward moderate-level grazing and the reduction of prairie dog acreage has impacted grass-shrub systems in South Dakota. Forest systems have been impacted by grazing, logging, and fire suppression.

Climate change impacts to terrestrial and riparian-wetland systems:

For terrestrial and riparian-wetland habitats, a downscaled global climate model was used to create a regional dataset of monthly average precipitation and temperature values for each of South Dakota 18 MLRAs for 2 future periods – 2021 to 2050 and 2070 to 2099. The climate change assessment was conducted for grass-shrub ecosystems. Forest ecosystem impacts were not evaluated. In South Dakota, warm-season grasses (C_4 species) generally occur in warmer locations, and cool-season grasses (C_3 species) generally occur at cooler locations. A series of figures displays predicted climate change compared to recent conditions in South Dakota's MLRAs for the following: mean annual temperature, mean annual precipitation, mean winter and spring precipitations, mean growing season precipitation, and mean summer precipitation. In general, the data indicate greater winter precipitation for most MLRAs, variable precipitation during the growing season, and significant temperature increases. Weather events are also anticipated to be more extreme.

Of particular interest from the climate change projections for terrestrial and riparian-wetland habitats is the potential impact of July temperature on the balance of C_3/C_4 plant species. One analysis of Great Plains grasslands indicates a shift from C_3 to C_4 dominance at the projected July temperatures for all but one of South Dakota's MLRAs. Projected climate change impacts to individual plant species are added considerations in native ecosystem restoration projects, which may result in a change in recommended plant species to those more likely to be successful under shifting climate change conditions.

Impacts of direct and indirect alteration of riparian-wetland habitats are discussed, including conversion for agriculture and disruption of natural disturbance process through dams, channelization, diversion and related stream flow reductions, beaver population reduction, and invasive nonnative species impacts.

Climate change impacts to wetlands are discussed in the context of speculation that a 10% increase in spring precipitation will be needed to offset impacts of a 2°C temperature increase. Impacts of projected higher levels of evaporation/evapotranspiration during summer months will vary with HGM class and hydrology sub-class. Climate change impacts to wetlands are expected to be more severe in western South Dakota, although impacts to eastern South Dakota wetlands will vary with basin capability of holding water and whether wetlands are fed by groundwater or other sources.

Conservation challenges overview for aquatic systems:

As with terrestrial and riparian-wetland habitats, direct and indirect habitat conversion and alteration are considered the most significant threats to aquatic systems. Interactions between land practices and aquatic systems must also be considered for influences on stream temperature and flow, aquatic vegetation impacts, altered nutrient loads, and sedimentation. Indirect impacts include flood control, channelization, removal of beaver, and introduction of nonnative species.

Climate change and human stressor impacts to aquatic species:

Predicted climate change impacts to aquatic species were determined using NatureServe's vulnerability assessment tool. Six aquatic SGCN fit the most serious category, extremely vulnerable to climate change impacts. They were Finescale Dace, Lake Chub, Mountain Sucker, Northern Pearl Dace, Northern Redbelly Dace, and Southern Redbelly Dace. Two aquatic SGCN, Longnose Sucker and Sturgeon Chub, were considered highly vulnerable to climate change impacts, the second most serious category. Not all aquatic SGCN were analyzed, due to lack of information. The predictive value of this exercise is expected to improve with additional information.

Nine data layers related to stressors to aquatic habitats were analyzed and ranked for use in the human stressor index (HSI), which was a large component of the aquatic conservation opportunity area identification. These data included impervious surfaces, percent land cover in cropland, confined animal feeding operations, road stream crossings, major hydrologic modifications, dams, permitted discharges, active oil and gas wells, and gravel mining locations.

Conservation challenges summary:

In addition to challenges linked to habitats, a variety of challenges pertaining to terrestrial or aquatic habitats or species, or both, are described. Major categories include land use practices, movement barriers, nonnative species, recreational disturbance, and diseases.

Conservation actions overview:

The complexity of designing strategies to address impacts of habitat loss by direct and indirect means and the poor understanding of habitat juxtaposition and quality are described. The many unknowns in this area support the selection of the ecosystem representation approach as the coarse filter to accommodate the needs of the majority of species.

Representation goals:

As with the original plan, representation goals for terrestrial and riparian-wetland systems are set at 10% of the primary historical ecosystem for each ecological site within each MLRA. This figure has been suggested, but it is not a scientifically-proven number to assure sustainability of all species and habitats. Habitat types most likely to be underrepresented today are areas with frequent fire regimes and light grazing. A list of actions to help achieve representation goals is presented and organized by categories of management, research, and education.

Terrestrial COA identification:

Prior to proposing an approach, SDGFP contacted other natural resource agencies and tribes and visited with internal habitat staff for input. Terrestrial COAs were designed to attempt to provide for the 10% representation goals previously described. Data sources/layers included lands protected because of public ownership or permanent easement, large intact habitat blocks with relatively low levels of human impacts, buffers around major rivers, and wildlife species data points combined as a species richness category. Proposed terrestrial COAs are considered a first step in a process that should include consideration of existing conservation initiatives and logical land management planning boundaries.

Aquatic COA identification:

Aquatic COA selection criteria included highest confirmed/probable species richness for aquatic SGCN, lowest human stressor index value, and highest percentage of public land ownership. Additional COAs were selected to accommodate underrepresented SGCN with limited ranges. Forty-nine aquatic COAs were selected to assist in identifying high-quality examples of habitat types in South Dakota that will help maintain aquatic diversity.

Conservation actions summary:

In addition to providing for the 10% representation goals for terrestrial and riparian-wetland systems and for testing the utility of the terrestrial and aquatic COAs, a number of conservation actions to assist in meeting ecosystem diversity goals are described. They are organized into coordination, management, research, and education categories.

Public involvement:

A public attitude survey conducted during the revision process indicated continued strong support among South Dakotans for wildlife and efforts to maintain quality habitat. Eighty percent of South Dakota residents reported that they believe fish and wildlife contribute to a high quality of life. Results on specific issues or species conflicts can help SDGFP and its partners formulate educational strategies to best address misunderstandings or lack of public support for critical conservation initiatives. The survey also indicated that more than 91% of South Dakota residents have participated in hunting, fishing, or wildlife viewing at some point in their lifetime.

Public involvement strategies included outreach to government agencies, tribes, and the general public using the SDGFP website for sharing general information and for gathering specific input, such as comments on the draft SGCN list. Specific, targeted requests for input were also sent to government agencies and tribes throughout the revision process. Open houses were held at the agency's 2 outdoor campuses/regional offices, in Sioux Falls and Rapid City. Internal staff were regularly updated on the revision's progress. All input was carefully considered during all phases of the plan revision.

A 5-week public comment period resulted in responses from 6 entities. All comments were reviewed and discussed by the Wildlife Action Plan Science and Outreach teams and responses prepared for those that related to the Plan. In addition, the SDGFP Commission was briefed at various points during the Plan's preparation, resulting in an official endorsement of the Plan by the Commission at their June 2014 meeting.

Monitoring, research, and adaptive management:

Monitoring strategies and information needs are described to evaluate ecosystem diversity goals and to determine whether representation goals are met. Goals can be met with public land acreage and through Farm Bill programs that target ecosystem restoration. Data gathering will help address the need to monitor ecosystem goals at the landscape level for comparison to historical amounts. Ecosystem- and community-level monitoring should evaluate composition, structure, and function to determine if areas are representative of historical plant communities or are, for instance, degraded with invasive species to the point that they no longer function appropriately as representative ecosystems.

A variety of potential monitoring activities at the species, ecosystem, community, and landscape levels are described. These lists can be prioritized and matched to available funding. Research and monitoring need lists were drafted by SDGFP staff for terrestrial and aquatic animal groups, by habitat type or geographical areas, and to meet conservation challenges and restoration needs. Lists reflect input received from government agencies, tribes, and species experts.

The adaptive management philosophy is described, as well as the anticipated influence of the upcoming shift to a new accountability system within the U.S. Fish and Wildlife Service's Federal Assistance Program.

Plan review:

SDGFP intends to review the plan at 10-year intervals, unless there are compelling reasons to revise the plan sooner. To assure use of the appropriate methods of engaging conservation partners, SDGFP will contact them early in the revision process to determine how they recommend that SDGFP solicit input.

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South Dakota Wildlife Action Plan Science Team:
Eileen Dowd Stukel, SDGFP
Jon Haufler, EMRI
Casey Heimerl, SDGFP
Silka Kempema, SDGFP
John Lott, SDGFP
Carolyn Mehl, EMRI
Dave Ode, SDGFP
Chelsey Pasbrig, SDGFP
Chad Switzer, SDGFP
Nathan Baker, Andrew Burgess, and Ruth Howell also assisted.

Outreach Team:
Larry Gigliotti
Cynthia Longmire
Eileen Dowd Stukel
Casey Heimerl
Silka Kempema
Dave Ode
Chelsey Pasbrig
Chad Switzer

SDGFP GIS Staff:
Christopher Marsh
Chelsea Krause
Heather Berg
David Freidel

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LIST OF ACRONYMS

AES - Aquatic Ecological System

AIS – Aquatic Invasive Species

BLM - Bureau of Land Management

C - °Celsius

COA - Conservation Opportunity Area

CREP - Conservation Reserve Enhancement Program

CRP - Conservation Reserve Program

DGCM – Downscaled Global Climate Model

EDU - Ecological Drainage Unit

EMRI – Ecosystem Management Research Institute

EPA - Environmental Protection Agency

ESA – Endangered Species Act

F - °Fahrenheit

FSA – Farm Service Agency

GAP – Gap Analysis Program

GCM – Global Climate Model

GIS – Geographic Information System

GPFHP - Great Plains Fish Habitat Partnership

HAPET - Habitat and Population Evaluation Team

HCPC - Historical Climax Plant Community

HGM – Hydrogeomorphic (system)

HSI - Human Stressor Index

HUC_8 - Eight digit Hydrologic Unit Code

LCC – Landscape Conservation Cooperative

MFRI - mean fire return interval

MLRA – major land resource area

MO - Missouri

MOGAP - National Aquatic Gap Analysis Program of the Missouri River Basin

MS - Mississippi

NGO - non-governmental organization

NGP – Northern Great Plains

NHD - National Hydrography Dataset

NLCD - National Land Cover Data

NPS - National Park Service

NRCS – Natural Resources Conservation Service

NWI – National Wetlands Inventory

PARC – Partners in Amphibian and Reptile Conservation

PARCA – Priority Amphibian and Reptile Conservation Areas

SDBBA – South Dakota Breeding Bird Atlas

SD DENR - South Dakota Department of Environment and Natural Resources

SD DOT – South Dakota Department of Transportation

SDGFP - South Dakota Game, Fish and Parks

SDNHD - South Dakota National Heritage Database

SDSU – South Dakota State University

SDOU – South Dakota Ornithologists' Union

SDWAP – South Dakota Wildlife Action Plan

SGCN - Species of Greatest Conservation Need

SOM – soil organic matter

STM - State and transition model

SWG – State Wildlife Grant

TNC – The Nature Conservancy

TRACS – (Wildlife) Tracking and Reporting Actions for the Conservation of Species

USACE – United States Army Corps of Engineers

USEPA – United States Environmental Protection Agency

USFS - United States Forest Service

USFWS - United States Fish and Wildlife Service

USGS - United States Geological Survey

VST - Valley Segment Type

WAP - Wildlife Action Plan

WGA – Western Governors' Association

WVO - Wildlife Value Orientation

PLAN ORGANIZATION - WHERE TO FIND KEY ELEMENTS

The following summary identifies the Sections in the South Dakota SDWAP that address the eight key elements required by Congress and briefly describes changes made to these sections for the 2014 update. Sections of the Plan that are described as unchanged were evaluated during the revision process and found to be suitable processes.

The revision process began with an initial contact with the U.S. Fish and Wildlife Service' Wildlife and Sport Fish Restoration Program in Denver, Colorado (Appendix A).

Table 1-1. Location of key elements within the South Dakota Wildlife Action Plan and description of 2014 updates to these elements, where applicable.

ELEMENT AND SUB-ELEMENT	CHAPTER/SECTION	2014 UPDATE
1 - Species		
Species of greatest conservation need	· Chapter 1, Section 1.5 (overview) · Chapter 2 (full list) · Chapter 2, Section 2.1 (conservation goals) · Appendix C (species profiles) · Chapter 4, Section 4.4 (aquatic SGCN review) · Appendix U (supplemental information on Aquatic SGCN associated with COAs)	· Reviewed and revised list (overview section); used new data sources and expert opinions for list development · Description of species profile format, map data sources and case studies to help reader understand where to locate species of greatest conservation need (SGCN) information · Species profile for each SGCN · Relevance of SGCN locations and species richness to aquatic conservation opportunity area selection · Listing of aquatic SGCN associated with conservation opportunity areas (COAs)
2 – Key Habitats		
Descriptions	· Chapter 3, Section 3.1-3.6	· Used Major Land Resource Area (MLRA) boundaries as

	· Chapter 4, Sections 4.1-4.3	terrestrial ecoregion boundaries · Descriptions of natural disturbance processes · Descriptions of ecological sites used for terrestrial and riparian-wetland systems · Developed database of native ecosystem plant community tables · Adapted aquatic classification system from USGS MOGAP project for Missouri River drainage
Locations	· Appendix C (species profiles) · Chapter 3, Sections 3.4 and 3.6 · Chapter 4, Section 4.4 · Chapter 6, Section 6.1 · Chapter 6, Sections 6.3-6.5 · Appendices R and T (supplemental information on COAs)	· Current distributions of SGCN · Updated ecological site GIS layers and maps using new data for terrestrial and riparian-wetland ecosystems · Used aquatic SGCN to describe species richness · Representation goals at 10% level identified for terrestrial and riparian-wetland ecosystems · Selected terrestrial conservation opportunity areas to meet representation goal of 10% of ecological sites within each MLRA · Selected aquatic conservation opportunity areas to accommodate the needs of SGCN, using a variety of data sources on habitat, stressors

		and SGCN predicted and known occurrences
Relative Conditions	· Chapter 3, Section 3.6, plus SDGFP web tool to allow users to find lists of recommended plant species matched to ecological sites for restoration potential · Chapter 5, Section 5.4 · Chapter 6, Sections 6.3-6.5	· Updated assessment of ecological sites with new information, including climate change impacts · Descriptions of the aquatic habitat levels within aquatic MOGAP · Terrestrial and aquatic COA identification process included data on intact habitats, protected lands, and relative human stressors
3 – Conservation Challenges		
Causes of concern – terrestrial ecosystems	· Chapter 5, Section 5.1 and 5.5	· Updated based on new information, including climate change assessment
Causes of concern – riparian-wetland system	· Chapter 5, Section 5.2 and 5.5	· Updated based on new information, including climate change assessment
Causes of concern – aquatic systems	· Chapter 5, Section 5.4 and 5.5	· Updated based on new information
Causes of concern – species	· Chapter 5, Section 5.3 · Appendix C (species profiles)	· Consideration of climate change impacts · Literature review and update
4 – Conservation Actions		
Conservation goals – representation goals for terrestrial ecosystem diversity	· Chapter 6, Section 6.1 and 6.6 · Chapter 6, Section 6.4	· Updated based on key habitat changes and climate change assessment · Identified terrestrial conservation opportunity areas – new approach not

		found in original Plan
Conservation goals –aquatic SGCN representation through conservation opportunity area identification	· Chapter 6, Section 6.5	· New approach not found in original Plan to accommodate the needs of aquatic SGCN and other aspects of aquatic biodiversity
Conservation goals and actions – species	· Chapter 2, Section 2.1 · Chapter 5, Section 5.3 · Chapter 6, Section 6.6 · Appendix C (SGCN profiles) · Appendix K (species or habitat restoration needs)	· Mitigation descriptions for climate change impacts to terrestrial and riparian-wetland SGCN · Listing of recommended coordination, management, research, and education practices · Updated for SGCN
Conservation actions – key habitats	· Chapter 3, Section 3.6 · Chapter 6, Sections 6.5 · Appendix K (species or habitat restoration needs)	· Updated based on key habitat changes and climate change assessment · Aquatic COA process incorporated emphasis on key habitats needed to accommodate the needs of SGCN and other aspects of aquatic biodiversity
Priorities for implementation	· Chapter 6, Section 6.1 · Chapter 6, Section 6.5 · Appendix C (SGCN profiles)	· Emphasis on ecosystem diversity and historical reference for ecosystem restoration for terrestrial and riparian-wetland ecosystems · Aquatic COAs identified to accommodate the needs of aquatic SGCN · Specific research and monitoring priorities contained in SGCN profiles, in addition to identified habitat

		priorities for ecosystem diversity maintenance and restoration
5 - Monitoring		
Monitoring – terrestrial ecoregions and ecosystems	· Chapter 8, Section 8. 1	· Updated based on new information
Monitoring – aquatic ecosystems	· Chapter 8, Section 8.2	· Added to 2014 revision
Monitoring – species	· Chapter 8, Section 8.3 · Appendix E (ongoing monitoring programs) · Appendix C (species profiles)	· Updated based on new information, including State Wildlife Grant project results
Monitoring – effectiveness of strategy	· Chapter 2 and Appendix C (species profiles) · Chapter 6, Sections 6.1-6.2 · Chapter 6. Sections 6.3-6.5	· SGCN list as fine-filter approach · Updated based on new information · Addition of terrestrial and aquatic COAs identified as tools for accommodating habitats and SGCN requirements
Priority research, monitoring and survey efforts - species	· Chapter 8, Sections 8.3 · Appendix C (species profiles) · Appendices G-K (compiled research and survey needs)	· Reviewed and updated, with input from government agencies, tribes, and species experts
Adaptive management	· Chapter 8, Section 8.1-8.3	· Updated based on new information
6 – Strategy Review		
Procedures	· Chapter 9	· Reviewed but unchanged

7 – Coordination		
Plan development, including SGCN list development and review	· Chapter 7, Sections 7.1-7.2 · Appendix V (listing of agencies, universities, and tribes contacted during revision process)	· Updated with new staff, new data sources, and updated lists of agency and tribal contacts
Plan implementation	· Chapter 7	· Reviewed but unchanged
Plan review and revision	· Chapter 9	· Revision interval changed to 10 years · General framework for future revision described
8 – Public Participation		
Plan development	· Chapter 7, Sections 7.3-7.4	· More extensive use of SDGFP website; did not use Advisory Group method for revision
Public attitude survey	· Chapter 7, Section 7.5	· Conducted attitude survey to continue understanding public's attitudes about wildlife and native habitats; repeated some question asked during survey conducted during original Plan preparation
Plan implementation	· Chapter 7	· More extensive use of SDGFP website during revision and subsequent implementation planned
Plan review and revision	· Chapter 9 · Appendix W (public comments and SDGFP responses/resolutions)	· More extensive use of SDGFP website during revision and subsequent implementation planned

CHAPTER 1 INTRODUCTION

European settlers coming to South Dakota in the 1800s found and exploited a wealth of natural resources, including abundant wildlife populations. Species such as the American bison, pronghorn, and white-tailed deer were decimated by the early 1900s and others, such as the passenger pigeon, eastern elk, and Audubon's bighorn sheep, were lost forever to extinction. Fearing further losses, hunters led a new movement of wildlife conservation, which included new hunting ethics, the science of wildlife management, and other protection measures.

A survey by South Dakota Game, Fish and Parks (SDGFP) found that more than 90% of the public believe that South Dakota should preserve as much wildlife as possible and that healthy wildlife populations are important to our economy and our well-being. They consistently classified wildlife and natural resource conservation as a critical part of our outdoor heritage. This result wasn't surprising to those of us who have both worked in the wildlife field and enjoyed our state's tremendous fish and wildlife resources in our leisure time.

Our forward-thinking ancestors helped assure that we would have fish to catch, game to hunt, and other critters to view, photograph and just simply enjoy having around. The Sport Fish and Wildlife Restoration Programs were established to steer hunter and angler dollars back to the management and restoration of fish and game and to stem the tide of resource exploitation and misuse. Other laws have helped in the awesome challenge of monitoring and managing the complex pieces of our natural world.

But we still have far to go to do something as meaningful as our ancestors did when they passed the landmark bills that set the stage for sound fish and wildlife management. Wildlife managers have tended to focus on certain game species and their habitats, with less emphasis on nongame species and some landscapes that may not fit our traditional view of "good" habitat. Many of the species on state and federal lists of endangered species may have unfamiliar names and small distributions – they've fallen through the cracks of wildlife management, but we know that each component of our natural world is a critical piece.

Many dedicated people continue to search for a long-term solution to fill these cracks in our conservation efforts. In the meantime annual funding from Congress has helped immensely in assisting states to meet their increasing responsibilities to manage for the needs of all fish and wildlife species and their habitats. State Wildlife Grant funding is one example, and the South Dakota Department of Game, Fish and Parks (SDGFP) will continue to make the best use possible of this important funding source as long as it lasts. When we accepted these funds, we committed to preparing a comprehensive plan for all fish and wildlife species in the state (SDGFP 2006). This revised plan (Plan) offered a great opportunity to revisit where we are and where we should go from here.

This Plan is a voluntary guidance document with an emphasis on conserving biological diversity in South Dakota through partnerships and cooperation. The Plan is not a set of mandates or a land acquisition model. Nor is the plan specific to SDGFP. To be successful in avoiding future endangered species conflicts and jeopardizing unique habitats, we must engage private landowners, tribes, environmental and agricultural organizations, government entities ranging from local to federal agencies, as well as the more than 90% of our citizens who believe in the importance of wildlife to our quality of life and to our economy.

We recognize the sovereign status of tribes in South Dakota. Since the vast majority of lands in South Dakota are privately held, private land management and voluntary landowner participation are essential to successful wildlife management. The Plan's approach is to consider what our landscape was like before settlement, but that doesn't mean we would like to turn back the clock to a time before agriculture or other land-altering practices came to South Dakota. The Plan focuses on native species and habitats, but we have no intention of abandoning our commitment to introduced species, such as the ring-necked pheasant, which is an irreplaceable part of our agency's history and our state's hunting legacy. This plan does not replace other planning efforts, such as those dealing with game management, but attempts to address broader, unmet needs. We hope to build on our traditional strengths and constituents in expanding our stewardship to resources that need our attention and care. We support the use of the best science available and the continued collection of sound information to help SDGFP and the SDGFP Commission make informed decisions. We plan to use the best practices available for conservation education to teach South Dakota's children and adults about our unique natural resources.

Each of us, whether we hunt, fish, hike, feed birds, or photograph nature, has a treasured memory or a special place that helped to cultivate and personalize our connection with nature. It may be a memory of the first fish we caught, an amazing retrieve by a hunting dog, a traditional family camping spot, or an unforgettable chance encounter with something wild. Our vision for this Plan is that each of us can find a way to contribute to our state's future natural diversity to replicate what our ancestors did for us in fish and wildlife conservation. We hope that our commitment to making things better will assure that our grandkids and yours have the chance to create their own treasured memories and find their own special places in nature.

1.1 Background

Since the advent of wildlife management, federal laws and policies have placed the primary responsibility for wildlife management programs in the hands of the 50 states. However, the effective implementation of these programs has long depended on adequate federal funding. To fund these programs, Congress passed the 1937 Wildlife Restoration Act, also known as the Pittman-Robertson Act, which imposed a 10% manufacturer's tax on hunting ammunition and firearms. Tax proceeds generated from this Act are distributed to state fish and wildlife agencies for research, habitat protection, and species recovery. Anglers followed suit in 1950, urging passage of the Sport Fish Restoration Act, also called the Dingell-Johnson Act. The Dingell-Johnson Act placed a 10% manufacturer's tax on fishing rods, reels, and tackle to be distributed to state fish and wildlife agencies for sport fish restoration. The Wallop-Breaux Amendment was passed in 1984 to expand the Dingell-Johnson Act by including boating and angling gear for financial support of recreation access and education programs. With the primary source of funding for state wildlife programs coming from hunters and anglers, state wildlife managers implemented very successful management programs to recover or improve game species. However, nongame and endangered species funding needs have not been linked with a similar funding solution. Today, hundreds of species are considered in danger of extinction. Endangered Species Act (ESA) funds have helped recover some well-known species, such as the bald eagle and peregrine falcon but hundreds more are declining every year. Efforts to recover declining species are extremely expensive, and most wildlife advocates agree that preventive actions that keep species from needing to be listed under ESA are the answer to assure the future of America's fish and wildlife resources.

Recognizing the need to take action to prevent species declines, more than 6,400 groups have come together as the Teaming with Wildlife Coalition. This Coalition includes wildlife managers, conservationists, hunters and anglers, businesses, and many others who support the goal of restoring and conserving our nation's wildlife. Teaming with Wildlife is a legislative effort to identify and secure a stable, long-term funding source for fish and wildlife species that have not been traditionally funded by existing federal programs. A well-funded, coordinated approach to inventories, management, and related educational efforts can help prevent future endangered species listings and help state wildlife agencies fulfill their trust responsibility to manage for the needs of all wildlife species.

As a result of the efforts of the Teaming with Wildlife Coalition and others, the Federal Government developed the State Wildlife Grant Program. The State Wildlife Grant Program provides funding to every state and territory to support conservation aimed at keeping wildlife from becoming endangered. This program continues the long history of cooperation between the federal government and the states for managing and conserving wildlife species. To receive future federal funds through the State Wildlife Grant program, Congress charged each state and territory with developing a Wildlife Action Plan. The wildlife plans provide an essential foundation for the future of wildlife conservation and an opportunity for states, federal agencies, and other conservation partners to strategically think about their individual and coordinated roles in conservation efforts across the nation.

The South Dakota Department of Game, Fish, and Parks completed its statewide Comprehensive Wildlife Conservation Plan, now called the South Dakota Wildlife Action Plan (SDWAP) in 2006, and it was approved by the U.S. Fish and Wildlife Service shortly thereafter. The SDWAP serves as a strategic vision and plan of action for statewide wildlife conservation and makes South Dakota eligible for Federal conservation funding. The SDWAP identifies conservation needs and actions that can be implemented by landowners, agencies, partnerships, or private organizations. Further, it prioritizes resources and activities to prevent future decline of species and ecosystems in South Dakota. It places emphasis on ecosystems and species of greatest conservation need (SGCN).

The purpose of the SDWAP is to provide:

1. A strategic vision and plan of action for statewide wildlife conservation and funding; a declaration of goals and how to achieve them.
2. A means for collaboration among diverse interests that helps achieve the goals of maintaining or enhancing South Dakota's ecosystems and wildlife resources.

As such, the SDWAP is designed to maintain and conserve the State's biodiversity. It is designed to operate using proactive measures and incentive-based programs on private lands, and cooperative efforts with other agencies on public lands. It is a plan not just for SDGFP but for cooperative efforts to include landowners, other agencies, and organizations. It emphasizes the State's native biodiversity, but is not designed to detract from the value of important nonnative species, and in fact, provides many indirect benefits to many of these species such as ring-necked pheasants. The plan does not replace other planning efforts, such as those developed for game management, but rather addresses broader biodiversity objectives using complementary programs.

The SDWAP helps guide voluntary and cooperative actions, and does not place mandates or restrictions on uses of private land. It uses an historical reference to help characterize and understand biological diversity, but is not a plan to return to historical conditions. The programs and approaches recommended are based on a recognition and respect for private property rights as well as recognizing the importance of tribal sovereignty in any cooperative programs. It is developed with the view that working cooperatively and identifying mutually agreed upon programs and actions will produce desired conservation benefits that can be effectively integrated with other land uses and objectives.

1.2 Summary of Plan Updates and Changes

For the last several years, SDGFP has been coordinating and leading a planning team to revise the SDWAP to incorporate new or updated information and evaluate the potential impacts of climate change on South Dakota's ecosystems and species. Specifically, the SDWAP has revised its terrestrial ecological boundaries to take advantage of improved tools and ecological information developed for Major Land Resource Areas (MLRAs), as classified and mapped by the Natural Resources Conservation Service. Within each MLRA, the native ecosystem diversity for forest, grass, and shrub ecosystems has been updated to reflect the current knowledge of ecosystem diversity applied at this scale. This additional information will better assist managers in implementation of restoration activities. Further, wetland and riparian ecosystem classification is updated and mapped using improved data and methods. In addition, the recently updated Aquatic GAP information has been incorporated to map key watersheds and identify key stream and river reaches with high conservation value or management needs.

Concerns over climate change have dramatically increased since the original plan was developed. Congress has allocated funding to specifically incorporate climate change considerations into state Wildlife Action Plans. The SDWAP, with its ecosystem-based approach, is very well positioned to incorporate meaningful considerations for climate change. The effect of climate change on ecosystems in terms of potential changes to species compositions and structures is incorporated, where information is available. The results of the evaluation of climate change effects on ecosystems were then used to evaluate the potential effects on SGCN.

The Plan included 90 SGCN in 2006 and after review this was increased to 101 species in 2014. Requirements for many of these species as well as their status in South Dakota may not be well documented. New information on some of these species has been generated during recent years. In addition, some species of concern have been added where information on habitat or population status indicate possible declines or projections for climate change in South Dakota indicate significant future challenges for a species.

To assist with targeted planning for conservation actions, conservation opportunity areas are identified for the updated SDWAP. These areas represent the best opportunities for voluntary ecosystem restoration or other effective management actions within South Dakota and may also include areas with large numbers of SGCN or important linkage zones. Identification of conservation opportunity areas also allows for improved or renewed opportunities to build collaborative relationships with landowners and stakeholders in those landscapes, especially those with an interest in fish and wildlife conservation in South Dakota. See Figures 6-5 and 6-11.

An additional objective for the 2014 update of the SDWAP is to make the document more user-friendly as well as improve our online supporting resources. To accomplish this, the data developed for the 2014 update will be made available to the public in a new web-based tool available for conservation planning. The SDWAP itself has been streamlined to present key information on the overall ecosystem-based process, identification of SGCN, predicted effects of climate change, discussion of conservation challenges, recommendations for conservation actions, and identification of conservation opportunity areas.

Incorporation of Wildlife Action Plan Best Practices

Wildlife Action Plan revisions offer the opportunity to craft plans that increase consistency across state boundaries. A committee working under the Association of Fish and Wildlife Agencies (AFWA) provided voluntary guidance for consideration during plan revisions (AFWA 2012). Although the AFWA report was finalized after much of South Dakota's Plan was drafted or the revision processes finalized, this Plan incorporated many of the suggested best practices. A summary is presented in Appendix B.

1.3 Key Elements

Congress identified eight required elements of a state wildlife action plan with the expectation that "species in greatest need of conservation" will be identified, while also addressing the "full array of wildlife" and wildlife-related issues. The strategies must provide and make use of:

1. Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife; and,
2. Descriptions of locations and relative conditions of key habitats and community types essential to conservation of species identified in (1); and,
3. Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats; and,
4. Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions; and,
5. Proposed plans for monitoring species identified in (1) and their habitats, for monitoring effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions; and,
6. Descriptions of procedures to review the strategy at intervals not to exceed ten years; and,
7. Plans for coordinating the development, implementation, review, and revision of the SDWAP with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats.
8. Congress also affirmed through this legislation that broad public participation is an essential element of developing and implementing these plans, the projects that are carried out while these plans are developed, and the Species of Greatest Need of Conservation that Congress has indicated such programs and projects are intended to emphasize.

1.4 Goals

The goals of the SDWAP are strategic and designed to:

1. Guide the conservation of biological diversity in South Dakota;
2. Initiate a process to identify and monitor the status of biological diversity in South Dakota;
3. Identify challenges to maintaining or restoring biodiversity and establish a conservation action process for native ecosystems and species of concern;
4. Develop objectives and action plans to achieve these goals;
5. Satisfy legal mandates for rare species recovery;
6. Satisfy eligibility requirements for applicable funding sources;

7. Develop a list of projects to help match available funds with resource priorities; and
8. Implement a process that allows and encourages participation by government agencies, tribes, conservation partners, and the public.

1.5 Species of Greatest Conservation Need - Overview

A primary element of the SDWAP is the identification of Species of Greatest Conservation Need (SGCN) across the state. The previous list of SGCN was reviewed and updated for 2014 by SDGFP in cooperation with South Dakota Natural Heritage Program ecologists and included input from many experts in the state and region. The review process involved identifying species or taxa experts who were asked for input and associated justifications for suggested additions or deletions. The Wildlife Action Plan Science Team (Science Team) reviewed this input. The draft list was shared multiple times with land and resource management agencies and tribes in South Dakota. All agency and tribal feedback was considered within the context of the selection criteria. The draft list was also shared with the general public in a specific public comment opportunity, and all feedback was again carefully considered before finalizing the SGCN list.

The SGCN list contains 101 animal species; 29 bird species, 11 mammal species, 12 reptile or amphibian species, 11 terrestrial insect species, 9 freshwater mussel species, 4 gastropod species, 21 fish species, and 4 aquatic insect species. Plant species were not included as species of greatest conservation need. The SDWAP's coarse filter approach, described later in the Plan, should accommodate the diversity of plant species when implemented appropriately.

1.6 Conservation Strategies - Overview

Conservation of a State's biological diversity and SGCN can be approached through several strategies based on different objectives and assumptions (Grossman et al. 1998, van Jaarsveld et al. 1998, Haufler 1999, Gutzwiller 2002, Noon et al. 2003). Selection of a strategy or multiple strategies depends on the unique objectives of a State's planning effort. Various strategies for conservation of biological diversity were evaluated and assessed for the SDWAP. Two different conservation strategies were selected to meet the State's objectives for conservation of biological diversity. The first uses a coarse-filter/fine-filter strategy to ensure the habitat needs of wildlife species by maintaining or restoring native ecosystem diversity for terrestrial and riparian-wetland systems across South Dakota. The second uses a modification of the aquatic GAP analysis strategy to identify needed conservation opportunity areas (COAs) to protect aquatic systems. The application and implementation of each of these conservation strategies will be discussed in detail in later sections of this document. For many of the SGCN identified for this effort, implementation of these two strategies will improve and restore habitat conditions across South Dakota. In some instances, SGCN may also experience non-habitat related challenges that must also be recognized and addressed to meet conservation objectives. These non-habitat related conservation challenges and actions are also discussed in later sections of this document.

CHAPTER 2 SPECIES OF GREATEST CONSERVATION NEED

A primary element of the SDWAP is the identification of Species of Greatest Conservation Need (SGCN) across the state. Table 2-1 lists the SGCN for the SDWAP. The previous list was reviewed and updated, and fourteen species were added to the list. Three species, the Bear Lodge Meadow jumping mouse, Blanding's Turtle, and paddlefish, were removed from the SGCN list due to new information on their status or because other species already represented specific habitat needs.

Species were included on the revised SGCN list based on meeting one or more of the following criteria:

1 = State or federal listed species for which the state has a mandate for recovery (listed as threatened or endangered);

2a = Species that are regionally or globally imperiled and for which South Dakota represents an important portion of their remaining range;

2b = Species that are regionally or globally secure and for which South Dakota represents an important portion of their remaining range; or

3 = Species with characteristics that make them vulnerable, including any of the following:

- are indicative of or depend on a unique or declining habitat in South Dakota;
- require large home ranges/use multiple habitats;
- depend on large habitat patch sizes;
- depend on an ecological process (such as fire) that no longer operates within the natural range of variation;
- are limited in their ability to recover on their own due to low dispersal ability or low reproductive rates;
- have a highly localized or restricted distribution (endemics); or
- concentrate their populations during some time of the year.

Globally imperiled or secure status in criteria 2a and 2b was based, in part, on NatureServe conservation status ranking (http://www.natureserve.org/explorer/index.htm).

Criteria 2a and 2b focus on the responsibility of each state to provide habitat for species viability to help avoid future endangered species listings. Species included on the SGCN list under criteria 2a, 2b, and 3 illustrate that not all SGCN are rare species within South Dakota.

NatureServe's global and state ranks represent a standardized method of describing a species' abundance and a generalized vulnerability description. Global ranks describe the species' status throughout its range. State ranks are assigned by state Natural Heritage Programs to describe abundance and vulnerability within the state's borders (http://gfp.sd.gov/wildlife/threatened-endangered/default.aspx). The system also includes various descriptors to represent uncertain, historical, extirpated, or accidental status. A few SGCN, such as the aquatic insect species, are not assigned a state rank because of a lack of information. State and global ranks are revised with improved information.

2.1. Conservation Goals for Species of Greatest Conservation Need

The terrestrial and aquatic ecosystem approaches presented in this Plan will accommodate the needs of the majority of wildlife species. The overall advantage to this approach is that fish and wildlife managers presently focus on only a small number of species, when considering the vast array of vertebrates and invertebrates. However, many existing laws and management approaches continue to emphasize a species approach to wildlife management and recovery.

In proposing conservation goals for the 101 SGCN, the specific selection criterion is informative. For species listed because they are state and/or federal threatened or endangered species or candidates for federal listing, recovery is mandated by state and/or federal laws. SDGFP is committed to assisting in recovery of federal listed species through a Cooperative Agreement with the U.S. Fish and Wildlife Service for the Conservation of Endangered and Threatened Animals, first approved on June 30, 1977 and renewed annually since then. South Dakota's endangered species law mandates that state listed species must be recovered

(http://legis.sd.gov/Statutes/Codified_Laws/DisplayStatute.aspx?Type=Statute&Statute=34A-8).

Twenty-seven species are included as SGCN because they are listed as threatened or endangered under state or federal authority. The overall conservation goal for these species is to recover them to the point that state protection as a threatened or endangered species under the state endangered species law is no longer necessary and to support national recovery efforts for those that are federal listed, proposed for listing, or candidates for federal listing under the Endangered Species Act.

Criteria 2a and 2b were used to justify listing of 24 SGCN. These criteria apply to species for which South Dakota represents an important portion of the species' remaining range. However, that does not necessarily mean these species are rare in South Dakota. For those species that have state heritage ranks of S1, S2, or S3, the conservation goal is to improve the species' abundance and distribution to justify a higher state rank. For species with more secure state ranks of S4 or S5, the conservation goal is to maintain or improve that status by addressing species-specific threats or unique habitat needs that are not addressed through the Plan's coarse filter approaches, which are explained later in this document.

The remaining 50 SGCN were listed because of one or more characteristics that make them vulnerable, which may be life history characteristics, unique habitat needs, or lack of sufficient disturbance regimes to maintain important habitats. State heritage ranks can also assist in proposing conservation goals for this group, as previously described. For many of these species, not enough is known to propose defensible conservation goals aside from efforts to improve status and reduce vulnerability to decline or extirpation. Many of these information gaps are described in the species profiles (Appendix C) and listed in Appendices G-K. As new information is available, these conservation goals can be defined and refined.

Table 2-1. List of species of greatest conservation need as updated for the 2014 South Dakota Wildlife Action Plan.

Common Name	Scientific Name	Federal Status[a]	State Status[b]	Global Rank[c]	State Rank[d]	2006 SGCN[e]	2006 Eval.[f]	2014 SGCN[g]	2014 Eval.[h]
BIRDS									
American Dipper	*Cinclus mexicanus*		T	G5	S2	Y	1	Y	1
American Three-toed Woodpecker	*Picoides dorsalis*			G5	S2	Y	3	Y	3
American White Pelican	*Pelecanus erythrorhynchos*			G4	S3B	Y	2	Y	2b
Baird's Sparrow	*Ammodramus bairdii*			G4	S2B	Y	2	Y	2a
Bald Eagle	*Haliaeetus leucocephalus*		T	G5	S1B, S2N	Y	1	Y	1
Black Tern	*Chlidonias niger*			G4	S3B	Y	2	Y	2a
Black-backed Woodpecker	*Picoides arcticus*			G5	S3	Y	3	Y	3
Burrowing Owl	*Athene cunicularia*			G4	S3S4B	Y	3	Y	3
Chestnut-collared Longspur	*Calcarius ornatus*			G5	S4B	Y	2	Y	2a
Ferruginous Hawk	*Buteo regalis*			G4	S4B	Y	3	Y	3
Greater Prairie-Chicken	*Tympanuchus cupido*			G4	S4	Y	2	Y	2a
Greater Sage-Grouse	*Centrocercus urophasianus*	C		G3G4	S2	Y	3	Y	3
Interior Least Tern	*Sternula antillarum athalassos*	E	E	G4T2Q	S2B	Y	1	Y	1
Lark Bunting	*Calamospiza melanocorys*			G5	S5B	Y	2	Y	2a
Le Conte's Sparrow	*Ammodramus leconteii*			G4	S1S2B	Y	3	Y	3
Lewis's Woodpecker	*Melanerpes lewis*			G4	S3B, S3N	Y	3	Y	3
Long-billed Curlew	*Numenius americanus*			G5	S3B	Y	2	Y	2a
Marbled Godwit	*Limosa fedoa*			G5	S5B	Y	2	Y	2a
Northern Goshawk	*Accipiter gentilis*			G5	S3B, S2N	Y	3	Y	3
Osprey	*Pandion haliaetus*		T	G5	S1B	Y	1	Y	1
Peregrine Falcon	*Falco peregrinus*		E	G4	SXB	Y	1	Y	1
Piping Plover	*Charadrius melodus*	T	T	G3	S2B	Y	1	Y	1
Ruffed Grouse	*Bonasa umbellus*			G5	S4B, S4N	N		Y	3
Sprague's Pipit	*Anthus spragueii*	C		G4	S2B	Y	2	Y	2a

Table 2-1 (continued). List of species of greatest conservation need as updated for the 2014 South Dakota Wildlife Action Plan.

Common Name	Scientific Name	Federal Status[a]	State Status[b]	Global Rank[c]	State Rank[d]	2006 SGCN[e]	2006 Eval.[f]	2014 SGCN[g]	2014 Eval.[h]
BIRDS (continued)									
Trumpeter Swan	*Cygnus buccinator*			G4	S3B, S3N	Y	2	Y	2b
White-winged Junco	*Junco hyemalis aikeni*			G5T4	S5B, S5N	Y	2	Y	2b
Whooping Crane	*Grus americana*	E	E	G1	SNA	Y	1	Y	1
Willet	*Tringa semipalmata*			G5	S5B	Y	2	Y	2b
Wilson's Phalarope	*Phalaropus tricolor*			G5	S4B	Y	2	Y	2b
GASTROPODS									
Callused Vertigo	*Vertigo arthuri*			G5	S2	Y	3	Y	3
Cooper's Rocky Mountainsnail	*Oreohelix strigosa cooperi*			G5T2T3Q	S2	Y	2	Y	2a
Frigid Ambersnail	*Catinella gelida*			G1	S1	y	3	Y	3
Mystery Vertigo	*Vertigo paradoxa*			G4G5Q	S1	Y	3	Y	3
AMPHIBIANS AND REPTILES									
Black Hills Redbelly Snake	*Storeria occipitomaculata pahasapae*			G5T4Q	S3	Y	2	Y	2b
Blanchard's Cricket Frog	*Acris blanchardi*			G5	S1	Y	3	Y	3
Cope's Gray Treefrog	*Hyla chrysoscelis*			G5	S2	Y	3	Y	3
Eastern Hognose Snake	*Heterodon platirhinos*		T	G5	S2	Y	1	Y	1
False Map Turtle	*Graptemys pseudogeographica*		T	G5	S3	Y	1	Y	1
Lesser Earless Lizard	*Holbrookia maculata*			G5	S2	Y	3	Y	3
Lined Snake	*Tropidoclonion lineatum*		E	G5	S1	Y	1	Y	1
Many-lined Skink	*Plestiodon multivirgatus*			G5	S1	Y	3	Y	3
Sagebrush Lizard	*Sceloporus graciosus*			G5	S2	N		Y	3
Short-horned Lizard	*Phrynosoma hernandesi*			G5	S2	Y	3	Y	3
Smooth Softshell	*Apalone mutica*			G5	S2	Y	3	Y	3
Western (Ornate) Box Turtle	*Terrapene ornata*			G5	S2	Y	3	Y	3

Table 2-1 (continued). List of species of greatest conservation need as updated for the 2014 South Dakota Wildlife Action Plan.

Common Name	Scientific Name	Federal Status[a]	State Status[b]	Global Rank[c]	State Rank[d]	2006 SGCN[e]	2006 Eval.[f]	2014 SGCN[g]	2014 Eval.[h]
MAMMALS									
Black-footed Ferret	*Mustela nigripes*	E	E	G1	S1	Y	1	Y	1
Black Hills Red Squirrel	*Tamiasciurus hudsonicus dakotensis*			G5TNR	SNR	N		Y	2b
Franklin's Ground Squirrel	*Poliocitellus franklinii*			G5	S5	Y	2	Y	3
Fringe-tailed Myotis	*Myotis thysanodes pahasapensis*			G4T2	S2	Y	2	Y	2a
Northern Flying Squirrel	*Glaucomys sabrinus*			G5	S2	Y	2	Y	2b
Northern Myotis	*Myotis septentrionalis*	T		G2G3	S3	Y	3	Y	3
Northern River Otter	*Lontra canadensis*		T	G5	S2	Y	1	Y	1
Richardson's Ground Squirrel	*Urocitellus richardsonii*			G5	S5	Y	2	Y	2b
Silver-haired Bat	*Lasionycteris noctivagans*			G5	S4	N		Y	3
Swift Fox	*Vulpes velox*		T	G3	S1	Y	1	Y	1
Townsend's Big-eared Bat	*Corynorhinus townsendii*			G3G4	S2S3	Y	3	Y	3
TERRESTRIAL INSECTS									
American Burying Beetle	*Nicrophorus americanus*	E		G2G3	S1	Y	1	Y	1
Dakota Skipper	*Hesperia dacotae*	T		G2	S2	Y	2	Y	2a
Great Plains Tiger Beetle	*Amblycheila cylindriformis*			G4G5	S1	Y	3	Y	3
Indian Creek Tiger Beetle	*Cicindela nevadica makosika*			G5T1	S1	N		Y	2a
Iowa Skipper	*Atrytone arogos iowa*			G3T3	S2	Y	3	Y	3
Little White Tiger Beetle	*Cicindela lepida*			G3G4	S1	Y	3	Y	3
Northern Sandy Tiger Beetle	*Cicindela limbata nympha*			G4T4	S4	N		Y	3
Ottoe Skipper	*Hesperia ottoe*			G3G4	S2	Y	2	Y	3
Pahasapa Fritillary	*Speyeria atlantis pahasapa*			G5T3	S3	Y	2	Y	3
Poweshiek Skipperling	*Oarisma poweshiek*	E		G1	S1	Y	2	Y	2a
Regal Fritillary	*Speyeria idalia*			G3	S3	Y	3	Y	2a

Table 2-1 (continued). List of species of greatest conservation need as updated for the 2014 South Dakota Wildlife Action Plan.

Common Name	Scientific Name	Federal Status[a]	State Status[b]	Global Rank[c]	State Rank[d]	2006 SGCN[e]	2006 Eval.[f]	2014 SGCN[g]	2014 Eval.[h]
AQUATIC INSECTS									
A Mayfly	*Analetris eximia*			G3	SNR	N		Y	3
Dakota Stonefly	*Perlesta dakota*			G3	SNR	N		Y	2a; 3
Dot-winged Baskettail	*Epitheca petechialis*			G4	SNR	N		Y	3
Elusive Clubtail	*Stylurus notatus*			G3	SNR	N		Y	3
FRESHWATER MUSSELS									
Creek Heelsplitter	*Lasmigona compressa*			G5	S1	Y	3	Y	3
Elktoe	*Alasmidonta marginata*			G4	S1	Y	3	Y	3
Hickorynut	*Obovaria olivaria*			G4	S1	Y	3	Y	3
Higgins Eye	*Lampsilis higginsii*	E		G1G2	S1	Y	1	Y	1
Mapleleaf	*Quadrula quadrula*			G5	S2	Y	3	Y	3
Pimpleback	*Quadrula pustulosa*			G5	S1	N		Y	3
Rock Pocketbook	*Arcidens confragosus*			G4	S1	Y	3	Y	3
Scaleshell	*Leptodea leptodon*	E		G1G2	S1	Y	1	Y	1
Yellow Sandshell	*Lampsilis teres*			G5	S1	N		Y	3
FISHES									
Banded Killifish	*Fundulus diaphanus*		E	G5	S1	Y	1	Y	1
Blacknose Shiner	*Notropis heterolepis*		E	G5	S1	Y	1	Y	1
Blackside Darter	*Percina maculata*			G5	S2	Y	3	Y	3
Blue Sucker	*Cycleptus elongatus*			G3G4	S3	N		Y	3
Carmine Shiner	*Notropis percobromus*			G5	S2	Y	3	Y	3
Central Mudminnow	*Umbra limi*			G5	S2	Y	1	Y	3
Finescale Dace	*Chrosomus neogaeus*		E	G5	S1	Y	1	Y	1
Hornyhead Chub	*Nocomis biguttatus*			G5	S3	Y	3	Y	3
Lake Chub	*Couesius plumbeus*			G5	S1	Y	3	Y	3

Table 2-1 (continued). List of species of greatest conservation need as updated for the 2014 South Dakota Wildlife Action Plan.

Common Name	Scientific Name	Federal Status[a]	State Status[b]	Global Rank[c]	State Rank[d]	2006 SGCN[e]	2006 Eval.[f]	2014 SGCN[g]	2014 Eval.[h]
FISHES (continued)									
Logperch	*Percina caprodes*			G5	S3	Y	3	Y	3
Longnose Sucker	*Catostomus catostomus*		T	G5	S1	Y	1	Y	1
Mountain Sucker	*Catostomus platyrhynchus*			G5	S3	Y	3	Y	3
Northern Pearl Dace	*Margariscus nachtriebi*		T	G5	S2	Y	1	Y	1
Northern Redbelly Dace	*Chrosomus eos*		T	G5	S2	Y	1	Y	1
Pallid Sturgeon	*Scaphirhynchus albus*	E	E	G2	S1	Y	1	Y	1
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*	T		G4	S4	N		Y	1
Sicklefin Chub	*Macrhybopsis meeki*		E	G3	S1	Y	1	Y	1
Southern Redbelly Dace	*Chrosomus erythrogaster*			G5	S1	Y	3	Y	3
Sturgeon Chub	*Macrhybopsis gelida*		T	G3	S2	Y	1	Y	1
Topeka Shiner	*Notropis topeka*	E		G3	S2	Y	1	Y	1
Trout-perch	*Percopsis omiscomaycus*			G5	S2	Y	1	Y	3

[a] Federal Status - E= Endangered, a species in danger of extinction throughout all or a significant portion of its range; T = Threatened, a species likely to become endangered in the foreseeable future; C = Candidate for federal listing; PE = Proposed for federal listing as endangered; PT = Proposed for federal listing as threatened

[b] State Status - E= Endangered, a species in danger of extinction throughout all or a significant portion of its range in South Dakota; T = Threatened, a species likely to become endangered in the foreseeable future in South Dakota

Table 2-1 (continued). List of species of greatest conservation need as updated for the 2014 South Dakota Wildlife Action Plan.

[c, d] Global/State Rank Definition (applied rangewide for global rank and statewide for state rank; these may change with new information)
G1 S1 = Critically imperiled because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
G2 S2 = Imperiled because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
G3 S3 = Either very rare and local throughout its range, or found locally (even abundantly at some of its locations) in a restricted range, or vulnerable to extinction throughout its range because of other factors; in the range of 21 of 100 occurrences.
G4 S4 = Apparently secure, though it may be quite rare in parts of its range, especially at the periphery. Cause for long term concern.
G5 S5 = Demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery.
GU SU = Possibly in peril, but status uncertain, more information needed.
GH SH = Historically known, may be rediscovered.
GX SX = Believed extinct, historical records only.
GNR SNR = Not yet ranked
_T = Rank of subspecies or variety
_Q = Taxonomic status is questionable, rank may change with taxonomy
SZ = No definable occurrences for conservation purposes, usually assigned to migrants
SP = Potential exists for occurrence in the state, but no occurrences
SR = Element reported for the state but no persuasive documentation
SA = Accidental or casual
Bird species may have two state ranks, one for breeding (S#B) and one for nonbreeding seasons (S#N). Example: Ferruginous Hawk (S3B, SZN) indicates an S3 rank in breeding season and SZ in nonbreeding season.

[e]2006 SGCN - SGCN selected for the 2006 SDWAP; "Y" = Yes, “N”=No

[f]2006 Evaluation – criteria for selection as SGCN in 2006 SDWAP

1 = State or Federal listed species for which the State has a mandate for recovery
2 = Species for which SD represents a significant portion of the species overall range
3 = Species that are indicative of or depend upon a declining or unique habitat in SD

Table 2-1 (continued). List of species of greatest conservation need as updated for the 2014 South Dakota Wildlife Action Plan.

[g]2014 SGCN - SGCN selected for the 2014 SD SDWAP; "Y" = Yes, “N”=No

[h]2014 Evaluation = Criteria for selection as SGCN in 2014 SDWAP revision

1 = State or federally listed species for which the state has a mandate for recovery (listed as threatened or endangered);

2a = Species that are regionally or globally imperiled* and for which South Dakota represents an important portion of their remaining range;

2b = Species that are regionally or globally secure* and for which South Dakota represents an important portion of their remaining range; or

3 = Species with characteristics that make them vulnerable, including any of the following:

- are indicative of or depend on a unique or declining habitat in South Dakota;
- require large home ranges/use multiple habitats;
- depend on large habitat patch sizes;
- depend on an ecological process (such as fire) that no longer operates within the historical range of variation;
- are limited in their ability to recover on their own due to low dispersal ability or low reproductive rates;
- have a highly localized or restricted distribution (endemics); or
- concentrate their populations during some time of the year.

*Based, in part, on NatureServe conservation status ranking: http://www.natureserve.org/explorer/index.htm

2.2 Species Profile Description

Individual species profiles were developed for each of the SGCN (Appendix C and Appendix D). Although format varies slightly between terrestrial and aquatic species, each species profile contains the following information:

Description – a general physical description of the species.

Protection Status – State and Federal designations for protection of a species. For a definition of the Protection Status codes used in each of species descriptions, see Table 2-1.

Distribution

Historic – The best information on distribution of a species prior to European settlement and while habitat was influenced by historical disturbance regimes.

Current – The current known distribution of a species presented in a mapped format.

Data sources are listed on terrestrial species profile maps. Data sources for aquatic species profile maps were the South Dakota Natural Heritage Database and the Macroinvertebrate Reference Database, maintained by Nels Troelstrup, PhD, Department of Biology and Microbiology, South Dakota State University. See Figure 2-1 and Table 2-2 for descriptions of distribution mapping terminology and sources.

Key Habitat - physical description of the known primary habitat features that a species requires to persist in the landscape.

Conservation Challenges – known or expected causes of concern based on our best knowledge of the species; these concerns are categorized as habitat or non-habitat related challenges recognized range-wide and may or may not affect the species in South Dakota; a discussion of conservation challenges is presented in Chapter 5.

Conservation Actions – habitat and non-habitat related conservation actions for each SGCN; habitat related conservation actions are addressed through the coarse filter strategy for ecosystem diversity; non-habitat related actions are identified; a discussion of conservation actions is presented in Chapter 6.

Current Monitoring and Inventory Programs – relevant ongoing monitoring programs. The overall list (Appendix E) was drafted by SDGFP and incorporated input from private, governmental, and tribal partners. All species currently monitored as sensitive species by the South Dakota Natural Heritage Program (http://gfp.sd.gov/wildlife/threatened-endangered/rare-animal.aspx) benefit from opportunistic data resulting from field surveys, scientific research, activities conducted under various state permits, and on-line reporting from citizen scientists and internal and external technical staff.

State Wildlife Grant (SWG) Accomplishments – State Wildlife Grant-funded projects conducted in South Dakota related to the species, if appropriate. A listing of all SWG projects conducted by the time of the Plan's completion is found in Appendix F. Many of these projects are not listed in individual species profiles because they relate to habitats or apply to multiple species or species groups. Concise summaries and end-products of each project, such as graduate theses, dissertations, and publications, are available on the SDGFP website.

Priority Research and Monitoring Needs – relevant projects related to continuing or future research and monitoring needs for the species. The overall lists (Appendices G-K) were drafted by SDGFP and incorporated input from private, governmental, and tribal partners.

Existing Recovery Plan/Conservation Strategy – a preexisting state or federal recovery plan or conservation strategy developed for the species, if relevant.

Figure 2-2 presents an example of a SGCN profile.

Figure 2-1. Description of species of greatest conservation need distribution map terminology.

Terrestrial SGCN

Summer	
Migration	Migration corridor with observations occurring in spring and fall
Winter	
Year Round	

Aquatic SGCN

Confirmed	
Probable	Watershed with hydrology connected to adjacent watershed with current species documentation
Historic	Species records from the South Dakota Natural Heritage Database documented pre-1985
Current	Species records from the South Dakota Natural Heritage Database documented from 1985 through 2013

Table 2-2. Description of sources used in species of greatest conservation need distribution maps

Source Code	Description
Amphibians and Reptiles of SD	Kiesow, A.M. 2006. Field guide to amphibians and reptiles of South Dakota. South Dakota Dept. of Game, Fish, and Parks, Pierre, South Dakota.
Birds of SD	Tallman, D.A., D.L. Swanson, and J.S. Palmer. 2002. Birds of South Dakota. Third edition. South Dakota Ornithologists' Union, Aberdeen, South Dakota.
Butterflies of SD	Marrone, G. 2002. Field guide to butterflies of South Dakota. South Dakota Dept. of Game, Fish, and Parks, Pierre, South Dakota.
Expert Opinion	Internal and external consultation with species experts
Mammals of NGP	Jones, J.K. Jr., D.M. Armstrong, R.S. Hoffman, and C. Jones. 1983. Mammals of the Northern Great Plains. University of Nebraska Press, Lincoln, Nebraska, USA.
Mammals of SD	Higgins, K.F., E.D. Stukel, J.M. Goulet, and D.C. Backlund. 2000. Wild mammals of South Dakota. South Dakota Dept. of Game, Fish, and Parks, Pierre, South Dakota.
SDBBA	South Dakota Breeding Bird Atlas II. 2013. South Dakota Dept. of Game, Fish, and Parks, unpublished data.
SDGFP	Data acquired by the South Dakota Dept. of Game, Fish and Parks
SDNHD	Records from the South Dakota Natural Heritage Database. Historic records=pre 1985, Current records=1985 to 2013. In most cases current records were used for distribution maps with the exception of a few species for which there is limited information.
Tiger Beetles of SD and NE	Spomer, S.M., M.L. Brust, D.C. Backlund, and S. Weins. 2008. Tiger beetles of South Dakota and Nebraska. Dept. of Entomology, University of Nebraska, Lincoln, Nebraska, USA.

Figure 2-2. Example of information provided in each species of greatest conservation need profile.

American Burying Beetle AMBE *Nicrophorus americanus*

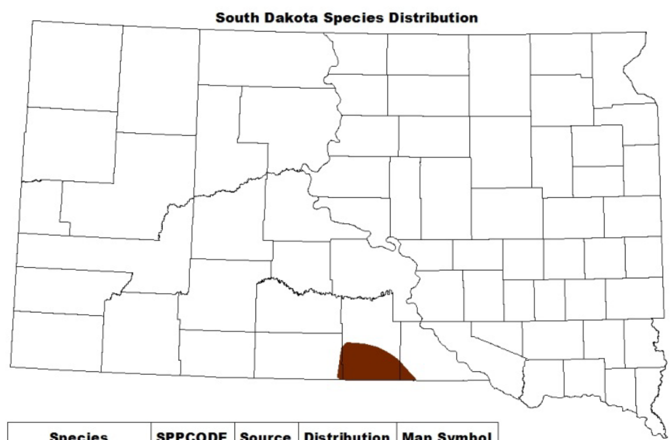
Description:

Large, shiny, black burying beetle with orange patches on wings and head.

Protection Status:

Federal: Endangered

State: None



Species	SPPCODE	Source	Distribution	Map Symbol
American burying beetle	AMBE	SDNHD	Year Round	

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout South Dakota with the possible exception of MLRA 62. Today, it is only known to occur in a small portion of its previous range - see current distribution map at right.

Key Habitat:

Believed to be a habitat generalist as long as there are abundant carrion sources. However, it has been found to be positively correlated with little bluestem mixed prairies, disturbed grasslands, and fine sandy loams that are well-drained and at least moderately permeable. It is typically negatively correlated with forests, bottomland habitat, clays, and silt loams. Habitat areas must be large enough to allow sufficient distance for movements in search of carrion and mates (e.g., may move as a far as 2 miles in 24 hours). A small area of potential habitat is not expected to support a population long term.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: population declines for this species are poorly understood at this time but some suggestions includes carcass reduction/limitations, pesticide use, disease, light pollution, or a combination of these factors

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and industry to reduce pesticide/herbicide use and excessive light pollution in habitat

Current Monitoring & Inventory Programs (Appendix E):

Population surveys

SWG Accomplishments (Appendix F):

Monitoring the American burying beetle in South Dakota (T-17A)

Priority Research & Monitoring Needs (Appendices G-K)

Periodically survey occupied areas to monitor population status and trends

Existing Recovery Plans/Conservation Strategies:

U.S. Fish and Wildlife Service. 1991. American burying beetle (*Nicrophorus americanus*) recovery plan. Newton Corner, MA. 80pp.

2.3 Case Studies

Two examples are presented to assist the reader in finding information about each species of greatest conservation need.

Burrowing Owl

From the species profile in Appendix C, we learn the following:

- this species is not protected as a state or federal threatened or endangered species
- the burrowing owl can potentially occur throughout much of South Dakota in colonies created by black-tailed prairie dogs or ground squirrels
- key habitats include burrows in areas with low vegetative cover to allow easy viewing of the surroundings and to aid in finding prey
- the distribution map was created using records from the South Dakota Natural Heritage Database and the South Dakota Breeding Bird Atlas project
- coordination with agencies and landowners will help assure that adequate numbers and distribution of colonial rodents provide the habitat needed by burrowing owls
- monitoring through the North American Breeding Bird Survey provides information on this species, in addition to regular prairie dog mapping efforts to describe its habitat
- several State Wildlife Grant-funded projects have provided useful information on abundance and management needs, but additional information is needed on specific habitat requirements and habitat trends
- a conservation plan for the burrowing owl released in 2003 can help guide management and conservation efforts in South Dakota

From Table 2.1, we learn that this species was included as a SGCN because of criterion 3 (Species with characteristics that make them vulnerable). In this case, the burrowing owl was included because of its dependence on the continued distribution of black-tailed prairie dog and ground squirrel colonies. Table 2.1 also informs us that this species has a global rank of G4 (Apparently secure, though it may be quite rare in parts of its range, especially at the periphery. Cause for long term concern). The burrowing owl's state rank is S3S4B, indicating that its breeding status falls between S3 (Either very rare and local throughout its range, or found locally in a restricted range) and S4 (same definition as G4 above, but with the range defined as its range within South Dakota).

Table 5.5 indicates that this species is predicted to have a variable response to climate change. Because of its dependence on colonial rodent burrows, the burrowing owl's response to climate change will depend on how climate change affects the black-tailed prairie dog and the more abundant ground squirrel species.

From Appendix E, we learn that several entities monitor the status of black-tailed prairie dog colonies in South Dakota. Appendix F provides the specific objectives of the SWG-funded projects (T-41, T-23, and T-2-5) pertaining to burrowing owls. Recommended monitoring and research needs for this species can be found in Appendices G through K. Examples include the need to monitor nest success, population trends, and prey availability.

Blacknose Shiner

From the species profile in Appendix C, we learn the following:

- this species is a state endangered species, but has no protection under the federal Endangered Species Act
- the blacknose shiner has a limited distribution, occurring only in southcentral South Dakota, which is the western periphery of this species' range; two historic records are also displayed outside the current distribution
- the distribution map was created using records from the South Dakota Natural Heritage Database and the Fish and Macroinvertebrate Reference Database at South Dakota State University (Section 2.2)
- the blacknose shiner inhabits cool, vegetated streams, rivers, and lakes with sandy substrates
- challenges for this species include habitat degradation practices that increase turbidity and siltation and reduce vegetation
- partnerships and cooperation are recommended to improve the species' status, in addition to management to reduce soil erosion and runoff of nutrients and pesticides into water bodies
- the blacknose shiner benefits from monitoring of western streams and rivers by SDGFP and South Dakota State University
- a State Wildlife Grant-funded project in the Sandhills (T-2-8) provided information on this species
- there is currently no conservation plan for the blacknose shiner to guide management and conservation efforts in South Dakota

From Table 2.1, we learn that this species was included as a SGCN because of criterion 1 (State or federal listed species for which the state has a mandate for recovery). Table 2.1 also informs us that this species has a global rank of G5 (Demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery). The blacknose shiner's state rank is S1 (Critically imperiled because of extreme rarity or because of some factors making it especially vulnerable to extinction).

Table 5.6 indicates that this species is moderately vulnerable to climate change, possibly due to barriers to dispersal and its reliance on specific habitat variables.

Appendix F provides the specific objectives of the SWG-funded project pertaining to the blacknose shiner. Recommended monitoring and research needs for this species can be found in Appendices G through J. Some examples include the need for additional information on distribution, status, population dynamics, critical habitats, limiting factors, seasonal movements, and recolonization potential. Appendix U lists the selected aquatic conservation opportunity areas for prioritizing efforts to help meet the needs of the blacknose shiner.

Chapter 3 Native Ecosystem Diversity – Terrestrial and Riparian-Wetland Ecosystems

South Dakota's native ecosystem diversity strategy is based on providing sufficient amounts of terrestrial and riparian-wetland native ecosystems on the landscape to support the native biodiversity that has evolved with those conditions. Native ecosystems represent the combination of communities of living organisms with the physical environment in which they live. The range of ecosystem conditions, or native ecosystem diversity, occurring across a landscape and available as habitat for plants and animals is the result of disturbance processes (e.g., grazing, fire, etc.) interacting with site conditions and climate. Native ecosystem diversity is usually described by the range of vegetation communities occurring on similar sites, as these are often the most obvious characteristic to the observer when trying to delineate differences among sites. While ecosystems can be clearly distinct from each other, more frequently they have less clearly defined edges that transition from one ecosystem type to another. However, to describe and quantify the amounts of these ecosystems for assessment and management purposes, it is necessary to map a line between ecosystems while recognizing that these delineations may not always be obvious to the naked eye without more detailed field surveys or assessments.

Native ecosystem diversity can be defined as the variety of plant communities (each similar community is considered a functional ecosystem) and their associated animal populations that would occur within a defined area as a result of the combined influences of the abiotic environment, climate, and natural disturbance processes. **Ecosystem diversity, when adequately described, characterized and conserved, should provide habitat for the majority of species, both plant and animal, that have evolved and adapted to the conditions present in a defined area.**

The combined, incremental effects of human activity on native ecosystem diversity and their associated wildlife since Euro-American settlement, have given rise to the need for development of South Dakota's wildlife conservation strategy. Natural resource managers have long recognized the difficulty in quantifying and describing these changes in meaningful ways to facilitate a reversal of their decline and loss across broad landscapes. To assist in that regard, a coarse-filter strategy based on native ecosystem diversity was selected as South Dakota's conservation strategy for terrestrial and riparian-wetland systems. It is used as the scientific framework to describe the underlying basis and assumptions used to define and quantify ecological restoration to support all biological diversity across South Dakota. The following sections describe this conservation strategy in more detail and provide information on its implementation.

3.1 Conservation Strategy

A conservation strategy that focuses on restoring native ecosystem diversity for terrestrial and riparian-wetland systems provides a strong scientific foundation for overall conservation of biological diversity as well as the flexibility to consider other land uses in the overall effort (Haufler 1999). This strategy evaluates ecosystem integrity and biological diversity relative to what has occurred historically at a specific site or location. For this purpose, historical is typically considered a time-period of less than 1000 years prior to European settlement. There is a strong scientific foundation for using an historical reference for defining ecosystem integrity and biological diversity (Morgan et al. 1994, Swetnam et al. 1999). It was the complex array and dynamic distribution of ecosystems across South Dakota that shaped and sustained the biological diversity of the region. Most of the wildlife present in South Dakota today is the product of historical ecosystems that existed on the Great Plains for thousands of years. Understanding the types, distribution, and dynamics of these ecosystems is fundamental to understanding and managing South Dakota's wildlife.

Terrestrial and riparian-wetland ecosystems and habitats have and continue to be directly altered by human actions. Although Native Americans interacted and influenced ecosystems for thousands of years, these influences are incorporated in an historical reference. It is the extent of human influence over the last 150 years that is of greatest conservation concern. Native ecosystem conversion to agricultural, urban, and suburban uses, are the most obvious impacts. However, there are also less obvious, yet in some instances more pervasive, human-induced changes as well. We have only recently begun to understand the implications of a century of European alterations to and interruptions of natural disturbance regimes in the Great Plains. Recent studies have shown that the suppression or cessation of natural disturbance has gradually changed ecosystem processes and ultimately the composition, structure, and function of many ecosystems (Kucera 1978, Fuhlendorf and Engle 2001, Lett and Knapp 2005, Jackson et al. 2010). These changes have also impacted the distribution and quality of habitat for many species. Therefore, important reference information for the identification of ecosystems or habitats in need of conservation includes a description and assessment of historical conditions as influenced by natural disturbance regimes. With such information, departure from historical amounts and distributions of ecosystems and corresponding species habitats can be mapped and quantified. Such information can be used to identify critical remaining areas of intact or "natural" ecosystems, highlight areas with greatest restoration potential, and describe historical habitat connectivity for selected species.

The SDWAP incorporates a combined coarse-filter and fine-filter strategy for conservation of biological diversity (TNC 1982, Haufler et al. 1996, Samson 2002, Haufler et al. 2002). The coarse-filter strategy seeks to preserve biological diversity by maintaining a variety of historically occurring and naturally-functioning ecosystems across the landscape. The fine-filter strategy then uses our best understanding of a species habitat needs to evaluate whether the coarse-filter will provide the habitat conditions to meet that species' needs, or whether additional actions are required.

A description of ecosystem diversity that is based on historical references for plant community compositions, structures, and dynamic processes provides the coarse-filter component of this strategy. A description of threats and habitat needs for individual wildlife species of concern represents the fine-filter component. For most wildlife species, habitat needs will be provided by the ecosystem diversity resulting from the coarse-filter. The SDWAP will use the coarse-filter/fine-filter strategy, based on the historical reference, across its broad planning area, but to be effective, it will need to consider relatively fine scale information on ecosystem types and distributions to address the habitat needs of many species (Poiani et al. 2000, Flather et al 2009).

Combining a coarse-filter and fine-filter strategy has several advantages. First, the coarse-filter provides a sound scientific foundation for identifying and quantifying the cumulative effects of post-settlement activities on native ecosystem diversity, which in turn provides better information for the fine filter assessment to evaluate the resulting impacts to species and their habitat (Haufler et al. 1999). Second, it is more time and cost effective to manage for desired ecosystem conditions than to manage for an ever-increasing number of endangered, threatened, or declining species scattered across the landscape. Third, a coarse-filter provides the mechanism to make sense of conflicting habitat demands in a single landscape for multiple species of interest. Finally, for many SGCN, little information on their distribution within South Dakota and specific habitat needs is available at this time. By applying the coarse-filter strategy, we are increasing the likelihood that the habitat needs of these species will be addressed with the restoration or maintenance of historical ecosystems.

Application

Biological diversity is often assessed at four levels: 1) landscape, 2) ecosystem (sometimes also referred to as the community level), 3) species, and 4) genetic (Noss 1990, Hunter 1991, Haufler et al. 2002). The combination of a coarse-filter and fine-filter strategy provides the mechanism to address these four levels of biological organization. The coarse-filter addresses the landscape and ecosystem levels while the fine-filter addresses the species level. Genetic analyses can be a component of the fine-filter, and may also provide insights into landscape and ecosystem level functionality. The primary emphasis for the purpose of the SDWAP, however, is on the landscape, ecosystem, and species level of scale. Genetic levels can be incorporated at future times when needed to address specific questions such as connectivity within a population of a species.

For the purposes of the SDWAP, we applied the coarse-filter/fine-filter strategy in the following sequence:

1. Delineate ecoregions (using MLRAs for terrestrial and riparian-wetland ecosystems and ecological drainage units for aquatic ecosystems) within South Dakota to facilitate ecosystem diversity characterization and management;
2. Classify ecosystem diversity (by ecological sites) as it occurred under natural disturbance regimes within each ecoregion to describe the coarse-filter;
3. Describe conservation challenges for maintaining or restoring native ecosystem diversity;
4. Develop ecosystem diversity goals that identify desired levels of representation for all historical ecosystems;
5. Identify and describe a process for implementing ecosystem diversity goals relative to existing conditions and for making recommendations for ecosystem restoration;
6. Evaluate species diversity within South Dakota and identify SGCN;
7. Evaluate the habitat needs/requirements of SGCN relative to the ecosystem diversity goals;

8. Identify those species requiring non-habitat related management activities not addressed by the emphasis on ecosystem diversity;
9. Develop conservation actions to address the habitat and non-habitat related needs of SGCN;
10. Identify Conservation Opportunity Areas to help direct conservation actions to the most appropriate locations; and
11. Identify opportunities for collaborative partnerships within the state to achieve the conservation goals.

3.2 Ecoregions – Major Land Resource Areas

Ecological classification systems at the regional level, often referred to as ecoregions, are developed to stratify smaller scale ecosystem complexity into discrete units. They describe areas of similar climate, physiography, hydrology, vegetation, and wildlife habitat potential. In addition, natural disturbances are often constrained by the underlying physical features of soils and topography characterizing a region. Major Land Resource Areas (MLRAs) (USDA NRCS 2006) have been delineated by the Natural Resources Conservation Service to characterize landscape patterns that combine soils, water, climate, vegetation, and land use. The MLRA classification is relatively well developed and is supported at greater resolutions by ecological site information and soils data. For this reason, MLRAs were selected as the primary terrestrial classification system to derive ecoregional boundaries. Section 3.1 presents a map of the 18 MLRAs occurring in South Dakota. Table 3-1 provides a summary of their acreage. For more information on the methodology used to develop MLRAs as well as more detailed descriptions of their characteristics and general features, see the NRCS handbook developed for that purpose (USDA NRCS 2006).

Two categories of ecological systems occur in South Dakota – terrestrial and riparian-wetland-aquatic. The terrestrial systems are further broadly delineated by grass-shrub systems and forested systems. Grass-shrub systems are the most common in South Dakota at roughly 40.5 million acres or 82% of the state while forested systems represent only 1.5 million acres or 3% of the state. Riparian-wetland-aquatic systems represent approximately 7.4 million acres or 15% of the state. Figure 3-2 presents a map of the distribution of these primary ecological systems in South Dakota.

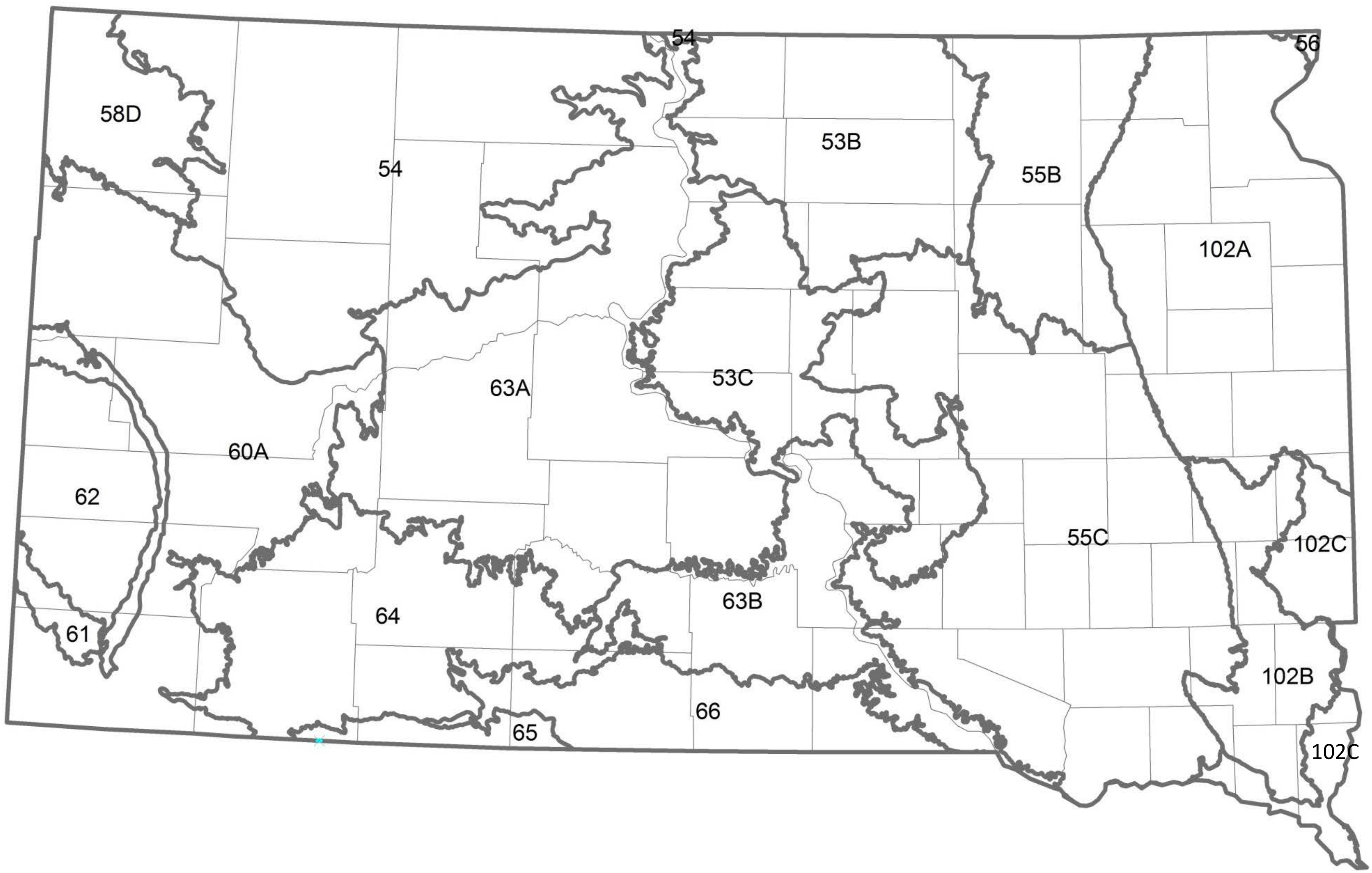


Figure 3-1. Map of Major Land Resource Areas for South Dakota (USDA NRCS 2006).

Table 3-1. Number of acres representing the 18 Major Land Resource Areas occurring in South Dakota.

MLRA #	NAME	ACRES
53B	Central Dark Brown Glaciated Plains	2,947,816
53C	Southern Dark Brown Glaciated Plains	2,581,928
54	Rolling Soft Shale Plain	6,185,838
55B	Central Black Glaciated Plain	2,201,465
55C	Southern Black Glaciated Plain	6,948,318
56	Red River Valley of the North	35,505
58D	Northern Rolling High Plains, Eastern Part	1,148,276
60A	Pierre Shale Plains	4,518,607
61	Black Hills Foot Slopes	549,299
62	Black Hills	1,394,761
63A	Northern Rolling Pierre Shale Plains	6,497,132
63B	Southern Rolling Pierre Shale Plains	2,324,982
64	Mixed Sandy and Silty Tableland and Badlands	3,179,007
65	Nebraska Sand Hills	298,073
66	Dakota-Nebraska Eroded Tableland	1,590,464
102A	Rolling Till Prairie	4,563,626
102B	Till Plains	1,418,212
102C	Loess Uplands	969,396
		49,325,705

3.3 Natural Disturbance Processes

The SDWAP selected a conservation strategy that uses the historical reference and understanding of natural disturbance regimes to maintain or restore biological diversity in the State. But what do we mean by the terms historical reference and natural disturbance and why are they important?

We define historical reference as the ecosystem conditions that resulted from natural (i.e. fire, herbivory, etc.) and human-influenced (i.e. Native American) disturbance that created the dynamic conditions species relied upon for their habitat. Natural disturbance regimes are the patterns of frequency and intensity that can be quantified using ecological evidence (Morgan et al. 1994, White and Walker 1997). For example, both fire and flood regimes are frequently described relative to frequency of occurrence and relative intensity. Another term frequently used in relation to historical conditions is the historical or natural range of variability. Historical range of variability is an important concept because it emphasizes that many ecosystems varied in amounts, compositions, and structures due to variations in climate and stochastic events (Aplet et al. 1999, Keane et al. 2009).

The historical reference is usually confined to a period less than 1,000 years prior to European settlement, as these reflect the habitat conditions most relevant to the wildlife species that are present today (Morgan et al. 1994). In some areas of the country quantifying historical reference may be a difficult task due to a lack of ecological information to help describe historical conditions. Depending on the area of South Dakota in question, specific types of historical information can be available to help reconstruct the historical range of variability (White and Walker 1997, Egan and Howell 2001). However, in some ecosystems historical information is less available, and historical ecosystem dynamics require use of models based on best available information. The use of models to describe and quantify historical conditions will be discussed further in a later section of this Plan.

It is recognized that ecosystems were not static during any defined reference period. Species distributions were changing, human activities were changing, and species themselves were adjusting to these changes through behavioral and genetic alterations. However, providing an understanding of the ecosystem diversity that occurred during an identified timeframe prior to European settlement provides critical reference information for defining and quantifying a baseline of what should be considered "natural" for an area. The following sections discuss the primary natural disturbance processes influencing the ecosystem and biological diversity of South Dakota prior to European settlement.

Climate

The past Northern Great Plains climatic pattern is cyclical between wet and dry periods (Woodhouse and Overpeck 1998). Cold winters and hot summers are typical, along with low humidity, desiccating winds, light rainfall, and plenty of sunshine. South Dakota is near the geographic center of North America and with few natural barriers on the northern Great Plains, air masses move freely across the plains and account for rapid changes in temperature. The South Dakota climate is an integral process that can cause changes in plant species composition between years and among seasons (Collins and Barber 1985). The cycle of wet and dry periods can also influence periodic increases and decreases in the tall and short grasses (Truett 2003), as well as in woody plants (Sieg 1997).

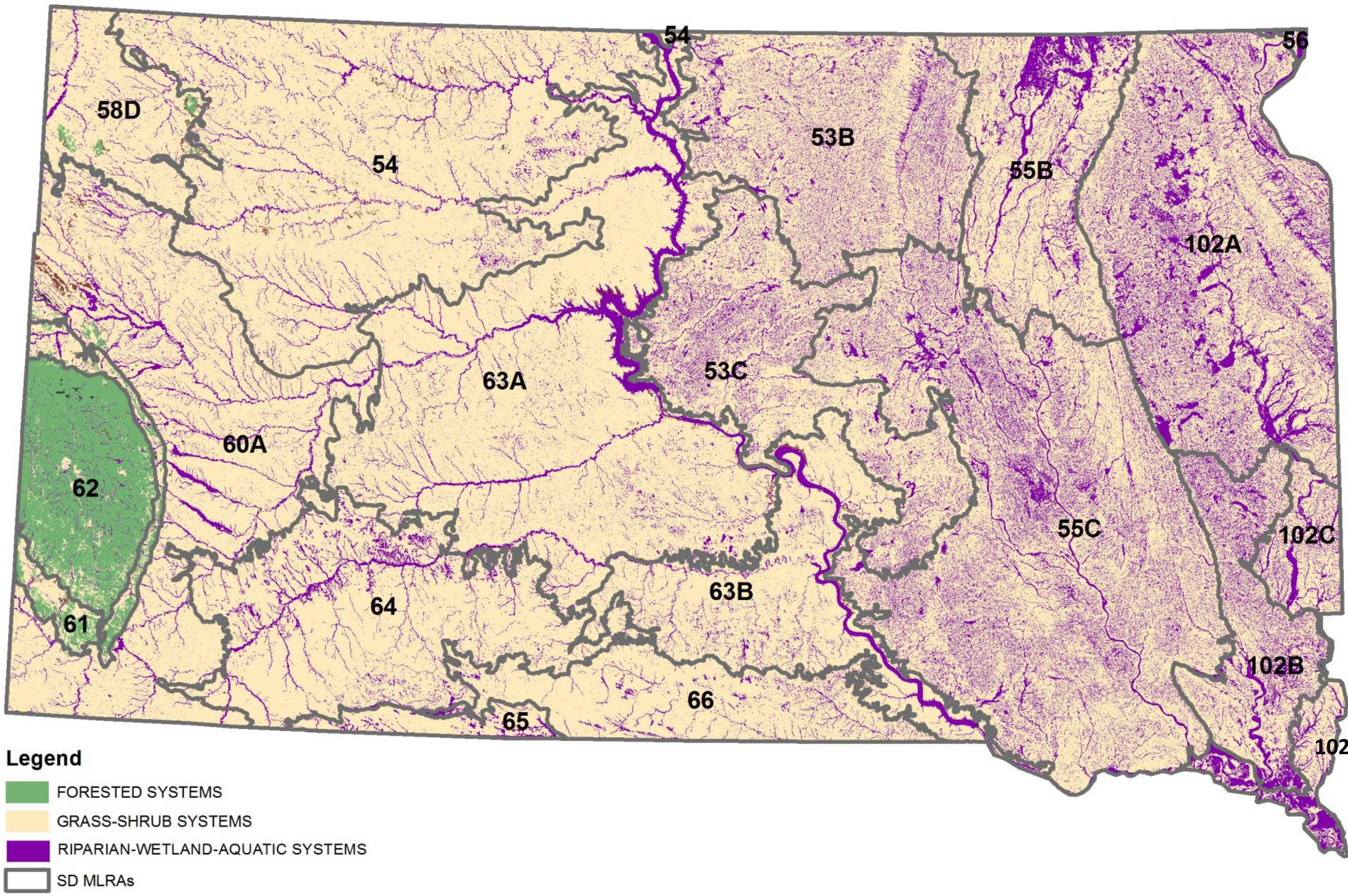
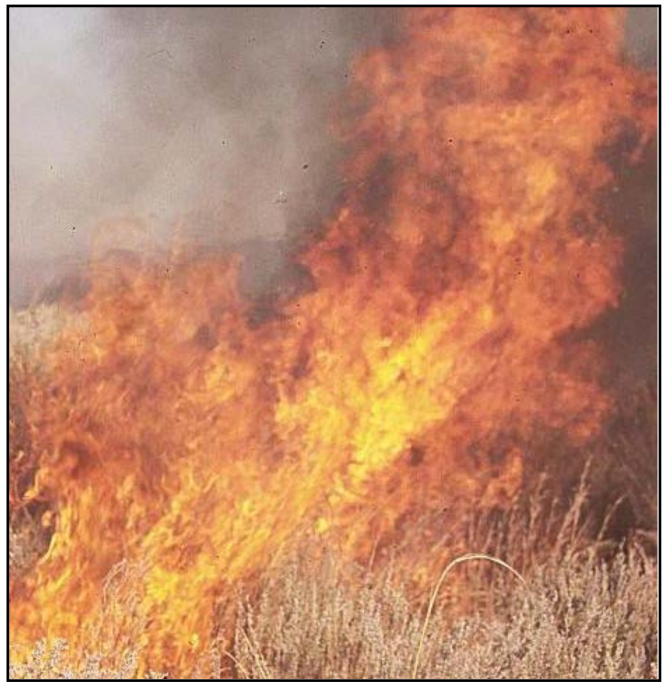


Figure 3-2. Location of primary ecological systems in South Dakota.

Fire

"A cloudy morning, and smoky all day from the burning of the plains, which were set on fire by the Minetares for an early crop of grass, as an inducement for the buffalo to feed on……" Captain Clark, Fort Mandan, North Dakota, 1805.

"The effect of fire must be regarded as having been always operative in the Great Plains region. Fires are started by lightning during almost every thunderstorm, and the advent of man, has, if anything, tended to check rather than to increase their ravages." (Shantz 1911)



Fire in South Dakota was a relatively common disturbance event prior to European settlement (Higgins 1986). Many anecdotal and scientific reports have documented the widespread occurrence of fire throughout the State and the region. The causes of these fires were both natural (i.e. lightning) and human-initiated (i.e. Native Americans). Native Americans were observed on many occasions initiating fires to improve habitat, hunting, or travel conditions (Higgins 1986).

Grass/shrub ecosystems - Fire is closely linked with climatic cycles as even brief dry periods can provide conditions that favor fire, particularly in grassland-dominated systems. For thousands of years on the Great Plains, fire events have been an integral part of the grassland ecosystem (Daubenmire 1968a). Many plant species have developed strategies to benefit from fire, thereby contributing to a landscape mosaic of greater species and structural diversity resulting from the fire regime (Daubenmire 1968a, Anderson 1990).

Grassland species exhibit a number of characteristics and strategies that are suited to a fire-prone landscape, where low humidity, drying winds, and low soil moisture are common (Daubenmire 1968a). In general, fire-dependent ecosystems are expected to burn more easily than non-fire dependent ecosystems, as they have traits that make them more flammable (Mutch 1971). For example, grassland ecosystems often produce biomass that may not decompose in a given year or a multitude of years. If a site is not grazed to remove the year's growth, it will become more vulnerable to fire. Many studies have documented the significance of fire in maintaining the grassland's equilibrium (Collins and Barber 1985, Heisler et al. 2003, Anderson 1982). Yet, it is important to note that even in a single landscape, the differences between abiotic conditions characterizing ecological sites contribute to different fire regime characteristics in terms of frequency, severity, and patch size (Nichols et al. 1998).

The effects of fire on grassland ecosystems are a function of the fire's frequency and intensity, as well as the season that the fire occurred. Fire return intervals may have varied widely due to climate, site conditions or previous grazing disturbance. Lightning is a primary cause of naturally occurring wildfire events in South Dakota. Higgins (1984) reviewed lightning-caused fire records (1940-1981) and found an average of 6 fires per year per 10,000 km^2 in eastern North Dakota grasslands, 22 per year per 10,000 km^2 in southcentral North Dakota, 25 per year per 10,000 km^2 in western North Dakota grasslands, and 92 per year per 10,000 km^2 in pine-savanna lands in northwestern South Dakota. Lightning strikes appeared to be more prevalent in areas with trees. Fires caused by lightning occurred more frequently west of the Missouri River than east of the river. However, overall fire return intervals are lower west of the Missouri River, likely due to lower fuel loadings that carry fire across the landscape and beyond the immediate strike location.

Lightning caused fires can occur from March to December but the majority occurred from mid-to late summer (Higgins 1984). Specific information on the spatial extent of historical fires is not available but fires occurring during the growing season are expected to have been limited in spread by green vegetation and higher levels of humidity. Those fires occurring during drought conditions or after the growing season may have had the greatest spatial extent. Even within these fire-dominated landscapes, microhabitats exist in riparian zones, badlands, ravines, and other fire-protected locations where fire-intolerant species could persist.

Fire influences grassland vegetation in a number of ways. Depending on the season, fire can have a substantial effect on species diversity. For example, spring burning increased the dominance of tall-statured bunchgrasses and reduced the cover of short-statured sodgrasses (Kucera 1978). Fires occurring during the growing season generally limit spread or occurrence of woody vegetation outside of riparian/wetland areas (Kucera 1978). Fire also releases important nutrients into the soil for root uptake as well as releases nutrients bound in litter. Removal of plant litter also changes light and temperature levels at the ground level, influencing plant productivity and growth conditions (Vinton and Collins 1997).

Forest Ecosystems – Based on historical accounts (Parrish et al. 1996, Grafe and Horsted 2002) and recent studies (Brown and Sieg 1996, Brown and Sieg 1999), the Black Hills forested landscape was likely influenced by three primary fire regimes; short-interval, long-interval, and mixed severity. The short-interval fire regime was predominantly characterized by relatively frequent, low to moderate intensity fires that burned along the ground and remained within the forest understory. The frequency of these fires influenced both the species composition and vegetation structure within these forests. Fire tolerant species such as ponderosa pine and bur oak were usually dominant in the overstory and bunch grasses were dominant in the understory. The potential for destructive wildfire, insect, or disease events were low. Stand history studies in fire-influenced forest ecosystems have demonstrated that stands occurring within the short-interval fire regime had relatively predictable species composition and vegetative structure (Sheppard and Battaglia 2002). They were also less likely to move through a typical successional progression of age classes. Instead, fire maintained a multi-age structured stand, characterized by saplings to old growth trees with relatively low numbers of trees per acre.

The long-interval fire regime was characterized by infrequent, high-intensity fire that consumes both the forest understory and overstory as it moved across the landscape. These stand replacing events resulted in a short term, severe effect on stand conditions, in contrast to the persistent, yet less obvious effects of the short-interval fire regime. The result of this impact was to set the stand back to an early successional stage, and release plant species stimulated by severe fire events. Typically, the stand proceeded along a successional trajectory for many years, depending on the ecological site, before another high-intensity fire would again set the stand back to an early successional stage.

A "mixed-severity" fire regime also occurred in landscapes with both short- and long-interval fire regimes. That is, depending on site conditions or position on the landscape, low, moderate, and high severity fires could occur within the same forest stand, resulting in a mosaic of diverse stand conditions. This fire regime is more common through the transitional portion of the environmental gradient where the lower elevation and drier sites were dominated by the short-interval fire regime and higher elevation or moister sites were dominated by the long-interval fire regime. Consequently, where a transitional site occurred primarily adjacent to the drier types, it was predominantly influenced by a short-interval fire regime with pockets of long-interval fire influences. Where it occurred primarily adjacent to the moister types, it was predominantly influenced by a long-interval fire regime with pockets of short-interval fire influences. Topographic features also influenced the occurrence of a mixed-severity fire regime. For example, dry south aspect slopes and ridges within a cool and moist ecological site (e.g., cool, moist white spruce) were predominantly influenced by a short-interval fire regime. Whereas under average site conditions, this ecological site would more typically be influenced by a long-interval fire regime.

Grazing

"This scenery already rich, pleasing, and beautiful was still farther heightened by immense herds of buffalo, deer, elk, and antelope which we saw in every direction feeding on the hills and plains." Meriwether Lewis, 1804

Although the Great Plains grasslands were grazed by a multitude of herbivores, no single species was more influential than bison in shaping the grassland ecosystems of South Dakota. Bison were the largest herbivore both in size and numbers, prior to European settlement. Historic population numbers of bison in North America have been estimated at 30 million individuals. However, by 1890, bison were functionally and physically extirpated from the wilds of South Dakota (Shaw

1995). Today, several thousand bison exist in relatively small herds within fenced boundaries of parks or private lands.

Loss of bison from the Great Plains grasslands occurred before any meaningful research could be conducted on their foraging habits and movement patterns. Much of the information we have today is extrapolated from ungulate studies of similar grazing systems around the world or from research conducted on the remaining small bison herds that are confined within relatively small portions of a landscape. The historical movement pattern of free-ranging bison has been a contentious topic for researchers. However, the dominant view is that bison had two distinct, but not mutually exclusive bison populations; resident herds and migrant herds. Migrant herds of bison are estimated to have outnumbered resident herds by more than four to one (Shaw 1995). In fact, grazing ecosystems around the world are dominated by migratory herbivores (Isenberg 2000, Epp and Dyck 2002). Migratory grazers track high-quality forage across a large geographic region. Since the nutritional content of plants is highest during the early stages of growth, grazers tend to seek areas where plants are actively growing; this new growth is sometimes referred to as the “green wave” (Stelfox et al. 1986). At the landscape level, location and seasonal extent of the “green wave” are primarily controlled by annual climate variability. Grazing is often intense in the path of a herd but usually does not last long because the animals are continually moving. The time a bison herd would remain in an area was dependent on the availability of high-quality forage. This long evolutionary history between grasslands and migratory grazers has resulted in an interdependent web of energy and nutrient flows. Removal of migratory grazers from the Great Plains has likely altered the functional character of these grassland ecosystems.

The levels of grazing within the “green wave” were further influenced by juxtaposition to water sources and recent fire events. Bison, like most herbivores, require a regular supply of water. Those sites surrounding rivers, lakes, and ponds would receive a disproportionate amount of heavy grazing due to the congregating herd of animals. Those sites farthest from water sources would receive the least amount of grazing (Soper 1941). Many researchers have also found that recently burned sites will attract bison (Frank et al. 1998, Bamforth 1987, Biondini et al. 1999). The release of soil nutrients and the corresponding rapid new growth represent high-quality forage for several seasons following a fire event. At the landscape level, historical fire and grazing disturbance regimes interacted to provide a mosaic of structural and successional conditions across South Dakota’s grassland ecosystems. Within native grasslands throughout the world, it is a rare event for herbaceous regrowth to go ungrazed following a fire (Coppock and Detling 1986). The amount of forage removed from a site and its distribution in the landscape determine the probability and intensity of the next fire event. Thus, the combination of fire and grazing yields the dynamic habitat mosaic and landscape heterogeneity to which prairie wildlife species are well adapted (Hartnett et al. 1996).

Ecologists frequently characterize grassland ecosystems of the Great Plains by the ungrazed height or stature of the dominant grass species (e.g., tallgrass, mixedgrass, and shortgrass systems). The dominant grass species, and consequently grass height, are functions of both precipitation and grazing (Truett 2003). In general, the height and stature of dominant grasses within South Dakota decrease from east to west with corresponding levels of precipitation, as well as drought cycles. The height and stature of dominant grasses will also decrease with increased grazing intensity. Therefore, the boundaries of the tallgrass versus mixedgrass versus shortgrass systems, as we delineate them today, would have changed over time in response to drought cycles and grazing intensity.

At the ecosystem level, bison grazing influenced the grassland community in many ways (Hartnett et al. 1996, Hartnett et al. 1997, Knapp et al. 1999). Overall, bison consume more warm-season grasses. However, early in the season, cool season grasses and sedges represent a higher percentage of the forage. As the season progresses, warm-season grasses are preferred. For this reason, it has been suggested that bison may have grazed the tallgrass prairies in the dormant and early growing season and then moved on to the mixedgrass and shortgrass prairies as the growing season progressed. This pattern exists in other grazing systems of the world containing both short and tallgrass systems. Bison prefer grasses over forbs, with greater than 90% of the diet consisting of graminoids (grasslike plants), thereby increasing the ratio of forbs in the community. Many of the dominant tall-statured bunchgrass species, such as bluestems or Indiangrass, decrease with increasing bison grazing while many of the short-statured sodgrass species, such as blue grama and buffalograss, increase.

Black-tailed Prairie Dogs

> *The barking squirrels "appear here in infinite numbers and the shortness and virdue of grass gave the plain the appearance throughout its whole extent of beautiful bowling-green in fine order." Lewis, 1804.*

The black-tailed prairie dog is the only species of prairie dog found in South Dakota. They were historically distributed throughout the shortgrass and mixedgrass regions of South Dakota but were unlikely to be found in the tall-grass region of eastern South Dakota, as site productivity limited their ability to keep grass heights low for colony safety (Virchow and Hygnstrom 2002). Prairie dogs are highly social animals and can live in colonies that range in size from one acre to thousands of acres. They have been estimated to occupy nearly several million acres of grasslands prior to European settlement in South Dakota (Van Pelt 1999). Nationwide and within South Dakota, they are currently estimated to occupy only a fraction of their former range.

Black-tailed prairie dogs are considered a natural disturbance component in South Dakota due to the effect of their colonies on grassland ecosystems. Prairie dogs construct ground burrows for their shelter and protection from predators. As many as 30 to 60 occupied and unoccupied burrows could occur in one acre of prairie dog colony (Clippinger 1989, May 2001). Prairie dogs are primarily herbivores and feed on grasses and forbs surrounding their burrows. They modify their surrounding environment in many ways. They change the grassland community structure and species composition by continuously cropping the vegetation surrounding their burrows very close to the ground (Collins and Barber 1985). The effect of the high burrow densities, digging activities, and heavy grazing action over the entire colony creates a unique ecosystem both structurally and compositionally, within the grassland matrix. Prairie dog colonies have been characterized as the most severely disturbed sites in the grassland matrix relative to the other disturbances of fire and bison grazing, since vegetation is: 1) subjected to above and below ground grazing by prairie dogs, 2) favored for grazing by certain ungulates, 3) subjected to mound building, and 4) subjected to increased wallowing by bison (Collins and Barber 1985).

Prairie dog colonies are used by a number of wildlife species, such as burrowing owls, which prefer unoccupied prairie dog burrows for nesting and denning (Miller et al. 1994, Agnew et al. 1986). The endangered black-footed ferret depends on prairie dogs and prairie dog colonies for both food and shelter, as it is the primary historical predator in the prairie dog ecosystem (Henderson et al. 1974). Numerous bird species have been found to prefer the open, bare ground of the prairie dog colony for nesting (Agnew et al. 1986, Clark et al. 1982).

Prairie dog ecosystems are frequently characterized as active or inactive. While fewer wildlife species may be associated with inactive prairie dog colonies, an inactive colony has important structural and compositional differences from active prairie dog colonies for many years after abandonment (Klatt and Hein 1978). The slowly collapsing burrows continue to provide habitat for various wildlife species. In addition, the plant species composition and the percentage of forbs versus grass species are often different than the surrounding grassland ecosystem, as well as different from active colonies. The length of time a prairie dog colony can influence the vegetation and habitat structure of a grassland ecosystem after abandonment can be variable by ecological site and length of colony establishment.

Beaver

> *"We saw many beaver....today. (They) dam up the small channels of the river between the islands and compel the river in these parts to make other channels; which as soon as it has effected that which was stopped by the beaver becomes dry and is filled up with mud sand gravel and driftwood. The beaver is then compelled to seek another spot for his habitation where he again erects his dam. Thus the river in many places among the clusters of islands is constantly changing the direction of such sluices.....This animal in that way I believe to be very instrumental in adding to the number of islands with which we find the river crowded." Lewis and Clark, 1804*

Prior to European settlement, beaver were found in nearly all aquatic habitats throughout North America that supported adequate water and food resources (Naiman et al. 1988). Current beaver populations in the Great Plains are substantially less than numbers present at the time of the early

French-Canadian trappers (late 1600's) (Jenkins and Busher 1979). Beaver are well known for their disturbance effects in aquatic and riparian/wetland ecosystems. The beaver's ability to influence and in some instances, drastically modify ecosystem structure and dynamics through dam building and wood cutting activities has been well-documented (Naiman et al. 1988, Ford and Naiman 1988, McDowell and Naiman 1986, Medin and Torquemada 1988). These activities alter stream morphology and patterns of discharge, decrease current velocity, increase retention of sediment and organic matter, and expand areas of flooded soil. Spatially and temporally, the effects of beaver fluctuated with population dynamics that were influenced by food supply, disease, flood disturbance, and predation (Naiman et al. 1988). These population dynamics were not only important at the ecosystem level but also at the landscape level. The overall area disturbed by an individual beaver pond is often small relative to disturbance processes such as fire (Johnston and Naiman 1986). However, the cumulative disturbance of many beaver ponds can result in extensive alteration to aquatic and riparian/wetland ecosystems.

Beaver pond creation is limited by geomorphology and food supply of an area. Most beaver dams occur on 1st to 4th order streams, as dams on larger streams are often removed by high flow events (Naiman et al. 1988). Beaver preferentially select areas for dam building that create the largest ponds with the greatest potential for expansion (Johnston and Naiman 1990a). As beaver numbers increase, more and more of the preferential sites become occupied and new ponds are then limited to less desirable sites where only small ponds are possible. While a small pond may be less desirable for a beaver, the diversity in pond sizes creates a corresponding diversity in riparian/wetland and aquatic ecosystems across the landscape. Historically, beaver population fluctuations would have primarily affected the number of smaller ponds on the landscape. With low populations the number of small ponds would decrease, as more preferred sites were available. With high populations the number of small ponds would increase, as preferred sites were already taken.

The importance of beaver dam building and feeding activities to plant and wildlife diversity of an area has also been well-documented (Dieter and McCabe 1989, Schlosser 1995, Johnston and Naiman 1990b, Barnes and Dibble 1988). Dam building and feeding activities often result in removal of trees and shrubs adjacent to streams. Riparian zones dominated by deciduous tree species that are preferred by beaver may be essentially clear-cut. The dams also impound water that expands existing wetlands or creates and maintains new wetlands. With the increased soil moisture, the existing upland vegetation will likely die and be replaced by moisture loving trees and shrubs such as cottonwoods, dogwoods, and willows. These are also the preferred foods of the beaver. In this way, beaver can reset the ecological development of the riparian or wetland ecosystem and often modify habitat to the point of creating an entirely different environment. At the aquatic level, beaver activities change invertebrate community structure from running-water taxa to pond taxa (Merigliano 1996). While these pond invertebrate communities may not be unique to the overall watershed, they represent added aquatic diversity to smaller streams. The permeability of the boundaries between beaver ponds and adjacent streams contributes to greater abundance and diversity in the fish community at the watershed level (Naiman et al. 1988).

One confounding factor to our understanding of beaver disturbance in riparian/wetland and aquatic ecosystems is the fact that attributes of many stream ecosystems have changed with the removal or reduction in beaver populations and the alteration of many flood regimes associated with European settlement. Consequently, much of our understanding of these ecosystems has been developed from sites that lack the influence of this previously abundant and ecologically important disturbance element.

Flood Events

> *"In order for a river to look the same, it must change" (Merigliano 1996).*

Flood disturbance has been an important part of the natural cycle of riparian/wetland ecosystems throughout South Dakota and has played an important role in maintaining ecosystem function and biological diversity within these systems. Flood events help maintain ecosystem productivity and diversity through both above- and below-ground processes that transport sediments, nutrients, and organisms between river channels and floodplains (Ward et al. 1999, Junk et al. 1989, Tockner et al. 1999, Reeves et al. 1995). Short-duration flood events of high stream-power result in channel and sediment movement, increased vegetation and deadwood in the channel, and upwelling of groundwater. The interaction of these influences on riparian ecosystems promotes successional stages, overall biodiversity, and complex food webs (Reeves et al. 1995). Both the plants and animals of flood-prone systems have adapted to flood disturbance, and many even require flood events to regenerate or complete their life cycle (Merigliano 1996, Pollock 1998). Flood events play a critical role in ecological succession and determining the structure and composition of the affected ecosystem (Sparks and Spink 1998).

Floods are frequently characterized by five primary components: 1) the magnitude of the discharge, 2) the velocity of the discharge, 3) the duration of the flood, 4) the season of the flood, and 5) the frequency of flooding (Poff and Ward 1989). When taken together, these components are frequently referred to as the "flood regime". The flood regime is influenced ecoregionally by geologic and climatic factors such as precipitation levels, sediment inputs, and stream gradient.

Flood events that are part of the natural flood regime are necessary to ensure the long-term viability of the plants and animals adapted to flood prone environments and the functioning of these ecosystems. To understand how floods influence ecosystems, one must first understand the effects of channel morphology. Channel morphology is primarily characterized as braided or meandering in South Dakota, depending on the locally dominant fluvial processes. Braided channels usually result from steep gradients, high flows, and sediments dominated by coarse or sandy particles (Friedman et al. 1997). Meandering channels, on the other hand, usually result from shallow gradients, low flows, and sediments dominated by silt and fine particles. The proportion of braided channels to meandering channels in the landscape increases with variable topography and decreasing precipitation patterns. Due to the geomorphology of South Dakota, meandering channels would be more common in the eastern part of the state whereas braided channels would be more common in the western part of the state.

Braided channels frequently have highly variable flows and easily eroded banks (Merigliano 1996). Sediment is deposited along the way and forms bars and islands that are exposed in the channel during periods of normal to low flows. Water then flows in a braided manner around these islands and bars, dividing and integrating as it flows downstream. During a flood event, the islands and bars can erode and become re-deposited in other locations downstream, thereby perpetuating the heterogeneity of the system as well as the mosaic of associated vegetation stages with each flood event (Merigliano 1996, Friedman et al. 1997, Miller et al. 1995). Meandering channels have on-going dynamic channel processes even outside of intermittently occurring flood events. A meandering channel is constantly eroding and re-depositing material along the channel. Erosion takes place on the outer parts of the meander bends where stream velocity is highest. Sediment is then deposited along the inner meander bends, where velocity is low. This deposition results in exposed bars called point bars. Because meandering stream channels are constantly eroding and re-depositing sediment along their channel, they tend to slowly migrate back and forth across their floodplain. During a flood event, however, the erosion and deposition process is magnified and can result in a more dramatic and immediate change in the stream channel location within the floodplain (Miller et al. 1995). The constant and sometimes dramatic movement of a meandering channel within the floodplain contributes to greater heterogeneity at the landscape level and species and structural diversity at the ecosystem level (Reeves et al. 1995, Benda et al. 1998).

3.4 Ecological Sites

A primary objective of the coarse filter strategy is to identify and characterize native ecosystem diversity for terrestrial and riparian-wetland systems for the entire state of South Dakota based on the historical reference. To accomplish this requires understanding two primary drivers of native ecosystem diversity, ecological sites and disturbance states. Ecological sites represent the physical environment component of an ecosystem (Daubenmire 1968b, USDA NRCS 2006) and disturbance states represent the vegetation communities that can occur on an ecological site in response to natural disturbance regimes. The following sections provide a more detailed discussion of the importance of delineating ecological sites and identifying disturbance states to efforts at describing the native ecosystem diversity of a region as well as the methods used to describe and map ecological sites and disturbance states.

The term ecological site has been used in various capacities by different ecological disciplines for many years. For the purpose of the ecological framework described in this document, we are using ecological sites as defined and developed by the Natural Resources Conservation Service (1997). NRCS ecological sites are a type of potential-based landscape classification system that identifies the different abiotic conditions (e.g., soils, aspect, elevation, temperature, moisture, etc.) that influence disturbance patterns and the potential plant communities that can occur on a site (USDA NRCS 1997, Bestelmeyer et al. 2009). They are based on the assumption that the differences in potential plant communities are influenced by these abiotic differences among sites (Bestelmeyer et al. 2006, Fuhlendorf and Smeins 1998).

Ecological sites may contain multiple soil types provided they exhibit similar properties that produce and support a characteristic plant community in response to similar disturbance processes. The soils characterizing an ecological site have developed over time through the interaction of parent material, climate, living organisms, and topography. This, in turn, influences the kind of plants that can occur and the combination of the plants and soils further influence the hydrology of a site, more specifically the amount of runoff and infiltration. The development of the soil, vegetation, and hydrology are therefore all interrelated and each influences and is influenced by the other. Each site responds similarly to drivers of ecosystem change such as climate, disturbance regimes, land-use practices, and management activities. For classification purposes, ecological sites are differentiated from each other based on several considerations including differences in plant species composition and productivity, differences in management response, and the processes of degradation and restoration (Bestelmeyer et al. 2009).

Plant communities change along environmental gradients. Ecological sites help delineate these gradients. Where changes in soil, geomorphic setting, or moisture conditions are abrupt, plant community boundaries can be distinct. Where boundaries are more gradual, plant community change will be less distinct and occur along wider environmental gradients of soils and topography.

Terrestrial Systems

The NRCS ecological site classification is correlated to existing NRCS soil maps (NRCS, Soil Survey Geographic Database (SSURGO; online)) and can therefore be displayed and mapped in a geographic information system (GIS). While the NRCS ecological site classification is suitable for the objectives of the ecosystem diversity framework described here, some limitations should be noted. A primary limitation is the fact that current soil mapping methodologies are often based on groupings of soils and may include minor inclusions of other soil types that may in fact represent another ecological site occurring within the larger soil type. As with most classification systems, the issue of mapping resolution is a common theme. While soil mapping may produce finer resolution data than most existing vegetation classification systems, it is still likely to represent less diverse conditions than actually occur on the landscape and the user should be aware of this limitation.

To map the ecological sites of South Dakota, the NRCS SSURGO data layers were obtained for the entire state of South Dakota. Approved ecological site descriptions were also obtained from South Dakota NRCS representatives (Stan Boltz, personal communication). In some instances, the SSURGO data had not been updated to include all of the approved ecological site labels so this was completed by project personnel with input from state NRCS representatives, where possible. The resulting map of ecological sites and MLRAs for terrestrial systems in South Dakota is provided in Figure 3-3. In some MLRAs, ecological sites were further described by precipitation zones but this variable was not included in this figure to reduce map complexity for display purposes. Table 3-2 identifies the number of acres for each of the terrestrial system ecological sites, by MLRA.

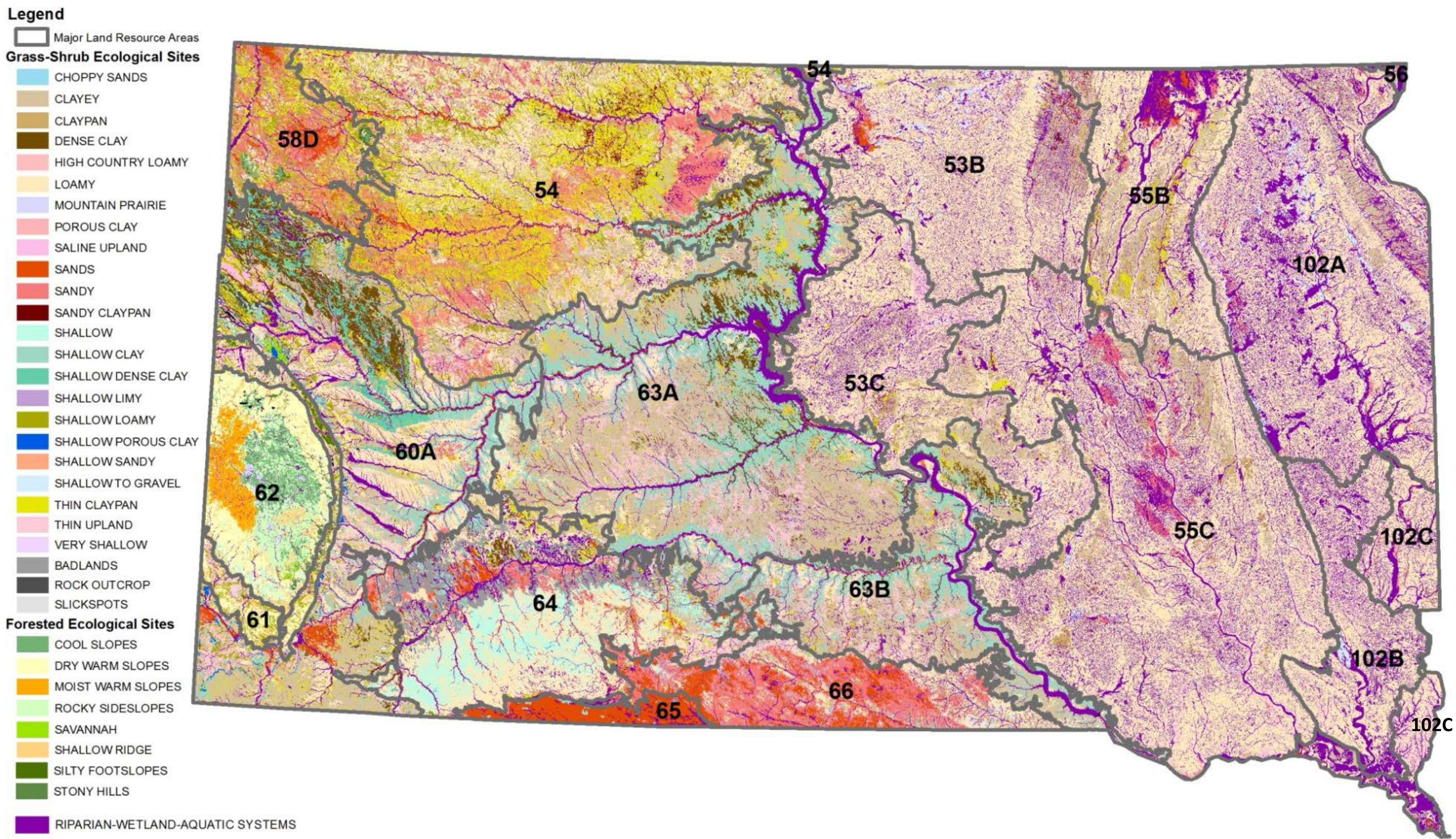


Figure 3-3. Location of primary terrestrial – grass-shrub and forested – ecological sites in South Dakota. Riparian-wetland-aquatic systems are lumped into one category for the purpose of this map.

Table 3-2. Number of acres representing each of the terrestrial ecological sites occurring within each of the eighteen South Dakota's Major Land Resource Areas.

ECOLOGICAL SITES	53B	53C	54	55B	55C	56	58D	60A	61	62	63A	63B	64	65	66	102A	102B	102C	TOTAL
Grassland/Shrub	2,421,457	2,150,807	5,741,376	1,689,675	5,473,773	13,621	1,031,167	3,939,576	325,459	114,044	5,783,550	2,013,920	2,516,210	263,000	1,470,169	3,282,696	1,023,294	634,935	39,888,729
LOAMY	1,868,040	1,391,119	1,555,879	996,855	4,267,806	4,685	96,586	731,664	106,906	28,737	414,611	244,360	1,033,802	1,358	275,295	2,479,640	892,008	509,420	16,898,772
CLAYEY	267,372	382,435	691,097	372,771	353,073	4,828	11,716	1,038,725	21,740	1,673	2,508,544	841,732	226,458		84,957	241,647	1,200	18,845	7,068,814
SHALLOW CLAY			86,544		6,275		3,147	497,667	6,357		1,617,371	493,773	117,403		9,983				2,838,520
SANDY	40,740	1,257	858,665	55,364	175,831	2,216	319,256	68,984	2,064		25,115	39,968	204,092	11,916	666,216	66,170	3,399	16,133	2,557,385
THIN UPLAND	32,761	252,470	200,913	29,032	369,202	537	9,722	268,788	68,008	4,301	454,068	195,657	68,522		30,990	267,962	102,805	77,999	2,433,740
THIN CLAYPAN	11,125	19,515	1,160,643	77,209	20,546		169,812	256,954	359		167,623	35,241	69,544	1,025	5,665				1,995,262
CLAYPAN	34,204	64,515	261,800	120,113	204,904		186,958	25,184			40,719	39,548	89,239	461	30,981	557			1,099,183
DENSE CLAY		3,558						423,146			403,106	60,577	48,172						938,560
SANDS	19,967		54,856	22,770	1,608	90	89,520	79,218	1,324		18,423	10,991	75,606	233,204	263,758	2,094		8,427	881,857
SHALLOW LOAMY			456,564	1,395			105,379	118,016	112,535	2,814			1,603						798,307
SHALLOW								9,580		47,020	41,137	18,451	548,582	598	9,957				675,327
SHALLOW TO GRAVEL	85,657	19,068		12,148	65,878	1,265					5,443	12,902	1,936		27,770	193,750	21,088	3,645	450,551
SHALLOW SANDY			333,171				25,442	2,456											361,069
VERY SHALLOW	53,692	16,869	32,938	745	8,650		5,480	34,872	6,165	1,017	87,391	19,445	25,772		448	30,875	2,793	465	327,617
SHALLOW DENSE CLAY								308,507											308,507
SHALLOW LIMY												234	5,480	895	63,403				70,012
SANDY CLAYPAN	7,898		48,304	1,274			8,148	299											65,922
SALINE UPLAND								38,030											38,030
SHALLOW POROUS CLAY								34,870											34,870
MOUNTAIN PRAIRIE										21,461									21,461
CHOPPY SANDS												1,040		13,542	747				15,329
HIGH COUNTRY LOAMY										7,021									7,021
POROUS CLAY								2,616											2,616
Forested			2,262				24,989	21,658	180,307	1,219,467									1,448,684
DRY WARM SLOPES								2,905	90,279	412,759									505,943
ROCKY SIDESLOPES										282,859									282,859
SHALLOW RIDGE								2,153	59,206	134,642									196,000
MOIST WARM SLOPES										185,501									185,501
COOL SLOPES			792				12,012	587	2,771	165,918									182,082
STONY HILLS			1,470				12,976	153	12,397	31,140									58,136
SAVANNAH								14,650	799	6,648									22,098
SILTY FOOTSLOPES								1,209	14,855										16,064
Sparsely Vegetated		36	41,675	90	315		26,939	108,213	5,374	937	28,572	12,411	344,306						568,867
BADLANDS			11,579				14,046	10,305			1,992	56	344,306						382,284
ROCK OUTCROP		36	29,996		315		12,352	33,643	5,374	937	25,733	12,355							120,742
SLICKSPOTS			99	90			542	64,265			846								65,842
Unknown [a]	2,062	1,009	2,399	1,754	3,467	71	149	4,515	1,564	3,811	3,571	1,874	87		281	4,972	936	1,221	33,742
DISTURBED SITES	2,062	1,009	2,399	1,754	3,467	71	149	4,515	1,564	3,811	3,571	1,874	87		281	4,972	936	1,221	33,742
Total	2,423,519	2,151,852	5,787,711	1,691,519	5,477,556	13,692	1,083,244	4,073,963	512,703	1,338,259	5,815,693	2,028,205	2,860,602	263,000	1,470,450	3,287,668	1,024,229	636,156	41,940,022

Riparian-Wetland Systems

The SDWAP has been revised to include a more detailed classification of riparian-wetland ecological sites to provide the foundation for better understanding potential native ecosystem diversity. For this purpose, a combination of existing classification systems are used including Stewart and Kantrud (1971), Cowardin et al. (1979), and the hydrogeomorphic (HGM) system (Brinson 1993). The following sections summarize how these classification systems were combined to meet the objectives for describing native ecosystem diversity in riparian-wetland ecosystems. First, a brief description of each classification system is needed to provide the foundation for this discussion.

Stewart and Kantrud (1971) developed a regional classification system for ponds and lakes of the glaciated prairie region of South Dakota. The primary objective of this classification system was to allow for the inventory of existing wetland plant communities. They grouped wetland vegetation into zones characterized by distinctive plant community compositions and structure and ponding regime (i.e. hydrology). Cowardin et al. (1979), hereinafter referred to as the Cowardin system, is similar in several respects to Stewart and Kantrud's system but was developed as a national classification system. The Cowardin system has become the most widely used wetland classification system in the United States. The overall emphasis of the Cowardin system also remains on the inventory of existing plant communities. More recently, the hydrogeomorphic (HGM) wetland classification system was introduced by Brinson (1993) to provide a tool for measuring functional changes in wetland ecosystems. The HGM system emphasizes the geomorphic setting and hydrologic attributes of a site rather than the existing biological characteristics of the plant communities. The geomorphic setting identifies the topographic location of the site within the surrounding landscape and the hydrological attributes that characterize the sources of water to the site.

The importance of identifying and classifying the underlying abiotic conditions and primary drivers responsible for both the functional and vegetative differences between ecological sites cannot be overstated. The HGM system was developed to capture these underlying abiotic conditions and has the most applicability in this regard relative to the other classifications. While both Stewart and Kantrud and the Cowardin systems resemble the HGM system in some components, they lack the ability to capture the underlying interaction of geomorphic and hydrological drivers that represent the abiotic influence on wetland and riparian ecological sites.

To apply the HGM system for ecological site classification within South Dakota, four hydrogeomorphic classes were identified including Lacustrine, Depressional, Riverine, and Slope classes. The four HGM classes are defined using slight modifications to NRCS (2008) definitions (Table 3-3). In addition, 7 hydrology sub-classes were identified to capture important drivers and attributes which influence the native functional and vegetative characteristics of wetland and riparian ecological sites. The hydrology sub-classes are primarily described and defined relative to the Cowardin system's "modifier" level of classification, with the addition of ephemeral and considerable overlap to Stewart and Kantrud's "class" level (Table 3-4).

Table 3-3. Description of the hydrogeomorphic classes identified for wetland and riparian ecological sites of South Dakota (as definitions modified from NRCS 2008 and Brinson et al. 1995). Due to current mapping limitations, the Slope Hydrogeomorphic Class is not represented in the 2014 South Dakota Wildlife Action Plan mapping efforts.

HGM Class	Definition
LACUSTRINE	• adjacent to lakes (>20 acres) where the water elevation of the lake maintains the water table in the wetland • additional sources of water are precipitation and ground water discharge, the latter dominating where intergrade with uplands or slope wetlands occur • lose water by flow returning to the lake after flooding, by saturation surface flow, and by evapotranspiration • organic matter normally accumulates in areas sufficiently protected from shoreline wave erosion • historically rare in South Dakota but are more frequent today due to the damming of permanent stream courses
DEPRESSIONAL	• occur in topographic depressions (≤20 acres) • dominant water sources are precipitation, groundwater discharge, and both interflow and overland flow from adjacent uplands with direction of flow normally from the surrounding uplands toward the center of the depression • elevation contours are closed, thus allowing the accumulation of surface water • may have any combination of inlets and outlets or lack them completely • dominant hydrodynamics are vertical fluctuations, primarily seasonal • may lose water through intermittent or perennial drainage from an outlet, by evapotranspiration and, if they are not receiving ground water discharge, may slowly contribute to ground water discharge • common examples in South Dakota are prairie potholes
RIVERINE	• occur in floodplains and riparian corridors in association with stream channels • dominant water sources are often overbank flow from the channel or subsurface hydraulic connections between the stream channel and wetlands • sources may be interflow and return flow from adjacent uplands, occasional overland flow from adjacent uplands, tributary inflow, and precipitation • at their headwater, often are replaced by slope or depressional wetlands where the channel morphology may disappear • may intergrade with poorly drained flats or uplands • perennial flow in the channel is not a requirement
SLOPE	• normally found where groundwater discharges to or near the land surface • normally occur on sloping land; elevation gradients may range from steep hillsides to slight slopes • usually incapable of depressional storage because they lack closed contours • principle water sources are usually ground water return flow and interflow from surrounding uplands, as well as precipitation • hydrodynamics are dominated by downslope unidirectional water flow • can occur in nearly flat landscapes if ground water discharge is a dominant source to the wetland surface • lose water primarily by saturation subsurface and surface flows by evapo-transpiration but may develop channels that function as outlet • common examples in South Dakota are fens

Table 3-4. Seven hydrology sub-classes utilized for wetland and riparian ecological sites of South Dakota. Due to current mapping limitations, the seep/saturated hydrology subclass is not represented in the 2014 South Dakota Wildlife Action Plan mapping efforts (based on Cowardin et al. 1979 and Stewart and Kantrud 1971).

Hydrology Subclass	Definition
Permanent	Water covers the land surface or flows throughout the year, except under very extreme drought conditions.
Intermittent	Surface water is present but variable due to evapotranspiration throughout the year or absent in years of extreme drought.
Semi-permanent	Surface water persists throughout the growing season but is absent by late summer to early fall in most years.
Seasonal	Surface water is typically present from spring to early summer, but is absent by the end of the season in most years.
Temporary	Surface water is present for brief periods, a few weeks in spring or a few days after a heavy rain or the channel contains flowing water for only a few weeks in the spring or after a heavy rain, and when not flowing may remain in isolated pools or surface water may be absent altogether.
Ephemeral	Surface water is present for only a short period of time after snowmelt or storm events in early spring. Because of the porous condition of the soils, the rate of water seepage is very rapid after thawing of the underlying frost seal. Water is only retained long enough to establish some wetland or aquatic processes.
Seep	Groundwater saturated soils on gently sloping terrain; rarely ponded; may be slightly flowing early in the growing season but with no recognizable channel.

While not required as part of the ecological site framework, vegetation zones as defined by Stewart and Kantrud (1971, 1972) (Table 3-5) provide a useful tool in identifying the hydrological subclass and for describing vegetation communities as influenced by hydrological and water chemistry subclasses. Vegetation zones are presented as a useful tool for determining average hydrological conditions for an ecological site. For the purpose of describing native ecosystem diversity, each disturbance state was characterized using expected species compositions relative to defined vegetation zones.

Using this ecological classification system, a map of riparian and wetland hydrogeomorphic classes was developed (Figure 3-4) and a map of riparian and wetland ecological sites, or the combination of hydrogeomorphic class and hydrology sub-classes (Figure 3-5) were mapped throughout South Dakota. Data sources used in this mapping effort include a combination of NRCS ecological sites and National Wetlands Inventory (USFWS 2010). For a description of methods used in this assessment, see Appendix L. The NRCS ecological site and NWI information were available as GIS layers with associated attribute data. However, the ability to map the Slope HGM Class and the Seep Hydrological Subclass from existing

Table 3-5. Seven vegetation zones identified by Stewart and Kantrud (1971, 1972) and used in the wetland and riparian ecological sites of South Dakota to help describe vegetation communities by hydrological subclass. Due to current mapping limitations, the Fen vegetation zone is not represented in 2014 mapping efforts.

Vegetation Zones	Description
Low Prairie/Shrub/Forest	Characterized by moist site prairie grasses, forbs, shrubs, and trees. The hydrology influencing this zone is typically ephemeral, i.e. moist for a few days in spring.
Wet Meadow	Characterized by fine-textured grasses, rushes, and sedges of relatively low stature. The hydrology influencing this zone is typically temporary.
Shallow-marsh	Characterized by a mix of 3 phases depending on annual, seasonal, or site specific water levels: normal emergent phase of intermediate height grasses/grass-like plant species, open-water phase with submerged aquatic plants, and a drawdown phase of emergent/pioneering species or bare dirt. The hydrology influencing this zone is typically seasonal.
Deep-marsh	Characterized by a mix of 3 phases depending on annual, seasonal, or site specific water levels: normal emergent phase of coarser and taller grasses/grass-like plant species, open-water phase with submerged or floating aquatic plants, and a drawdown phase of emergent/pioneering species or bare dirt. The hydrology influencing this zone is typically semi-permanent.
Open Water	Characterized by water areas completely devoid of vegetation and areas where two species of vascular plants (widgeongrass and pondweed) may be present. The hydrology influencing this zone is typically permanent.
Fen	Characterized by floating or surface mats of emergent vegetation; may be intermixed with small open water areas. Springs may be present. The hydrology influencing this zone is typically seep.
Intermittent	Characterized by highly saline and relatively shallow water. The hydrology of this zone is typically intermittent.

data sources was not possible at this time. In addition, the ability to map fresh from saline systems using existing data sources was also lacking at this time.

The fluctuation of water levels resulting from changes in precipitation or evaporation is the primary driving force influencing the species composition and structure of riparian and wetland ecosystems. Fluctuating water levels can increase the amount of open water and bare soils that are present during a growing season (LaBaugh et al. 1998). Open water generally increases immediately following a precipitation event. As water runs off, discharges, or evaporates from the site, a drawdown phase may occur that exposes bare dirt and leads to emergent species colonizing or re-colonizing portions of the wetland (Stewart and Kantrud 1971). Water depths and related stages of cover interspersion often change drastically from year to year and season to season due to these fluctuating water levels (Stewart and Kantrud 1971). This may also influence the amounts and types of vegetation zones over time such as gaining a moister vegetation zone during above average precipitation or losing a vegetation zone during below average precipitation.

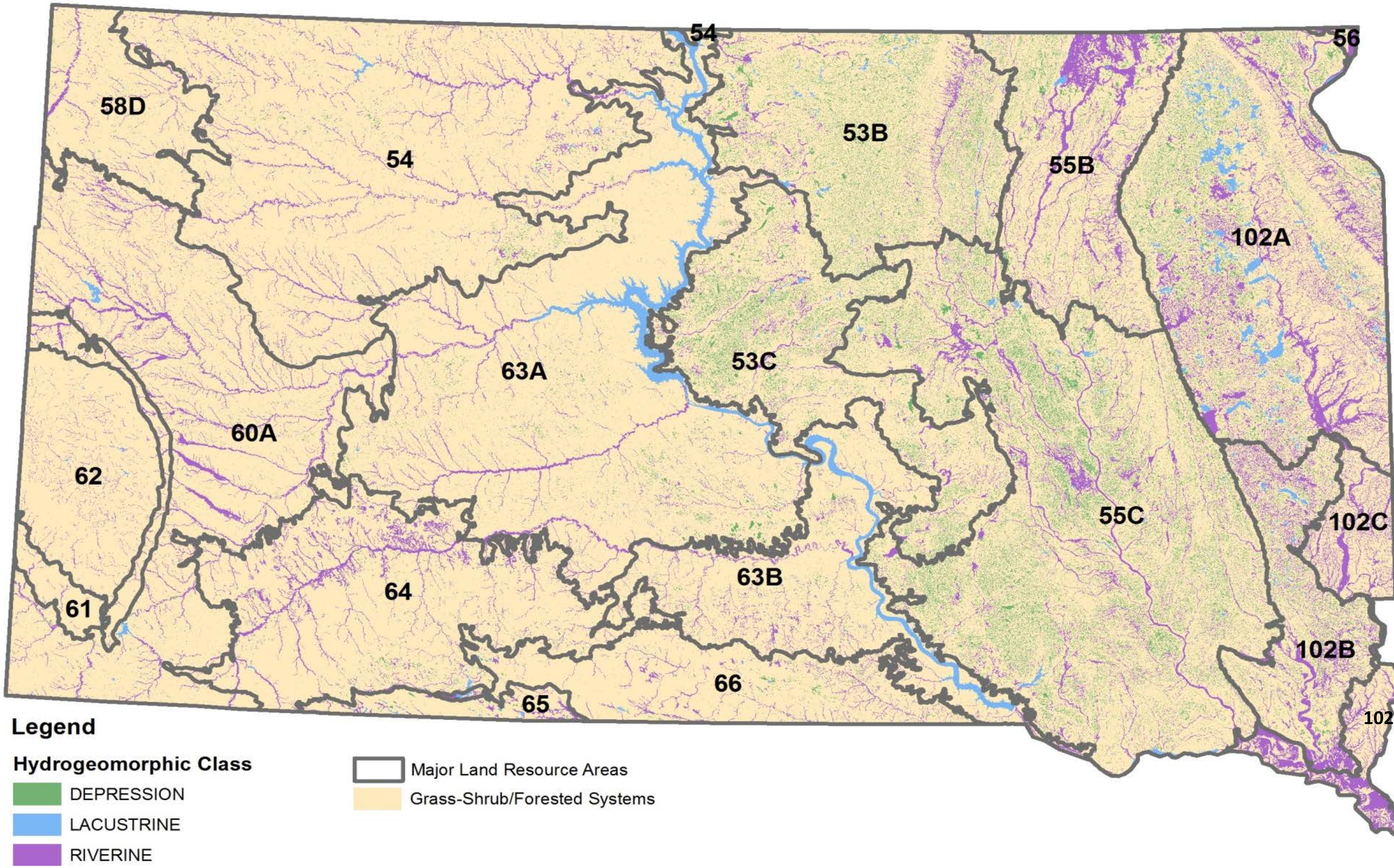


Figure 3-4. Location of riparian-wetland hydrogeomorphic classes in South Dakota.

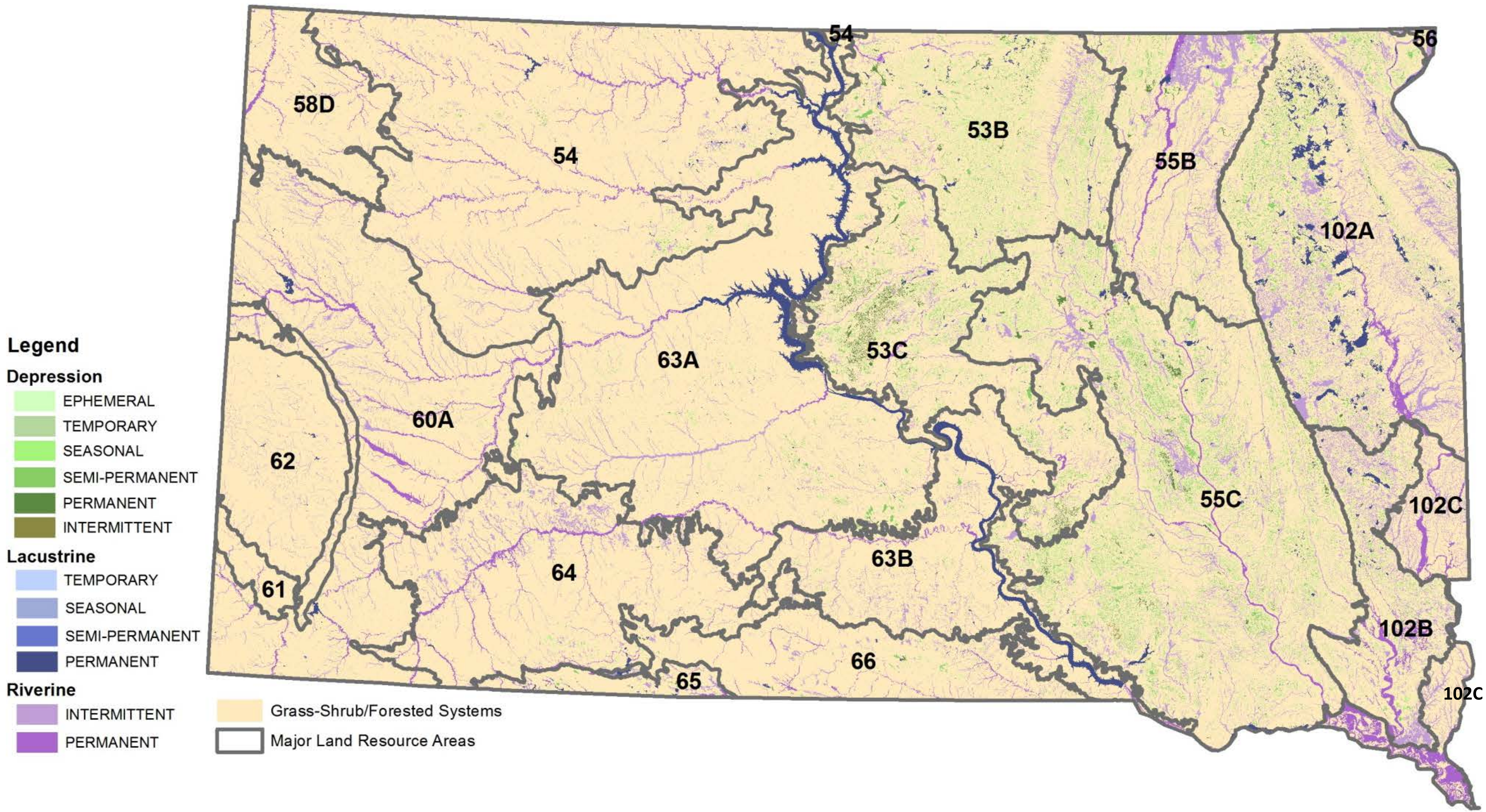


Figure 3-5. Location of riparian-wetland ecological sites, or the combination of hydrogeomorphic class and hydrology subclasses, in South Dakota.

Usually, vegetation zones within riparian and wetland ecological sites and as described by Stewart and Kantrud (1971) occur as concentric peripheral bands in response to different water levels, with the central ring usually representing the wettest portion of the site and the outer rings usually representing the progressively drier margins. The number of concentric bands present will depend on the hydrology sub-class for the ecological site. Figures 3-6 through 3-11 provide a generalized example of the typical vegetation zones occurring within each of the six hydrology sub-classes for the depressional HGM class under average precipitation conditions.

Figures 3-12 and 3-13 provide a generalized example of the typical vegetation zones occurring within the two hydrology subclasses for the lacustrine HGM class. Figures 3-14 and 3-15 provide a generalized example of the typical vegetation zones occurring within the two hydrology subclasses for the riverine HGM class. It is important to note that not all vegetation zones may be present on every ecological site but the figures present a general pattern that is frequently observed. Fen vegetation zones in particular require the associated ground water input to be present. It is also important to note that many riparian and wetland ecological sites have been altered by extensive cropland conversion, draining, filling, etc. that has occurred in the last century (Dahl 1990, Dahl and Johnson 1991) and potentially altering historical hydrology subclasses.

Historical grazing played an important role in influencing the structure and species composition of most vegetation zones within ecosystems on riparian and wetland ecological sites. Within the open water zone, grazing pressure had little to no influence on plant species composition. Within the deep marsh and shallow marsh zones, bison grazing likely also influenced the vegetation community structure in terms of creating patchy openings by knocking down vegetation or grazing heavily in this zone during drought years. The frequent fire return interval in the adjacent uplands also played an important role in shaping the structure and species composition of riparian and wetland ecological sites. Fire, particularly during drought cycles, could remove the build-up of organic matter and release nutrients to the wetland system. For the low prairie zone in particular, grass species were the dominant component and shrubs and trees were a more minor component in this vegetation zone due to the frequency of fire. Browsing and rubbing by bison and other herbivores likely further reduced the coverage of shrubs and trees in this ecological site. Where shrub and tree species occurred, they were more commonly associated with the low prairie and fen vegetation zones. Flood events further influenced the diversity of plant communities. In addition, flood events associated with riverine ecological sites create a favorable condition for some plants to regenerate such as plains cottonwood and willows, where the scouring action can create alluvial bars and other features that promote regeneration.

The effects of beaver activity on South Dakota riparian and wetland ecological sites have not been well documented. For the purposes of describing ecological sites, some assumptions are necessary. In particular, it is assumed that beaver activity would be associated with riverine ecological sites with a longer mean fire return interval to allow the growth of trees and shrubs necessary to sustain a beaver population. Where damming occurs, the water table typically rises, further influencing the hydrology of the adjacent riparian vegetation communities and probably benefitting tree and shrub species. This change can be relatively temporary or more long-term, if there are sufficient food supplies to support a population. Beaver typically feed on and build dams from the surrounding trees and shrubs. If the food supply is exhausted, the beaver will move on to a new site with better food sources. Vegetation within or close to the floodplain is expected to be the most heavily influenced by beaver activity. Where dams do occur, the result of going from a flowing water system to a pond system is expected to have an effect on the species composition and structure, as well as the associated biodiversity, but this change has not been evaluated or documented South Dakota.

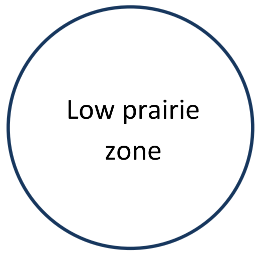


Figure 3-6. Depressional-Ephemeral Ecological Site. Typical vegetation zones under average precipitation conditions for the depressional class- ephemeral sub-class (as adapted from Stewart and Kantrud 1971).

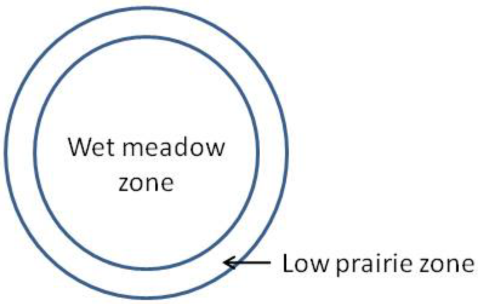


Figure 3-7. Depressional-Temporary Ecological Site. Typical vegetation zones under average precipitation conditions for the depressional class- temporary sub-class (as adapted from Stewart and Kantrud 1971).

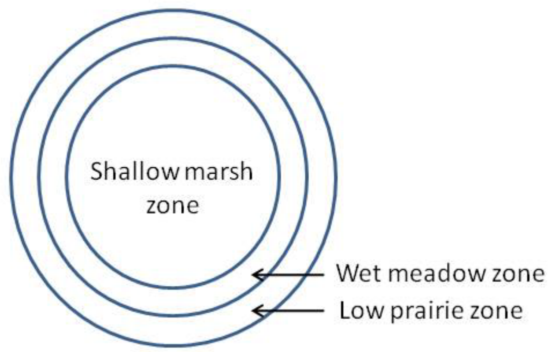


Figure 3-8. Depressional-Seasonal Ecological Site. Typical vegetation zones under average precipitation conditions for the depressional class- seasonal sub-class (as adapted from Stewart and Kantrud 1971).

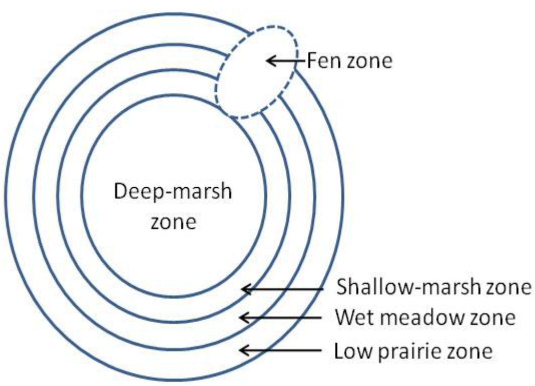


Figure 3-9. Depressional-Semipermanent Ecological Site. Typical vegetation zones under average precipitation conditions for the depressional class- semipermanent sub-class (Stewart and Kantrud 1971).

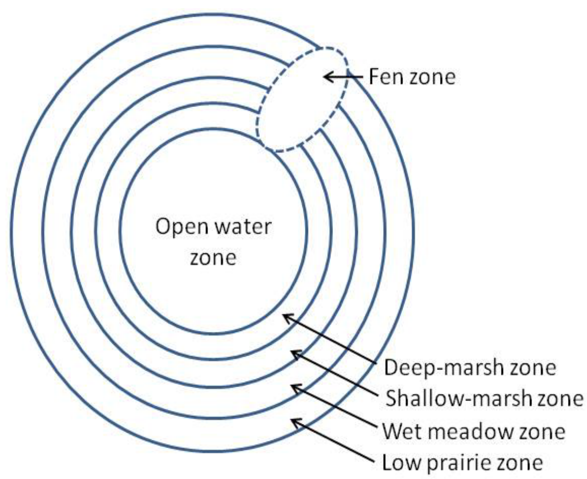


Figure 3-10. Depressional-Permanent Ecological Site. Typical vegetation zones under average precipitation conditions for the depressional class-permanent sub-class (as adapted from Stewart and Kantrud 1971).

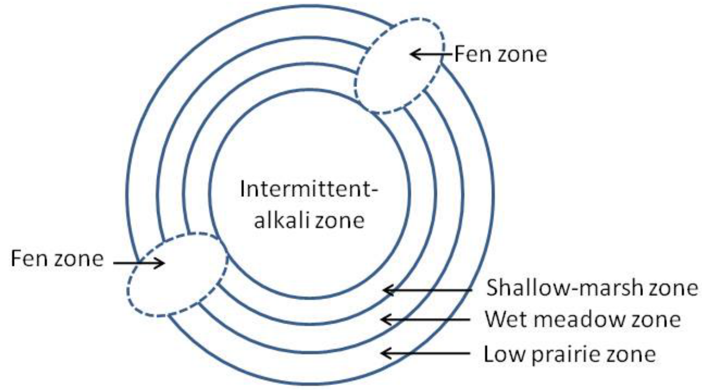


Figure 3-11. Depressional-Intermittent Ecological Site. Typical vegetation zones under average precipitation conditions for the depressional class-intermittent sub-class (as adapted from Stewart and Kantrud 1971).

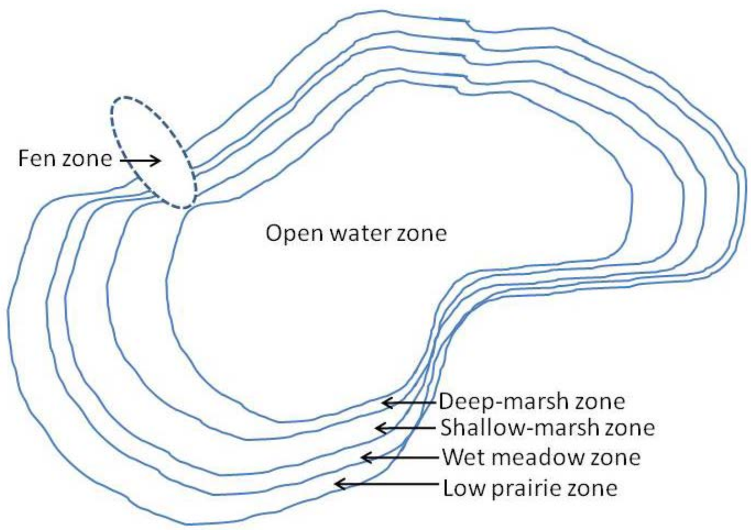


Figure 3-12. Lacustrine-Permanent Ecological Site. Typical vegetation zones under average precipitation conditions for the lacustrine class–permanent subclass (as adapted from Stewart and Kantrud 1971).

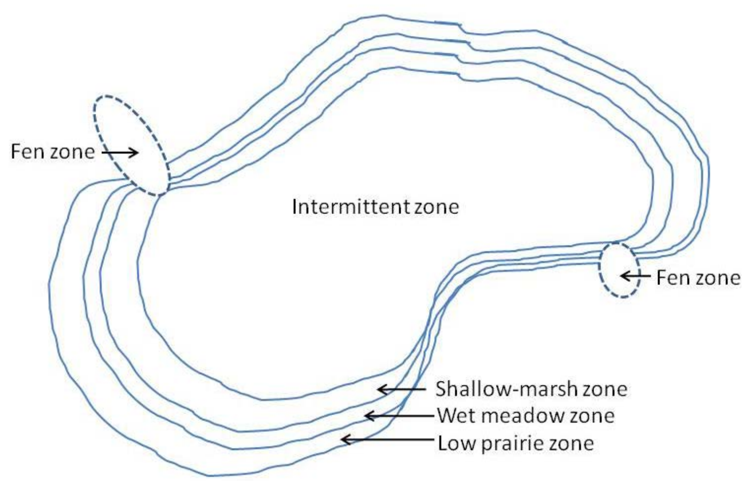


Figure 3-13. Lacustrine-Intermittent Ecological Site. Typical vegetation zones under average precipitation conditions for the lacustrine class -intermittent subclass (as adapted from Stewart and Kantrud 1971).

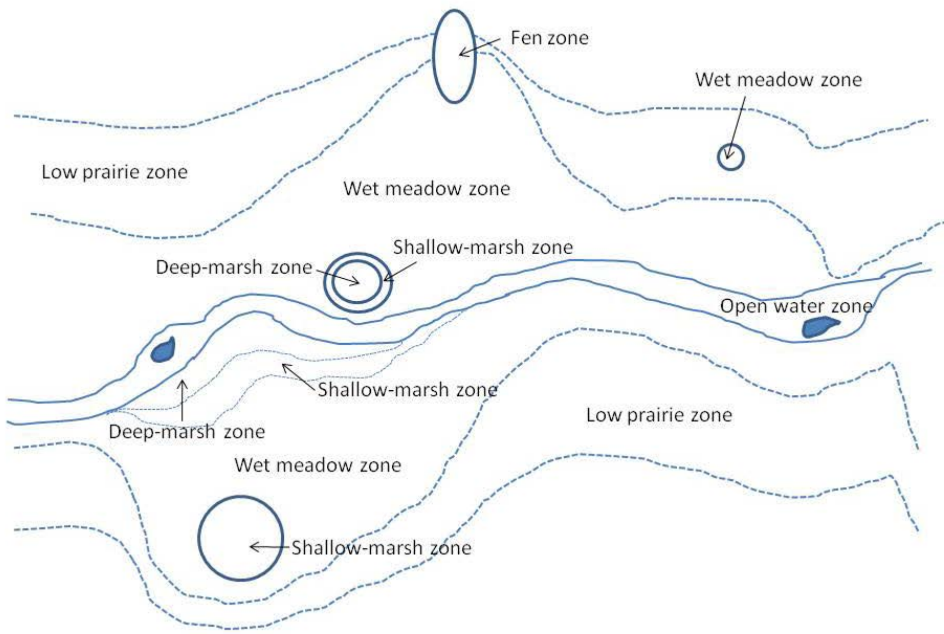


Figure 3-14. Riverine-Permanent Ecological Site. Typical vegetation zones under average precipitation conditions for the riverine class-permanent sub-class (as adapted from Stewart and Kantrud 1971).

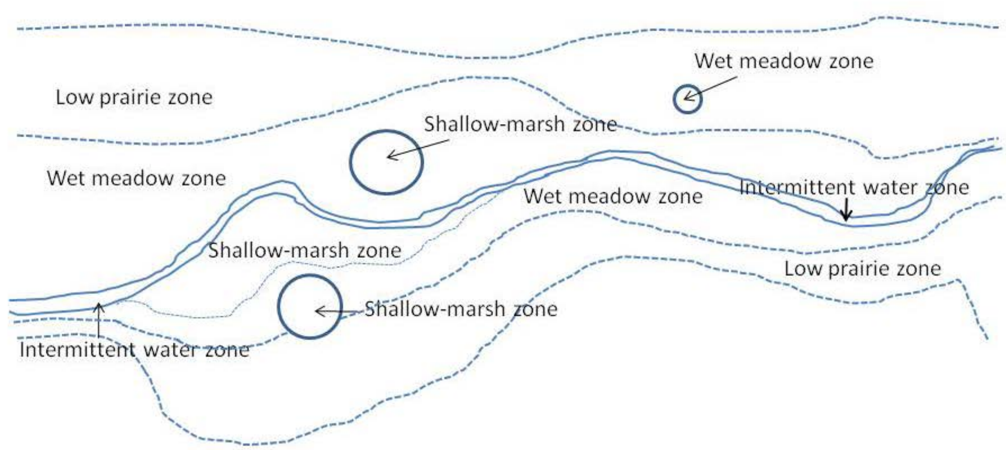


Figure 3-15. Riverine-Intermittent Ecological Site. An example of vegetation zones that might occur under average precipitation conditions for the riverine class-intermittent sub-class (as adapted from Stewart and Kantrud 1971).

The number of acres mapped for each of the riparian and wetland hydrogeomorphic classes is provided in Table 3-6. The number of acres mapped for riparian and wetland ecological sites by MLRA is provided in Table 3-7. It is important to note that these acres were calculated based on existing NWI and NRCS SSURGO/ecological site data that do not fully capture the historical extent of these sites prior to the extensive cropland conversion, draining, filling, etc. that has occurred in the last century (Dahl 1990 and Dahl and Johnson 1991). In addition, some depressional sites such as depressional-permanent may have expanded in acreage due to excavation activities. Some lacustrine ecological sites may have been created from damming and impounding activities that occurred in the last century. Reservoirs and impoundments occurring on historically riverine or depression ecological sites would have reduced those acres as they were historically and identify them today as lacustrine systems.

Table 3-8 identifies a rough approximation of the number of distinct or isolated depressional and lacustrine ecological sites occurring in each MLRA.

Table 3-6. Number of acres representing the hydrogeomorphic classes in South Dakota.

	HYDROGEOMORPHIC CLASS			
	DEPRESSION	**RIVERINE**	**LACUSTRINE**	**TOTAL**
EPHEMERAL	105,435		32	105,469
TEMPORARY	423,714		133	423,846
SEASONAL	764,218		1,011	765,230
SEMI-PERMANENT	851,425		10,282	860,728
INTERMITTENT	5,036	3,122,060		3,127,096
PERMANENT	191,763	1,125,104	785,471	2,102,335
TOTALS	**2,341,591**	**4,247,164**	**796,929**	**7,385,684**

Table 3-7. Number of acres representing riparian and wetland ecological sites, or the combination of hydrogeomorphic class and their hydrology sub-class, for each of the Major Land Resource Areas occurring in South Dakota.

Ecological Site	53B	53C	54	55B	55C	56	58D	60A	61	62	63A	63B	64	65	66	102A	102B	102C	TOTAL
DEPRESSION	**350,743**	**288,883**	**42,972**	**133,882**	**877,643**	**2,607**	**7,891**	**27,278**	**1,054**	**480**	**78,724**	**24,508**	**22,873**	**5,101**	**24,990**	**349,119**	**97,679**	**5,164**	**2,341,591**
EPHEMERAL	8,281	22,342	5,086	2,427	26,597		1,781	1,636	241	126	6,333		8,477	120	2,886	9,454	7,847	1,801	105,435
TEMPORARY	42,544	26,994	5,182	43,700	200,305	548	1,868	2,227	113	86	5,219	1,658	1,930	516	4,446	54,345	30,164	1,869	423,714
SEASONAL	166,548	72,674	17,538	43,003	268,595	528	1,909	9,262	248	67	26,350	9,089	9,956	862	9,363	97,749	29,772	705	764,218
SEMI-PERMANENT	112,638	91,086	13,751	37,983	333,617	1,334	1,244	6,875	363	147	27,017	8,969	1,178	2,622	6,228	177,973	27,979	421	851,425
PERMANENT	20,247	75,473	1,411	6,671	45,356	1	1,089	7,278	89	17	13,799	4,750	1,332	821	2,067	9,214	1,878	270	191,763
INTERMITTENT	485	314	4	98	3,173	196				37	6	42		160		384	39	98	5,036
LACUSTRINE	**24,934**	**12,514**	**14,423**	**9,431**	**44,435**	**522**	**1,172**	**15,629**	**118**	**2,005**	**323,036**	**129,707**	**4,750**	**3,727**	**6,984**	**187,048**	**14,969**	**1,525**	**796,929**
EPHEMERAL					15							15					2		33
TEMPORARY	1	1	1	14	4		31	69			2			2	2		5	1	133
SEASONAL	1	3	508	2	35		86	237			138	1							1,011
SEMI-PERMANENT	959	4,278	449	188	2,931		43	291			2	36	18	454	42	339	252		10,282
PERMANENT	23,973	8,232	13,465	9,227	41,450	522	1,012	15,032	118	2,005	322,894	129,655	4,732	3,271	6,940	186,709	14,710	1,524	785,471
RIVERINE	**148,620**	**128,679**	**340,732**	**366,633**	**548,684**	**18,684**	**55,969**	**401,737**	**35,424**	**54,017**	**279,679**	**142,562**	**290,782**	**26,245**	**88,040**	**712,791**	**281,335**	**326,551**	**4,247,164**
INTERMITTENT	139,424	116,048	181,631	304,517	482,677	18,684	16,934	213,813	28,304	53,574	219,803	93,305	198,147	18,555	57,889	656,510	197,122	125,123	3,122,060
PERMANENT	9,196	12,631	159,101	62,116	66,007		39,035	187,924	7,120	443	59,876	49,257	92,635	7,690	30,151	56,281	84,213	201,428	1,125,104
Total	**524,297**	**430,076**	**398,127**	**509,946**	**1,470,762**	**21,813**	**65,032**	**444,644**	**36,596**	**56,502**	**681,439**	**296,777**	**318,405**	**35,073**	**120,014**	**1,248,958**	**393,983**	**333,240**	**7,385,684**

Table 3-8. Number of individually mapped depression and lacustrine ecological sites for each of the Major Land Resource Areas in South Dakota.

Ecological Site	54	56	61	62	64	65	66	102A	102B	102C	53B	53C	55B	55C	58D	60A	63A	63B	TOTAL
DEPRESSION	**21,841**	**512**	**1,582**	**779**	**9,232**	**1,779**	**19,074**	**199,025**	**48,558**	**2,738**	**214,185**	**130,552**	**101,766**	**652,264**	**6,921**	**33,135**	**50,045**	**25,690**	**1,519,678**
EPHEMERAL	303	0	31	15	468	14	305	1373	1,383	177	953	2,066	315	3,183	91	101	447	0	11,225
TEMPORARY	6,231	177	248	111	2,399	447	6,763	52,449	21,789	1,351	58,358	27,718	49,436	223,572	2,673	3,275	4,687	3,167	464,851
SEASONAL	8,070	182	408	230	3,917	518	9,133	77,410	14,492	403	109,676	47,309	31,127	21,5886	1,781	6,656	11,714	6,420	545,332
SEMI-PERMANENT	5,348	136	654	348	983	558	2,271	64,925	10,258	499	40,726	35,140	18,559	188,383	1,472	7,409	9,982	6,804	394,455
PERMANENT	1,886	1	241	20	1,464	219	601	2,737	631	278	4,355	18,223	2,297	20,106	904	15,694	23,206	9,283	102,146
INTERMITTENT	3	16	0	55	1	23	1	131	5	30	117	96	32	1,134	0	0	9	16	1,669
LACUSTRINE	**3,798**	**16**	**21**	**67**	**1,126**	**621**	**659**	**15,643**	**1,305**	**97**	**2,642**	**3,953**	**4,334**	**8,375**	**178**	**1,608**	**32,620**	**5,561**	**82,624**
EPHEMERAL	0	0	0	0	0	0	0	0	7	0	0	0	0	1	0	0	0	2	10
TEMPORARY	5	0	0	0	0	1	2	0	5	3	2	4	11	15	2	3	4	1	58
SEASONAL	132	0	0	0	1	0	1	0	1	0	2	6	3	30	5	14	19	3	217
SEMI-PERMANENT	104	0	0	0	1	98	12	53	45	0	157	1,419	125	980	12	5	6	8	3,025
PERMANENT	3,557	16	21	67	1,124	522	644	15,590	1,247	94	2,481	2,524	4,195	7,349	159	1,586	32,591	5,547	79,314
TOTAL	**25,639**	**528**	**1,603**	**846**	**10,358**	**2,400**	**19,733**	**214,668**	**49,863**	**2,835**	**216,827**	**134,505**	**106,100**	**660,639**	**7,099**	**34,743**	**82,665**	**31,251**	**1,602,302**

3.5 Disturbance States

As discussed previously, natural disturbance regimes are often responsible for maintaining the dynamic landscape processes that are important drivers of ecosystem diversity as well as the persistence of biodiversity. With an understanding of natural disturbance regimes, recognizable patterns emerge that allow us to describe and predict a given plant community's response to the frequency or intensity of a disturbance type. For the purposes of the ecological framework, the term disturbance state is used to refer to a specific plant community that could occur on a specific ecological site in response to disturbance processes. A disturbance state describes a potential plant community or ecosystem that may occur on an ecological site in response to natural disturbance regimes but, because it is a generalization, it may include a certain amount of variation both spatially and temporally. The transition between disturbance states is due to the interaction of disturbance with the abiotic characteristics of an ecological site, combined with climate influences. A disturbance state can be transient or relatively persistent on an ecological site. Although ecological sites provide valuable information on the interaction of the physical environment with vegetation, they are combined with a classification of disturbance states to identify the full range of vegetative conditions or ecosystem diversity possible on an ecological site, as influenced by natural disturbance events and processes. We use the term disturbance state to refer to all distinct plant communities that we identify. Others may include the terms plant community or plant community phase as subsets of disturbance states, but we chose to not identify such distinctions.

A state and transition model (STM) is a framework that is used to summarize and describe the range of disturbance states for an ecological site. STMs help to describe patterns and mechanisms of vegetation response to identified disturbance processes on an ecological site by identifying the triggers, drivers, and mechanisms of transition among states (Bestelmeyer et al. 2009). They provide a record of the knowledge of disturbance states to date while also allowing for future adjustment as new information becomes available. Typically, state and transition models have been implemented through simple printed flowcharts that identify the range of disturbance states that can occur on an ecological site and the disturbance processes that will influence the transition from one state to another. Transitions can occur rapidly such as in the event of a fire or more slowly such as in the event of changes to the grazing regime. Sometimes multiple disturbance changes must occur simultaneously to trigger a transition to a different state.

It should be noted that most STMs in use today have been developed by NRCS to provide a scientific framework to evaluate and describe today's conditions. In that context, NRCS STMs include additional information that is not being used in this effort. Typically NRCS STMs include both native and today's impacted states. In addition, they may include only one native disturbance state, referred to as the Historical Climax Plant Community (HCPC). For the SDWAP, the goal for STMs is to identify the full range of native ecosystems that can occur on an ecological site in response to natural disturbance, where any one of these native ecosystems could be considered a reference condition. For this purpose, each native ecosystem occurring on an ecological site is considered a natural disturbance state. So while existing NRCS STMs were used to inform the development of the STMs for this project, the framework, assumptions, and results may differ from NRCS descriptions due to these primary differences in objectives.

One of the limiting factors in the use of STMs relative to native ecosystem diversity is the lack of quantitative data available to evaluate their accuracy and refine their content. Their development should be based on the best information available on plant species and community response to natural disturbance, with recognition that this information can sometimes be subjective and based on expert opinion. Strategies are in place to strengthen the quantitative data available to support the development of STMs in the future (Bestelmeyer et al. 2009). However, it may be impossible to collect empirical data on many historical states that simply do not exist today because of changes to natural disturbance processes or conditions. These limitations however should not detract from their usefulness today in efforts to describe native ecosystem diversity with recognition of the need to acquire additional data to support and strengthen them in the future.

Terrestrial Systems

Grass-Shrub Ecosystems

To describe the influences of natural disturbance on the vegetation of an ecological site, fire and bison and black-tabled prairie dog grazing, and where appropriate their interactions, were included as the primary mechanisms historically influencing the vegetation of terrestrial ecosystems (Table 3-9). While we recognize the diversity of grazing/herbivory that may have occurred historically in South Dakota, we are primarily interested in the effects of bison and black-tailed prairie dog grazing as they are considered keystone species where they historically occurred. Climate influences are primarily incorporated at the ecoregional classification level but more extreme cycles, such as drought, are also an important stochastic process that should be considered in discussions of disturbance states and overall planning but are difficult to incorporate into a classification of disturbance states due to the complexity and randomness of possible influences. Eight disturbance states were developed for grass-shrub ecosystems of South Dakota to describe the most common potential ecosystem conditions based on the combined influence of bison grazing, as defined along a gradient of lighter to heavier grazing pressure, and fire, as defined along a gradient of more frequent to less frequent fire.

Figure 3-16 presents the state and transition model framework used to characterize disturbance states for terrestrial grass-shrub ecosystems in South Dakota for the purpose of the SDWAP. These disturbance states were developed to capture the range of native grass-shrub vegetation conditions important to most biodiversity in the region, resulting from the influence of historical bison grazing, fire regimes, and prairie dog colonies that may occur on an ecological site. In some instances, not all of these disturbance states will occur on all ecological sites. While bison grazing and fire were likely to have occurred on most grass-shrub ecosystems in South Dakota, prairie dog colonies were less likely to occur in eastern South Dakota where soil productivity challenged a colony’s ability to maintain heavily grazed conditions for predator visibility and safety of the colony (Virchow and Hygnstrom 2002). In addition, some ecological sites were also poor prairie dog habitat due to high water tables, shallow soil depth, or soil conditions, such as sandy and heavy clay soils, that were unfavorable for belowground burrow development.

Table 3-9. Expected combined influence of historical bison grazing, fire frequency, and black-tailed prairie dog on creating eight vegetation disturbance states on grass-shrub ecological sites in South Dakota.

Disturbance State	***Bison Grazing Pressure[a]***	***Fire Frequency[b]***	***Prairie Dog Colony[c]***
A	Light	More frequent	
B	Moderate	More frequent	
C	Heavy	More frequent	
D	Light	Less frequent	
E	Moderate	Less frequent	
F	Heavy	Less frequent	
G	Heavy	Less frequent	Active
H	Light to moderate	More frequent	Inactive

[a] LIGHT grazing - <30% utilization of grass by bison and other herbivores; MODERATE grazing - $\geq$30% and <50% utilization; HEAVY grazing - $\geq$50% utilization;

[b] MORE FREQUENT - <15 year mean fire return interval; LESS FREQUENT - $\geq$15 year mean fire return interval

[c] ACTIVE prairie dog colony – prairie dogs present, maintaining/creating burrows, heavily grazing; INACTIVE prairie dog colony – prairie dogs absent, burrows still present and being used by some wildlife species but deteriorating, lighter grazing levels

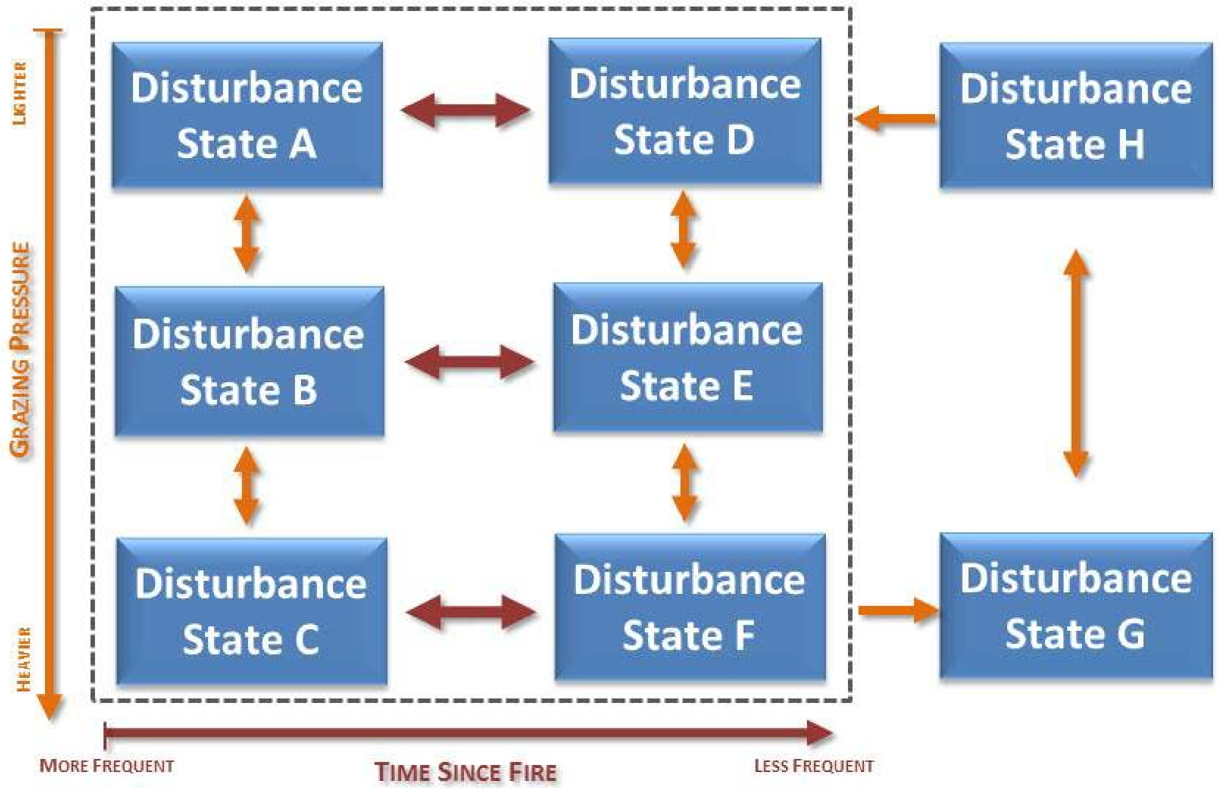


Figure 3-16. State and transition model framework to identify historically occurring disturbance states for terrestrial grass-shrub ecosystems of South Dakota, as influenced by the natural disturbance regimes of bison grazing, fire, and prairie dog colonization. Disturbance states A, B, C, G, and H were much more common historically and disturbance states D, E, and F are considered less common in South Dakota historically.

For most grass-shrub ecological sites in South Dakota, the majority of acres would have occurred as disturbance states A, B, C, and where prairie dog colonies could occur, disturbance states G and H. In general, disturbance states D, E, and F were relatively rare except on sparsely vegetated ecological sites under average conditions, where the discontinuity of vegetation discourages fire spread and leads to less frequent fire regimes. Table 3-10 presents the disturbance states expected to have historically occurred on an ecological site within each of the 18 MLRAs for South Dakota.

Forest Ecosystems

Information on disturbance states for forest ecosystems of South Dakota was not developed for the 2014 update because information is not currently available by ecological site. If this information is compiled by the NRCS, it can be considered in future Plan updates.

Riparian-Wetland Systems

Information on disturbance states for riparian-wetland ecosystems across South Dakota was not developed for the 2014 update. More detailed information on riparian and wetland disturbance states was developed for MLRA 53B (Mehl et al. 2009) as part of an effort to describe native ecosystem diversity for this region. Some riparian and wetland ecological site descriptions have been developed for parts of South Dakota and provide state and transition models using NRCS methodology.

Table 3-10. Disturbance states (Table 3-9; Figure 3-16) believed to have historically occurred in South Dakota for each grass-shrub ecological site by Major Land Resource Area. The projected historical relative abundance of these disturbance states are further characterized as "common" and "rare".

ECOLOGICAL SITES		53B	53C	54	55B	55C	56	58D	60A	61	62	63A	63B	64	65	66	102A	102B	102C
LOAMY	Common	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C	A, B, C	A, B, C
	Rare	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F
CLAYEY	Common	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H		A, B, C, G, H	A, B, C	A, B, C	A, B, C
	Rare	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F		D, E, F	D, E, F	D, E, F	D, E, F
SHALLOW CLAY	Common			A, B, C		A, B, C		A, B, C	A, B, C	A, B, C	A, B, C	A, B, C	A, B, C	A, B, C		A, B, C			
	Rare			D, E, F		D, E, F		D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F		D, E, F			
SANDY	Common	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H		A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C	A, B, C	A, B, C
	Rare	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F		D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F
THIN UPLAND	Common	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H		A, B, C, G, H	A, B, C	A, B, C	A, B, C
	Rare	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F		D, E, F	D, E, F	D, E, F	D, E, F
THIN CLAYPAN	Common	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H		A, B, C, G, H	A, B, C, G, H	A, B, C, G, H		A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H			
	Rare	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F		D, E, F	D, E, F	D, E, F		D, E, F	D, E, F	D, E, F	D, E, F	D, E, F			
CLAYPAN	Common	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H		A, B, C, G, H	A, B, C, G, H			A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H	A, B, C, G, H			
	Rare	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F		D, E, F	D, E, F			D, E, F	D, E, F	D, E, F	D, E, F	D, E, F			
DENSE CLAY	Common		A, B, C						A, B, C			A, B, C	A, B, C	A, B, C					
	Rare		D, E, F						D, E, F			D, E, F	D, E, F	D, E, F					
SANDS	Common	A, B, C		A, B, C	A, B, C	A, B, C	A, B, C	A, B, C	A, B, C	A, B, C		A, B, C	A, B, C	A, B, C	A, B, C	A, B, C			A, B, C
	Rare	D, E, F		D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F		D, E, F	D, E, F	D, E, F	D, E, F	D, E, F			D, E, F
SHALLOW LOAMY	Common			A, B, C	A, B, C			A, B, C	A, B, C	A, B, C				A, B, C					
	Rare			D, E, F	D, E, F			D, E, F	D, E, F	D, E, F				D, E, F					
SHALLOW	Common								A, B, C		A, B, C	A, B, C	A, B, C	A, B, C	A, B, C	A, B, C			
	Rare								D, E, F		D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F			
SHALLOW TO GRAVEL	Common	A, B, C	A, B, C		A, B, C	A, B, C	A, B, C				A, B, C	A, B, C	A, B, C	A, B, C		A, B, C	A, B, C	A, B, C	A, B, C
	Rare	D, E, F	D, E, F		D, E, F	D, E, F	D, E, F				D, E, F	D, E, F	D, E, F	D, E, F		D, E, F	D, E, F	D, E, F	D, E, F
SHALLOW SANDY	Common			A, B, C				A, B, C	A, B, C										
	Rare			D, E, F				D, E, F	D, E, F										
VERY SHALLOW	Common	A, B, C	A, B, C	A, B, C	A, B, C	A, B, C		A, B, C	A, B, C	A, B, C	A, B, C	A, B, C	A, B, C	A, B, C		A, B, C	A, B, C	A, B, C	A, B, C
	Rare	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F		D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F	D, E, F		D, E, F	D, E, F	D, E, F	D, E, F
SHALLOW DENSE CLAY	Common								A, B, C										
	Rare								D, E, F										
SHALLOW LIMY	Common												A, B, C	A, B, C	A, B, C	A, B, C			
	Rare												D, E, F	D, E, F	D, E, F	D, E, F			
SANDY CLAYPAN	Common	A, B, C, G, H		A, B, C, G, H	A, B, C, G, H			A, B, C, G, H	A, B, C, G, H										
	Rare	D, E, F		D, E, F	D, E, F			D, E, F	D, E, F										
SALINE UPLAND	Common								A, B, C, G, H										
	Rare								D, E, F										
SHALLOW POROUS CLAY	Common								A, B, C										
	Rare								D, E, F										
MOUNTAIN PRAIRIE	Common										A, B, C								
	Rare										D, E, F								
CHOPPY SANDS	Common												A, B, C		A, B, C	A, B, C			
	Rare												D, E, F		D, E, F	D, E, F			
HIGH COUNTRY LOAMY	Common										A, B, C								
	Rare										D, E, F								
POROUS CLAY	Common								A, B, C										
	Rare								D, E, F										

3.6 Native Ecosystem Plant Community Descriptions

As described previously, an ecosystem is the result of the combined interaction of ecological site and natural disturbance processes. To achieve the goal of ecological restoration using a coarse-filter it is very important to understand that every ecological site can produce different plant communities and thereby, different habitat conditions for associated wildlife species. Using the ecological site database developed by NRCS and providing slight modifications to these data to meet the objectives of the SDWAP, a database of plant community descriptions has been assembled for ecological sites and disturbance states for grass-shrub ecosystems, where data were available. Slight modifications included removing nonnative species from the species list. These plant community descriptions can be used to develop and conduct native ecosystem restoration activities on appropriate ecological sites.

Added to this information is the evaluation of future potential effects under projected climate change assessment through 2099. A description of the terrestrial climate change assessment is provided in Section 5-1. Specifically, each grass species was evaluated on whether it is a C_3 or C_4 species and characterized by whether it will likely decrease or increase with projected climate change for the ecosystem in question. This information will provide the landowner or land manager with the capability to assess the potential effects of these changes on the restoration objectives for a particular site. In the case of providing habitat for a particular wildlife species or SGCN, the possible future decrease of a dominant grass species may warrant the inclusion of another grass species that could provide similar habitat benefits such as height and structure preferred by the targeted species, and which is expected to increase with projected climate change.

More than 900 plant community descriptions are available in this database for both grass-shrub and riparian and wetland ecosystems. Each plant community description in the database identifies the expected disturbance state as described in Tables 3-9 and 3-10, and Figure 3-16 for each ecological site, where available. As stated previously, riparian and wetland plant community descriptions have not been developed for all disturbance states and ecological sites but where information is available, it is included in the database. Table 3-11 provides an example of a plant community description for the clayey ecological site – disturbance state A, for MLRA 53B. These data will be available to the public through the SDWAP web-tool. A description of the web-tools and their use for restoring native ecosystem diversity are provided in Appendix M and described more fully in a later section.

Table 3-11. Example of a plant community description developed for the clayey ecological site – disturbance state A for Major Land Resource Area (MLRA) 53B. The climate change effect information is described in a later section. MFRI = mean fire return interval.

MLRA 53B ECOSITE NAME: CLAYEY
ECOSITE ID: R053BY001ND
PLANT COMMUNITY NAME: Green Needlegrass/Western Wheatgrass
DISTURBANCE STATE: A
FIRE REGIME- MFRI <15 YEARS
GRAZING REGIME- Variable but occurring most years as sporadic or light bison grazing
AVERAGE ANNUAL PRODUCTIVITY (lbs/acres): 2300

COMMON NAME	SCIENTIFIC NAME	SYMBOL	MINIMUM % COMPOSITION BY WEIGHT	MAXIMUM % COMPOSITION BY WEIGHT	CLIMATE CHANGE EFFECT BY 2099
Grasses & Grass-likes			**90**	**95**	
western wheatgrass	*Pascopyrum smithii*	PASM	25	35	DECREASE
green needlegrass	*Nassella viridula*	NAVI4	10	25	DECREASE
shortbristle needle and thread	*Hesperostipa curtiseta*	HECU9	0	15	DECREASE
blue grama	*Bouteloua gracilis*	BOGR2	5	10	INCREASE
thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	ELLAL	0	10	DECREASE
big bluestem	*Andropogon gerardii*	ANGE	0	5	INCREASE
buffalograss	*Bouteloua dactyloides*	BODA2	1	5	INCREASE
needle and thread	*Hesperostipa comata ssp. comata*	HECOC8	1	5	DECREASE
other perennial grasses		2GP	1	5	
plains muhly	*Muhlenbergia cuspidata*	MUCU3	0	5	INCREASE
porcupinegrass	*Hesperostipa spartea*	HESP11	0	5	DECREASE
prairie dropseed	*Sporobolus heterolepis*	SPHE	1	5	INCREASE
sideoats grama	*Bouteloua curtipendula*	BOCU	1	5	INCREASE
slender wheatgrass	*Elymus trachycaulus*	ELTR7	1	5	DECREASE
plains reedgrass	*Calamagrostis montanensis*	CAMO	1	3	DECREASE
prairie Junegrass	*Koeleria macrantha*	KOMA	1	3	DECREASE
sedge	*Carex*	CAREX	1	2	DECREASE
saltgrass	*Distichlis spicata*	DISP	0	1	INCREASE
Forb/Herbs			**2**	**5**	
goldenrod	*Solidago*	SOLID	1	3	
white sagebrush	*Artemisia ludoviciana*	ARLU	1	3	
blazing star	*Liatris*	LIATR	0	2	
common yarrow	*Achillea millefolium*	ACMI2	1	2	
leafy wildparsley	*Musineon divaricatum*	MUDI	1	2	
milkvetch	*Astragalus*	ASTRA	0	2	
other perennial forbs		2FP	0	2	
purple locoweed	*Oxytropis lambertii*	OXLA3	1	2	
scarlet beeblossom	*Gaura coccinea*	GACO5	1	2	
scarlet globemallow	*Sphaeralcea coccinea*	SPCO	1	2	
scurfpea	*Psoralidium*	PSORA2	1	2	
upright prairie coneflower	*Ratibida columnifera*	RACO3	1	2	
white heath aster	*Symphyotrichum ericoides*	SYER	1	2	
American vetch	*Vicia americana*	VIAM	1	1	
autumn onion	*Allium stellatum*	ALST	1	1	
desertparsley	*Lomatium*	LOMAT	1	1	
false boneset	*Brickellia eupatorioides*	BREU	1	1	
other annual forbs		2FA	0	1	
prairie clover	*Dalea*	DALEA	0	1	
pussytoes	*Antennaria*	ANTEN	0	1	
wavyleaf thistle	*Cirsium undulatum*	CIUN	1	1	
white prairie aster	*Symphyotrichum falcatum*	SYFA	0	1	
Shrubs			**1**	**3**	
prairie rose	*Rosa arkansana*	ROAR3	1	2	
prairie sagewort	*Artemisia frigida*	ARFR4	1	2	
western snowberry	*Symphoricarpos occidentalis*	SYOC	1	2	
other shrubs		2SHRUB	0	1	
plains pricklypear	*Opuntia polyacantha*	OPPO	0	1	

CHAPTER 4 AQUATIC SYSTEMS

4.1 Aquatic Goals and Objectives

The main goal of the aquatic portion of the SDWAP is to maintain the integrity of aquatic communities by conserving the conditions and the processes that sustain them. A key component of this goal was to develop a strategy to focus conservation efforts on key aquatic landscapes called Conservation Opportunity Areas (COAs) to conserve the full array of biodiversity. These primarily riverine aquatic ecosystems adequately represent the full extent of distinct aquatic habitats across South Dakota and focus on SGCN. Emphasis on riverine ecosystems was largely due to habitat preferences of aquatic SGCN.

A function of this analysis was to provide spatial data that could be used by natural resource professionals, non-governmental organizations (NGOs), legislators, and the public to make more informed decisions when prioritizing opportunities to fill information gaps and identify specific areas as high priorities for conservation work.

A large portion of the spatial data used to identify South Dakota's aquatic COAs came from the National Aquatic Gap Analysis Program analysis of the Missouri River basin (MOGAP, Annis et al. 2010). From these data, we used a modified version of the aquatic GAP classification hierarchy to assist in the identification of aquatic COAs.

Specific objectives were to:

1. Classify and map riverine ecosystems into distinct ecological units at multiple levels.
2. Develop statewide distribution maps for all known and probable occurrences for all fish, mussels and aquatic invertebrates listed as SGCN.
3. Generate overall watershed ownership/stewardship statistics for aquatic ecological drainage units.
4. Account for factors that negatively affect or threaten aquatic biodiversity in South Dakota.
5. Identify areas that represent the variety of unique habitats in South Dakota as high priority for future conservation initiatives or protection.
6. Provide information to decision makers to help with conservation planning efforts.

Pallid Sturgeon photo by Sam Stukel, SD GFP

4.2 Aquatic Conservation Strategy

Sam Stukel, SD GFP

Conserving the large variety of aquatic biological diversity in South Dakota is challenging. Detection of long-term changes to freshwater ecosystems and assemblages is often difficult, as historic documentation of range and density is often lacking or incomplete (McCartney 2002). Additionally, conservation and management is difficult due to multiple stressors and disturbances occurring concurrently, making it difficult to determine the exact causes of species and habitat loss and decline (Cushing and Allan 2001, McCartney 2002).

Loss of habitat by land conversion and habitat degradation continues to be a leading cause of species loss and decline in South Dakota, while human and financial resources for conservation remain limited. In the past, conservation efforts to preserve biodiversity were primarily focused on individual species or isolated populations on the brink of extinction or local extirpation (Franklin 1993, Scott et al. 1993). This species-by-species approach to conservation has proved difficult, biased, and not cost effective (Hutto et al. 1987, Scott et al. 1987, 1991, Margules 1989, Noss 1991). Therefore, we must improve the efficiency and effectiveness of conservation efforts by managing biodiversity through a systematic approach. This approach will allow us to identify and prioritize which species, assemblages, habitats, and unique watersheds to focus our conservation efforts on and propose for conservation opportunity areas (COAs).

The US Geological Survey's National Gap Analysis Program (USGS GAP) was initiated in 1988 to provide a coarse-filter approach for identifying conservation needs for biodiversity by identifying gaps in existing conservation efforts (Scott et al. 1993). Within the overall USGS GAP is the Aquatic GAP Program which more specifically evaluates aquatic biodiversity and habitats to enable more efficient and effective conservation prioritization.

The Aquatic portion of the SDWAP incorporates a combined coarse filter and fine filter strategy for conservation of aquatic biodiversity. This filtering strategy along with incorporating data from the National Aquatic GAP allows us to provide a sound scientific foundation for identifying the cumulative effects of threats and land use practices on species and their habitats. Additional explanation about coarse filter and fine filter approaches can be found in Section 3.1.

Application of the Strategy

Biodiversity was assessed at two levels:

1. Ecosystem (Community level), and
2. Species.

The combined filtering strategy provides the mechanism to address different levels of biological organization. The coarse filter addresses the ecosystem or community levels while the fine filter addresses the species level. In the future, when additional information becomes available through survey and research work, we plan to add additional levels of biodiversity, including more detailed links to the landscape and genetic structure.

A Systematic Approach to Conservation

- Identify components of biological diversity on which to focus conservation efforts
  (e.g. SGCN, natural communities, etc.)

- Identify where to focus conservation efforts
  - Select areas based on highest known and probable occurrences of aquatic SGCN and natural communities
    (i.e. highest species diversity; representing all aquatic SGCN; giving special consideration to aquatic SGCN with limited ranges)
  - Select areas with the highest probability for successful conservation of SGCN
    (i.e. lowest known conservation challenges to aquatic ecosystems (i.e. lowest Human Stressor Index (HSI)); highest level of land stewardship and protection from conversion of natural land cover)
  - Select areas from across the state and SGCN ranges that represent unique watershed types to maintain variation
    (i.e. representing all Aquatic Ecological System types (AES-types))

4.3 Aquatic Diversity – Classification of Riverine Ecosystems

It is widely accepted that to conserve biological diversity, one must conserve the ecosystems that support them (Franklin 1993, Grumbine 1994). Ecosystems can be distinct with regard to their structure, function, or composition (Noss 1990). Structural features in riverine ecosystems include factors such as depth, velocity, and substrate. Functional features include flow, thermal regime, and energy sources. Composition can refer to both abiotic and biotic factors such as habitat type or species. Ecological composition is usually closely associated with ecosystem structure and function (Noss 1990).

Taking geographic variation into consideration, our specific objective was to identify and map riverine ecosystems that are distinct at multiple levels with regard to ecosystem structure, function, and evolutionary history. To accomplish this, we used levels four through seven of the eight-level classification system developed by The Nature Conservancy Freshwater Initiative and the National Aquatic GAP of the Missouri River basin (Table 4-1; Figure 4-1; MOGAP, Higgins 2003, Higgins et al. 2005, Annis et al. 2010). Levels within the hierarchy are delineated in a top-down fashion using landscape and stream features (i.e. drainage boundaries, geology, soils, landform, stream size, gradient, etc.).

Table 4-1. Hierarchical framework, with basic descriptions, used for classifying and mapping riverine ecosystems in the Missouri River Gap Analysis Project. Hierarchy is adapted after the classification hierarchies of Frissell et al. 1986, Pflieger 1989, Maxwell et al. 1995, Seelbach et al. 1997, and Higgins et al. 2005. Note: Levels in red account for the levels used in South Dakota's selection process for identifying Conservation Opportunity Areas (COAs).

LEVEL	DESCRIPTION
Zones	Continental boundaries broken into six major zones of the world that resulted from distinct evolutionary histories associated with plate tectonics.
Subzones	Major river networks broken into subcontinental strata with relatively unique aquatic assemblages created by plate tectonics, glaciation, and mountain ranges.
Regions	Major river networks broken into subzone strata created by drainage network patterns that determine dispersal routes and isolation mechanisms that have resulted in different responses to long-term changes in climate.
Subregions	Regional stratification units that have similar climate and physiography that often correspond to broad scale patterns in dominant vegetation.
Ecological Drainage Units (EDUs)	Drainage boundaries broken into subregion strata, a combination of drainages within a distinct physiographic setting that share a common evolutionary history.
Aquatic Ecological System-Types (AES-Types)	Watershed boundaries broken into hydrologic subunits of EDUs with similar physiographic character, basin morphology and position within the larger drainage.
Valley Segment Types (VSTs)	Stream size broken down into hydrologic subunits of AESs, a combination of stream reaches with similar fluvial processes, sediment transport, riparian vegetation, and thermal regime.
Habitat Unit Types	Hydrologic subunits of VSTs, examples include depth, velocity, substrate, riffles, pools, and runs.

Levels 1-3: Zone, Subzone, and Region

The upper three levels of the hierarchy are largely zoogeographic strata representing geographic variation in taxonomic composition of aquatic assemblages across the landscape resulting from distinct evolutionary histories. The first three levels (Zones, Subzones, Regions) provide little ecological content as these are more specifically related to continental, subcontinental, and subzone zoogeographical boundaries and were not included in our selection process for defining COAs, although they are important for research and conservation at a global scale (Matthews 1998).

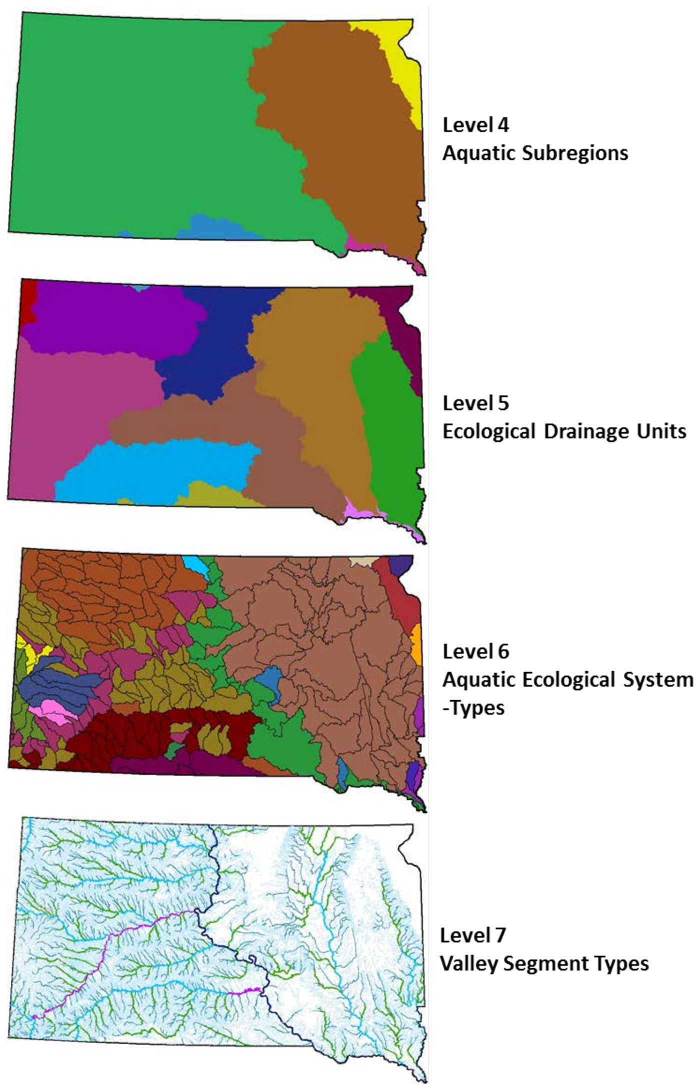


Figure 4-1. Map showing Levels 4-7 of the Missouri River Gap Analysis Project Aquatic Ecological Classification hierarchy in South Dakota (Annis et al. 2010).

Level 4: Aquatic Subregions

The Aquatic Subregions of South Dakota are separated along major drainages that generally correspond with abrupt transitions in geology, landform, soils, climate, land cover, etc. There are five Aquatic Subregions in South Dakota including the Sandhills and Plains, Middle Missouri Plains, Central Dissected Till Plains, Northern Glaciated Plains, and Upper Minnesota River (Figure 4-2). The Upper Minnesota River Basin is part of the Mississippi River drainage system and therefore was not a part of the MOGAP dataset. This area is found in northeastern South Dakota and encompasses the Upper Minnesota River drainage. Limited data were available for this watershed.

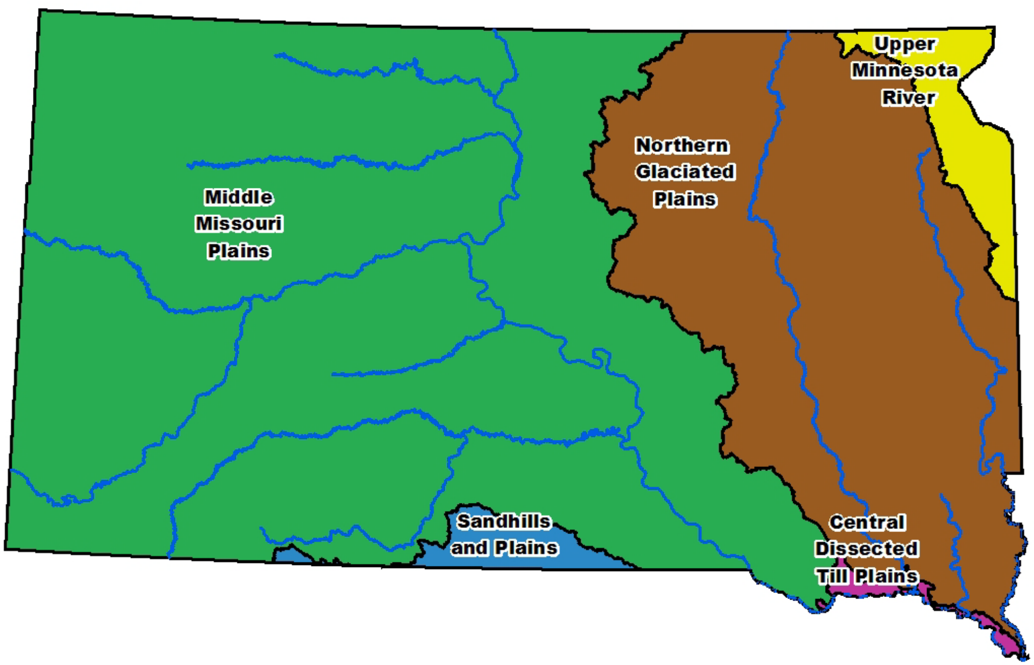


Figure 4-2. Map showing the boundaries of the five aquatic subregions of South Dakota, including the Upper Minnesota River basin, which lies outside of the Missouri River drainage.

Sandhills and Plains

The Sandhills and Plains Aquatic Subregion is primarily within the northern half of Nebraska, with only a small portion reaching into southcentral South Dakota. This subregion contains two Ecological Drainage Units (EDUs): the Middle Platte and the Niobrara, however the only EDU within South Dakota is the Niobrara River drainage. The Sandhills and Plains Aquatic Subregion consists of low hills, dissected plains, sand dunes, and wetlands; however, the majority of this subregion is composed of smooth plains.

Middle Missouri Plains

The largest Aquatic Subregion within South Dakota is the Middle Missouri Plains, which encompasses the western half of the state. This subregion contains seven EDUs: the Bad/Choteau, Cheyenne, Grand/Moreau, Heart, Little Missouri, Middle Missouri, and White drainage units. Major rivers include the Bad, Belle Fourche, Cheyenne, Grand, Little Missouri, Little White, Missouri, Moreau, and White rivers. The Middle Missouri Plains Aquatic Subregion consists of level to dissected uplands, hills, and mountainous regions near the Badlands formations; however, the majority of this subregion is composed of smooth plains.

Central Dissected Till Plains

The Central Dissected Till Plains Aquatic Subregion primarily lies within Nebraska and Iowa, with only a small portion in southeastern South Dakota. This subregion contains four EDUs: the Blackwater/Lamine, Grand/Chariton, Kansas, and Little Sioux/Nemaha drainage units, however only the Little Sioux/Nemaha drainage unit lies within South Dakota. This Aquatic Subregion consists mostly of flat to gently undulating plains and hills; however, the majority of this subregion is composed of smooth plains.

Northern Glaciated Plains

The Northern Glaciated Plains Aquatic Subregion is primarily located within North and South Dakota and encompasses the eastern half of South Dakota. This subregion contains two EDUs: the Big Sioux/Vermillion and James River drainages. This Aquatic Subregion is generally flat with some rolling plains areas; however, it is primarily composed of flat plains.

Level 5: Ecological Drainage Units (EDUs)

Embedded within the aquatic subregions are Ecological Drainage Units (EDUs), which are also referred to as "islands" on the landscape (Sowa et al. 2005). Ecological Drainage Units group watersheds that share common taxonomic composition (species and genetic integrity), which is the result of similar evolutionary histories within the major drainages within each Aquatic Subregion.

Ecological Drainage Units provide ecologically meaningful units within which conservation areas can be selected to ensure that conservation elements (i.e. species and community units) are represented across the landscape. This type of regional stratification is critical in conservation planning and includes genetic and ecological variability among species, communities, and ecosystems across their spatial and environmental ranges. Twelve EDUs are embedded within South Dakota, eleven within the Missouri River basin including the Bad/Choteau, Big Sioux/Vermillion, Cheyenne, Grand/Moreau, Heart, James, Little Missouri, Little Sioux/Nemaha, Middle Missouri, Niobrara, and White drainage units and an additional EDU that lies within the Mississippi River basin, the Upper Minnesota River (Figure 4-3; Table 4-2). The Upper Minnesota River EDU is part of the Mississippi River drainage system. Because it was not part of the MOGAP dataset, limited data were available for this EDU.

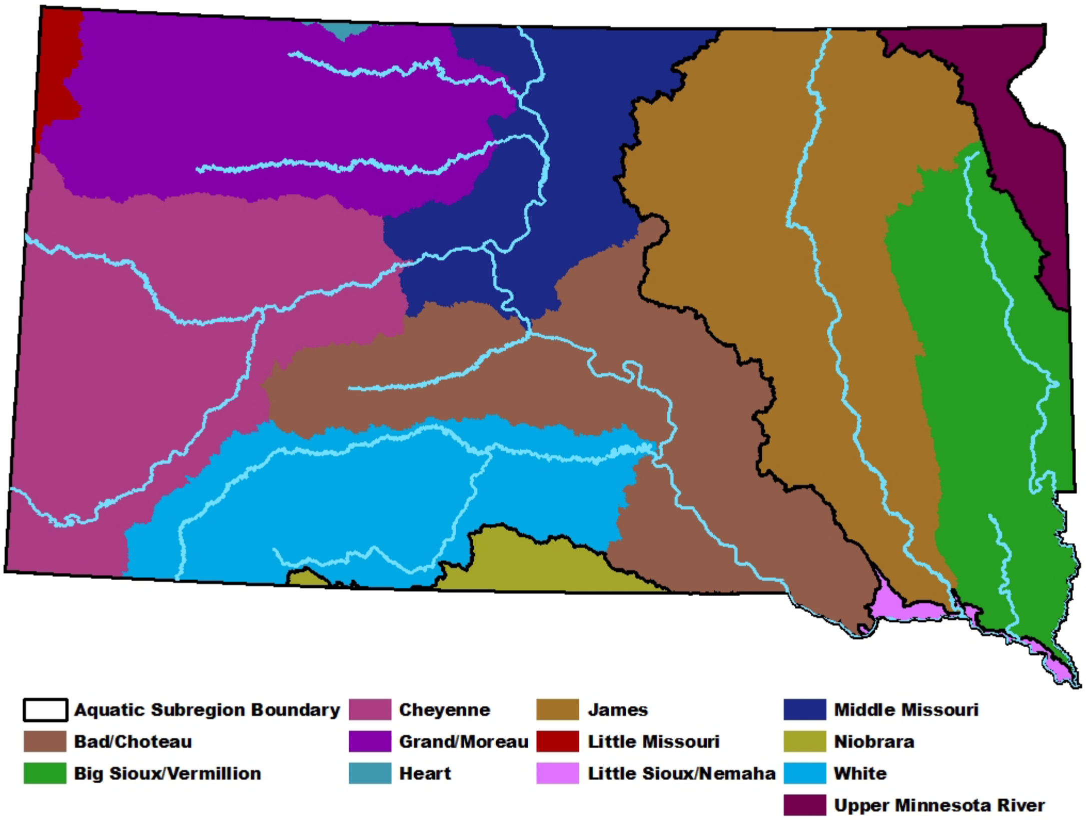


Figure 4-3. Map showing the boundaries of the twelve ecological drainage units (EDUs) of South Dakota, including the Upper Minnesota River drainage from the Mississippi River basin.

Table 4-2. Descriptions of Ecological Drainage Units (EDUs) in the Missouri River Basin of South Dakota.

Bad/Choteau EDU	Within the Middle Missouri Plains Aquatic Subregion lies the Bad/Choteau EDU. This EDU can be found within southcentral South Dakota, extending into northeastern Nebraska. In addition to the Bad and Choteau Rivers, the only other major river within this EDU is the Missouri. This area has been glaciated and has a landscape of level to rolling uplands and plains with some dissected hills and canyons. Pothole wetlands can also be found throughout this region. In South Dakota, 10 aquatic SGCN are known to inhabit this EDU. The fish community can generally be classified as minnow/sunfish/sucker.
Big Sioux/Vermillion EDU	Within the Northern Glaciated Plains Aquatic Subregion lies the Big Sioux/Vermillion EDU. This EDU can be found within eastern South Dakota and extends into the corners of Minnesota, Iowa, and Nebraska. In addition to the Big Sioux and Vermillion Rivers, the only other major river within the EDU is the Rock River. The landscape of this area changes from floodplains near the Missouri River to low rolling hills and plains with some bluffs and glaciations. The northern half of this EDU has many lakes and wetlands throughout. In South Dakota, 18 aquatic SGCN are known to inhabit this EDU. The fish community can generally be classified as minnow/sucker/sunfish.
Cheyenne EDU	Within the Middle Missouri Plains Aquatic Subregion lies the Cheyenne EDU. This EDU can be found within western South Dakota, Wyoming, and the extreme northwestern corner of Nebraska. In addition to the Cheyenne River, major streams within the EDU include the Belle Fourche River, Beaver Creek, Cottonwood Creek, Hat Creek, Indian Creek, Lance Creek, Mixes Food Creek, and Cherry Creek. The landscape of this area has not been glaciated and is composed of dissected hills, rolling plains, isolated buttes, badland formations, and salt pans. This area has many intermittent streams. In South Dakota, 8 aquatic SGCN are known to inhabit this EDU. The fish community can generally be classified as minnow/sunfish/sucker.
Grand/Moreau EDU	Within the Middle Missouri Plains Aquatic Subregion lies the Grand/Moreau EDU. This EDU is found in the northwestern corner of South Dakota and the southwestern corner of North Dakota. In addition to the Grand and Moreau Rivers, major streams within this EDU include the Missouri River, Handboy Creek, the North and South Forks of the Grand River, and the South Fork of the Moreau River. The landscape has not been glaciated and is composed of dissected hills, rolling plains, forested buttes, badland formations, and salt pans. This area has some headwater areas derived from springs, as well as intermittent streams in shallow valleys. In South Dakota, four aquatic SGCN are known to inhabit this EDU. The fish community can generally be classified as minnow/sunfish/perch.

Table 4-2 (continued). Descriptions of Ecological Drainage Units (EDUs) in the Missouri River Basin of South Dakota.

Heart EDU	Within the Middle Missouri Plains Aquatic Subregion lies the Heart EDU. This EDU lies primarily in southwestern North Dakota with only a small portion extending into north central South Dakota. In addition to the Heart River, major streams within the EDU include the Cannonball and Knife rivers. The landscape of this area has not been glaciated and is composed of dissected, level to rolling plains and hills, with an occasional sandstone butte. In South Dakota, no aquatic SGCN are known to inhabit this EDU. The fish community can generally be classified as minnow/sunfish/sucker.
James EDU	Within the Northern Glaciated Plains Aquatic Subregion lies the James EDU. This EDU is located in central North Dakota and extends south through eastern South Dakota to the Nebraska border. The only major stream or river within this EDU is the James River. The landscape of this area has been glaciated and is composed of rolling plains, moraines, and some sand dunes. This area has many lakes, wetlands, and is cut by steep perennial streams. In South Dakota, 15 aquatic SGCN are known to inhabit this EDU. The fish community can generally be classified as minnow/sunfish/sucker.
Little Missouri EDU	Within the Middle Missouri Plains Aquatic Subregion lies the Little Missouri EDU. This EDU is located in eastern Montana, western North Dakota and the northwestern corner of South Dakota. In addition to the Little Missouri River the only other major river is the Missouri River. These areas are unglaciated with landscapes of dissected hills, level to rolling plains, isolated buttes, badland formations, salt pans, and mounds. In South Dakota, 2 aquatic SGCN are known to inhabit this EDU. The fish community can generally be classified as minnow/yellow perch/sucker.
Little Sioux/Nemaha EDU	Within the Central Dissected Till Plains Aquatic Subregion lies the Little Sioux/Nemaha EDU. This EDU borders Iowa, Kansas, Missouri, Nebraska, and extends into the extreme southeastern corner of South Dakota. In addition to the Little Sioux and Big Nemaha River, other major streams include Boyer River, Nishnabotna River, Missouri River, Nodaway River, Olive River Branch, One Hundred River, and Two River, Platte River, Rattlesnake Creek, and Wahoo Creek. The landscape is primarily rolling low hills, with some dissected hills, bluffs, and irregular plains. In South Dakota, 9 aquatic SGCN are known to inhabit this EDU. The fish community can generally be classified as minnow/sunfish/sucker.
Middle Missouri EDU	Within the Middle Missouri Plains Aquatic Subregion lies the Middle Missouri EDU. This EDU runs from the northwestern corner of North Dakota to the north central portion of South Dakota. In addition to the Missouri River, major streams in the EDU include the Cannonball River, Cheyenne River, and Handboy Creek. These areas have been glaciated, and the landscape consists of level to hilly plains, rolling moraines, and scattered wetlands and lakes. In South Dakota, 5 aquatic SGCN are known to inhabit this EDU. The fish community can generally be classified as minnow/sunfish/sucker.

Table 4-2 (continued). Descriptions of Ecological Drainage Units (EDUs) in the Missouri River Basin of South Dakota.

Niobrara EDU	Within the Sandhills and Plains Aquatic Subregion lies the Niobrara EDU. This EDU is mainly in northern Nebraska, but also extends into the edges of south central South Dakota. The only major river within this EDU is the Niobrara River. This area has a landscape of flat and rolling hills, ridges and valleys, areas of sand dunes and canyons along streams. Most of the streams are intermittent, with a few large perennial streams. In South Dakota, 4 aquatic SGCN are known to inhabit this EDU. The fish community can generally be classified as minnow/sunfish/yellow perch.
White EDU	Within the Middle Missouri Plains Aquatic Subregion lies the White EDU. This EDU is located in southwestern South Dakota and the northwest corner of Nebraska. In addition to the White River, major streams in this EDU include Cain Creek, Little White River, and the Missouri River. This area has not been glaciated, and the landscape is composed of dissected hills, level to rolling plains, isolated buttes, badland formations, mounds, and salt pans. In South Dakota, 5 aquatic SGCN are known to inhabit this EDU. The fish community can generally be classified as minnow/sunfish/sucker.

Level 6: Aquatic Ecological System Types (AES-Types)

Embedded within EDUs are Aquatic Ecological Systems (AESs), which account for finer resolution variation in ecological composition of local assemblages. Aquatic Ecological System-Types (AES-Types) group small and large river hydrologic units into distinct "habitat types", which combine areas of similar geology, soils, landform, groundwater influence, thermal regime, and physical habitats.

These AES-Types are similar to the habitat classifications of lakes and other wetlands, with multiple instances of the same habitat type within a classification system, except that this classification applies specifically to riverine systems. For example, within riverine classification systems, riffles may be one example of an individual habitat type. Millions of individual riffles may occur across the landscape; however they are grouped together based on a similar habitat type. AES-Types are classified similarly. Each AES is broken down into individual spatially distinct macrohabitats. However, all individual AESs that are structurally and functionally similar are grouped together within the same AES-Type. Across the Missouri River basin there are 32 different AES-Types. Within South Dakota, 16 different AES-Types occur within the Missouri River basin (Table 4-3) and an additional 5 AES-Types lie within the Mississippi River basin (Figure 4-4). The AES-Types that lie within the Mississippi River basin are not part of the MOGAP dataset, therefore limited data exist (Annis et al. 2010). These AES-Types are the Big Slough, Lake Tewaukon, Upper Little Minnesota River, Upper West Branch Lac Qui Parle River, and Upper Yellow Medicine River.

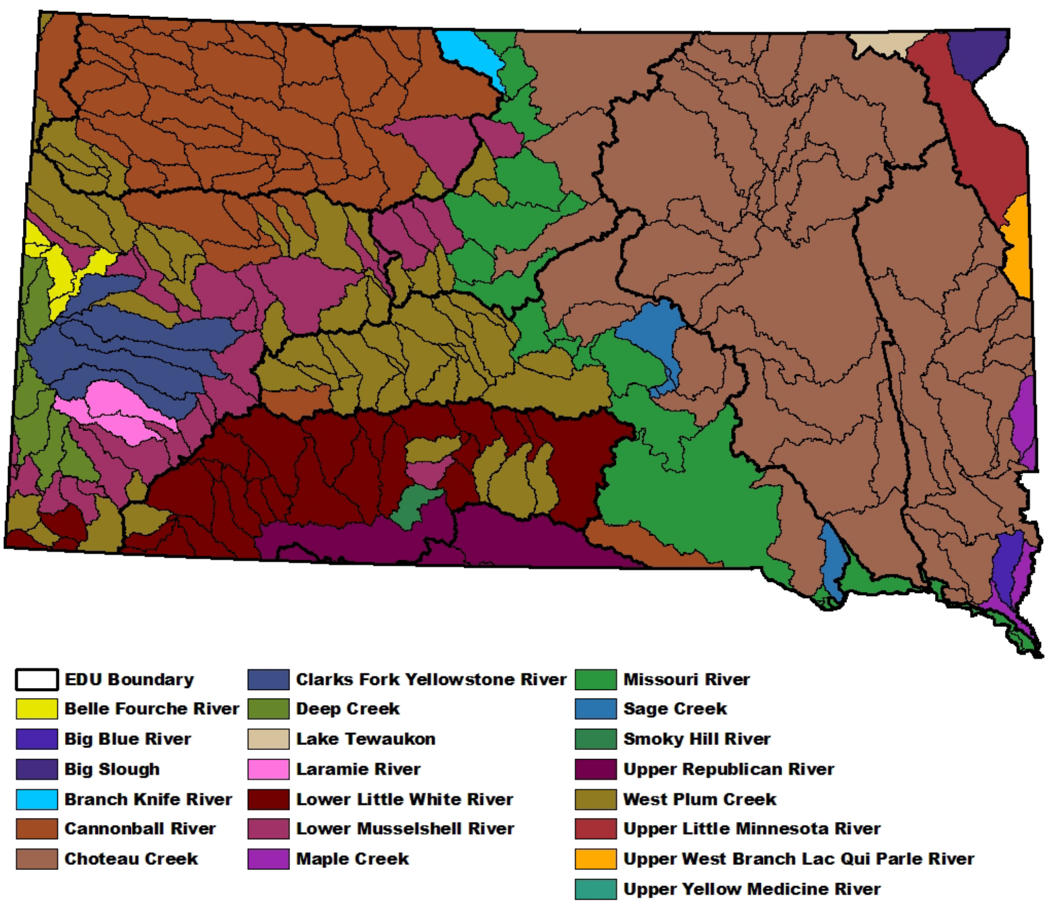


Figure 4-4. Boundaries of the 21 aquatic ecological system types (AES-Types) delineated for South Dakota.

Table 4-3. Descriptions of Missouri River Basin AES-Types in South Dakota.

Belle Fourche River	The Belle Fourche River AES-Type is located in Montana, Wyoming and South Dakota. Major perennial streams within this AES-type include the Belle Fourche River, Nowood River, and Smith River. Several landform types share dominance including irregular plains, breaks, and low hills.
Big Blue River	The Big Blue River AES-Type is located in Missouri, Kansas, Nebraska, Iowa and South Dakota. Major perennial streams within this AES-type include the Kansas River, Republican River, and Big Blue River. Several landform types share dominance, including smooth, flat, and irregular plains.
Branch Knife River	The Branch Knife River AES-Type is located in Montana, North Dakota and South Dakota. Major perennial streams within this AES-type include the Knife River, Heart River, and Big Dry Creek. Two main landform types found within this AES-type include irregular and smooth plains.
Cannonball River	The Cannonball River AES-Type is located in Montana, North Dakota, South Dakota, Wyoming and Nebraska. Major perennial streams within this AES-type include the Moreau, Cannonball, Grand, and Heart Rivers. Several landform types include smooth, irregular, and flat plains.
Choteau Creek	The Choteau Creek AES-Type is located in Montana, North Dakota, South Dakota, Iowa and Canada. Major perennial streams within this AES-type include the James, Big Sioux, and Poplar Rivers. This AES-type has the highest amount of flat plains landforms in the entire Missouri River basin.
Clarks Fork Yellowstone River	The Clark's Fork Yellowstone River AES-Type is located in Montana, Wyoming, Colorado, and South Dakota. Major perennial streams within this AES-type include the South Platte River, Wind River, and Bighorn River. There are no dominant landform types within the AES-type.
Deep Creek	The Deep Creek AES-Type is located in Montana, Wyoming, South Dakota and Colorado. Major perennial streams within this AES-type include the headwaters of the North Platte River, Smith River, and Sage Creek. Several landform types, including hills, low hills, irregular plains, and breaks share dominance within this AES-type.
Laramie River	The Laramie River AES-Type is located in Montana, Wyoming, Colorado, and South Dakota. Major perennial streams within this AES-type include the North Platte River, Laramie River, and Medicine Bow River. Several landforms share dominance including irregular plains, low hills, smooth plains, and breaks.
Lower Little White River	The Lower Little White River AES-Type is located in South Dakota, Nebraska, and Wyoming. Major perennial streams within this AES-type include the White River, and Hat Creek. Landform types include irregular plains, smooth plains, and breaks.

Table 4.3 (continued). Descriptions of Missouri River Basin AES-Types in South Dakota.

Lower Musselshell River	The Lower Musselshell River AES-Type is located in Montana, North Dakota, South Dakota, and Wyoming. Major perennial streams within this AES-type include the Little Missouri River, Musselshell River, Cheyenne River, and Belle Fourche River. Landform types include irregular plains, smooth plains, and breaks.
Maple Creek	The Maple Creek AES-Type is located in Missouri, Iowa, Minnesota, South Dakota, Nebraska, and Kansas. Major perennial streams within this AES-type include the Little Sioux River, Nodaway River, and Rock River. Landform types include smooth, irregular, and flat plains.
Missouri River	The Missouri River AES-Type is located in Missouri, Kansas, Nebraska, Iowa, South Dakota, North Dakota, and Montana. This AES-type follows the mainstem of the Missouri River. Landform types include flat, irregular, and smooth plains and breaks.
Sage Creek	The Sage Creek AES-Type is located in Montana, South Dakota, and Canada. Major perennial streams within this AES-type include the Milk River, Marias River, and Frenchman Creek. The most common landform types are flat, smooth, and irregular plains.
Smoky Hill River	The Smoky Hill River AES-Type is located in Kansas, Nebraska, Colorado, Wyoming, and South Dakota. Major perennial streams within this AES-type include the Republican River, Solomon River, Smoky Hill River, and Lodgepole Creek. The two main landform types are flat and smooth plains.
Upper Republican River	The Upper Republican River AES-Type is located mostly in Nebraska and Colorado, with some overlap in Kansas, South Dakota, and Wyoming. Major perennial streams within this AES-type include the Republican River, Elkhorn River, and Niobrara River. Two main landforms include flat and smooth plains.
West Plum Creek	The West Plum Creek AES-Type is located in Montana, South Dakota, Nebraska, and Wyoming. Major perennial streams within this AES-type include the Bad River, Little Missouri River, and West Plum Creek. Landform types include smooth plains, irregular plains, and breaks.

Level 7: Valley Segment Types (VSTs)

The smallest level of the hierarchical classification of riverine ecosystems is Valley Segment Types (VSTs). Valley Segment Types define and map longitudinal and other linear variations in ecosystem structure and function. Stream segments were selected within the 1:100,000 USGS/EPA National Hydrography Dataset (NHD) and were classified into VSTs according to stream size class (headwater, creek, small river, medium river, large river, and great river), flow, gradient, temperature, and geology (Figure 4-5).

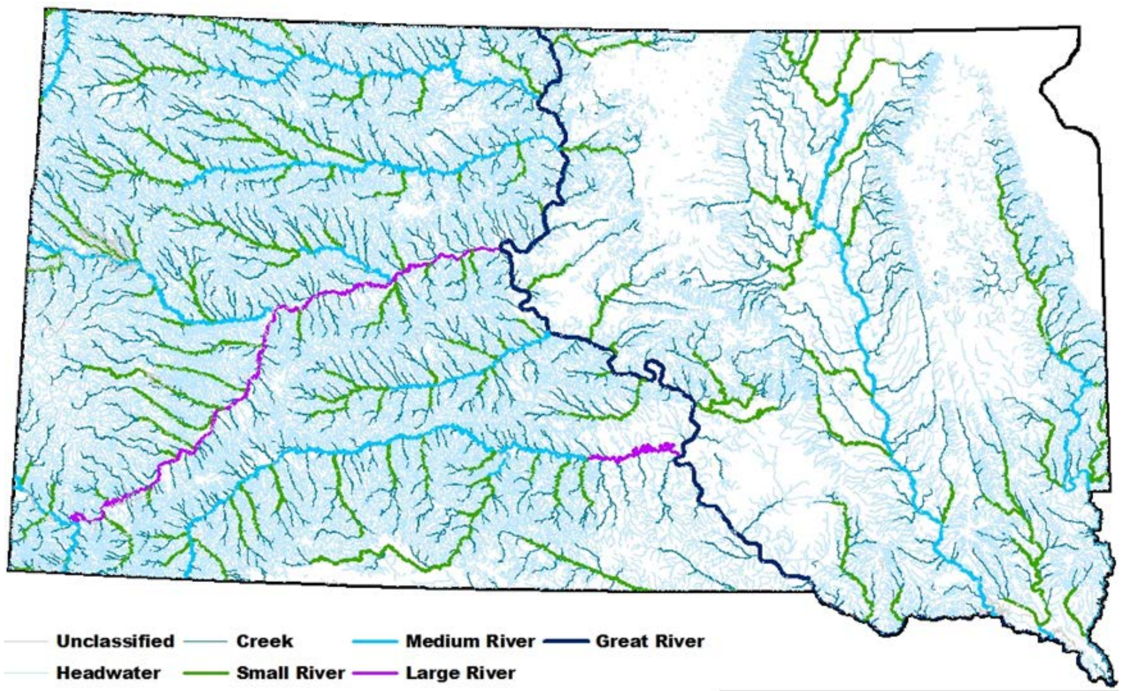


Figure 4-5. Map showing the six stream size classes used in the classification of valley segment types (VSTs) for South Dakota.

Data Limitations

Due to data gaps and a lack of consistent basin-wide information at the VST level, the MOGAP dataset only fully classified and mapped the primary channels of interconnected stream networks. Streams in any given size class may have very different flow volumes and water temperatures in different parts of the Missouri River basin. Within South Dakota, the stream networks are braided and consist of many channels and intermittent streams with limited data.

Due to large information gaps at the VST level, AES-Types were the chosen level for prioritizing areas for conservation. These medium sized watersheds represent various “habitat types” and are the smallest hierarchical classification of riverine ecosystem level for which we have the most information at the statewide level.

4.4 Aquatic Species of Greatest Conservation Need

A complete listing of SGCN is found in Table 2-1, which includes 36 aquatic SGCN (Table 4-4).

Table 4-4. List of aquatic species of greatest conservation need (SGCN) developed for the South Dakota Wildlife Action Plan.

Common Name	Scientific Name	Federal Status[a]	State Status[b]	Selection Code
FRESHWATER MUSSELS				
Creek Heelsplitter	*Lasmigona compressa*			3
Elktoe	*Alasmidonta marginata*			3
Hickorynut	*Obovaria olivaria*			3
Higgins Eye	*Lampsilis higginsii*	E		1
Mapleleaf	*Quadrula quadrula*			3
Pimpleback	*Quadrula pustulosa*			3
Rock Pocketbook	*Arcidens confragosus*			3
Scaleshell	*Leptodea leptodon*	E		1
Yellow Sandshell	*Lampsilis teres*			3
AQUATIC INSECTS				
A Mayfly	*Analetris eximia*			3
Dakota Stonefly	*Perlesta dakota*			2a; 3
Dot-winged Baskettail - A Dragonfly	*Epitheca petechialis*			3
Elusive Clubtail - A Dragonfly	*Stylurus notatus*			3
FISHES				
Banded Killifish	*Fundulus diaphanus*		E	1
Blacknose Shiner	*Notropis heterolepis*		E	1
Blackside Darter	*Percina maculata*			3
Blue Sucker	*Cycleptus elongatus*			3
Carmine Shiner	*Notropis percobromus*			3
Central Mudminnow	*Umbra limi*			3
Finescale Dace	*Chrosomus neogaeus*		E	1
Hornyhead Chub	*Nocomis biguttatus*			3
Lake Chub	*Couesius plumbeus*			3
Logperch	*Percina caprodes*			3
Longnose Sucker	*Catostomus catostomus*		T	1
Mountain Sucker	*Catostomus platyrhynchus*			3
Northern Pearl Dace	*Margariscus nachtriebi*		T	1
Northern Redbelly Dace	*Chrosomus eos*		T	1
Pallid Sturgeon	*Scaphirhynchus albus*	E	E	1
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*	T		1
Sicklefin Chub	*Macrhybopsis meeki*		E	1
Southern Redbelly Dace	*Chrosomus erythrogaster*			3

Table 4-4. (continued). List of aquatic species of greatest conservation need (SGCN) developed for the South Dakota Wildlife Action Plan.

Common Name	Scientific Name	Federal Status[a]	State Status[b]	Selection Code
FISHES(continued)				
Sturgeon Chub	*Macrhybopsis gelida*		T	1
Topeka Shiner	*Notropis topeka*	E		1
Trout-perch	*Percopsis omiscomaycus*			3
TURTLES				
False Map Turtle	*Graptemys pseudogeographica*		T	1
Smooth Softshell	*Apalone mutica*			3

[a] Federal Status - E= Endangered, a species in danger of extinction throughout all or a significant portion of its range; T = Threatened, a species likely to become endangered in the foreseeable future

[b] State Status - E= Endangered, a species in danger of extinction throughout all or a significant portion of its range in South Dakota; T = Threatened, a species likely to become endangered in the foreseeable future in South Dakota

Selection Codes and criteria used to select SGCN are listed in Table 2-1.

Species distributions can be displayed in a variety of ways, including:

1. *Actual distribution* – based on long-term surveys that are infrequent, time consuming, and not cost effective;
2. *Known distribution* – based on current knowledge of where the species distribution can be found; however, this may have data gaps; and
3. *Predicted (probable) distribution* – combines known distribution and knowledge of habitat associations of a species to develop a probable or expected species distribution.

Despite a scarcity of information, species distribution maps are an important part of our COA selection process as a large portion of the focus is on the presence of federally and state endangered, threatened, or rare aquatic species, listed as SGCN. The South Dakota Natural Heritage Database (SDNHD) represents the most comprehensive, statewide data on at-risk species and natural communities in the state; however, its data are far from complete. Therefore, our species distribution maps use a combination of both known and predicted distributions. With these maps we can better estimate where the best management options are for conserving individual species and aquatic communities.

Known species distributional data are primarily point records dating as far back as 1879 (SDNHD). Historical records were defined as records dating prior to 1985. These were not used in our current species distributional maps or in the COA selection process. Current records were those from January 1, 1985 through December 31, 2013. For the COA selection process both confirmed and probable species richness distributional information at the AES level was used. A confirmed species status was defined as an Aquatic Ecological System (AES) unit for which a current collection point was reported within the SDNHD (Figure 4-6). A probable species status was defined as the area outside an AES boundary without current collection point records, while still contained within the 8-digit Hydrologic unit code

(HUC_8) boundary (Figure 4-6). Both confirmed and probable species richness records were used in the COA selection process.

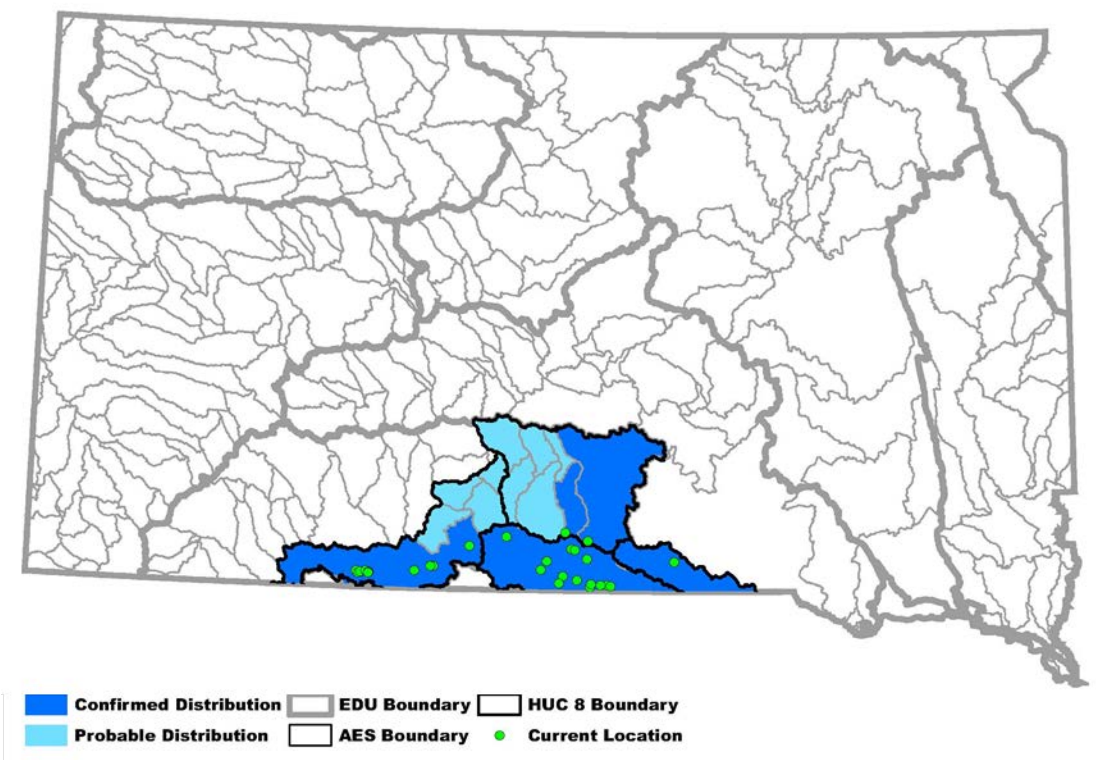


Figure 4-6. Sample map defining confirmed and probable distributional records at the aquatic ecological system (AES) and hydrologic unit code (HUC_8) boundary levels, respectively.

Individual species statewide distribution maps were developed for 21 fish, 9 mussels, 2 aquatic invertebrates and two aquatic turtle species listed as SGCN. Two aquatic invertebrates lack distribution maps, due to a lack of information on distribution. Individual distribution maps contain point data from the SDNHD, confirmed records at the AES level, and probable records from the HUC_8 boundary level. Individual distribution maps for SGCN can be found within the species profiles section (Appendix C).

Species Richness

Species richness is one of many measures of biodiversity and one way of assessing the representation of species and all unique riverine ecosystems across South Dakota. Considering the 36 aquatic SGCN, we used a combination of confirmed and probable species distributional data to collectively determine the richest AESs across South Dakota (Figure 4-7). This information was later used in the COA selection process.

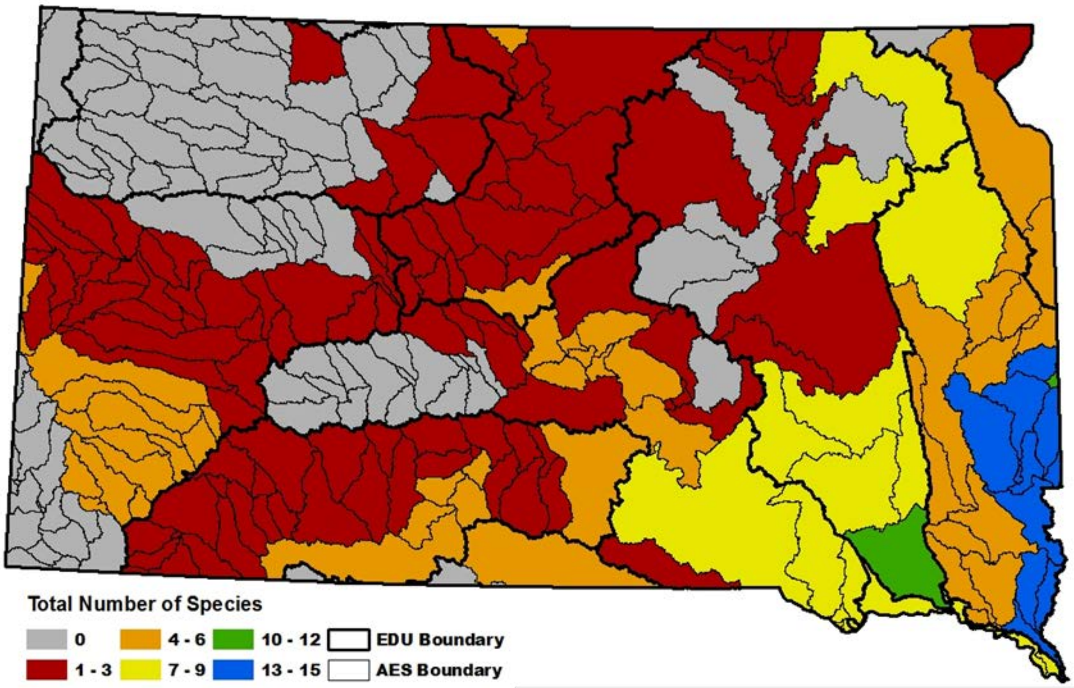


Figure 4-7. Map of overall species richness (fish, mussels, aquatic invertebrates, and aquatic turtles) for species of greatest conservation need for aquatic ecological system (AES) units.

The highest species richness (13-15 species) across all aquatic taxonomic groups occurs within the Northern Glaciated Plains aquatic subregion, and more specifically within the Big Sioux/Vermillion Ecological Drainage Unit (EDU), just before it empties into the Missouri River. This same stretch of river contains the highest species richness values for both fish (7 species; Figure 4-8 and mussels (4-6 species; Figure 4-9). In addition, the Upper Minnesota River, upper James River, and White River EDUs contain high species richness values for fish, and the lower James River EDU contains high species richness values for mussels (Figures 4-8 and 4-9).

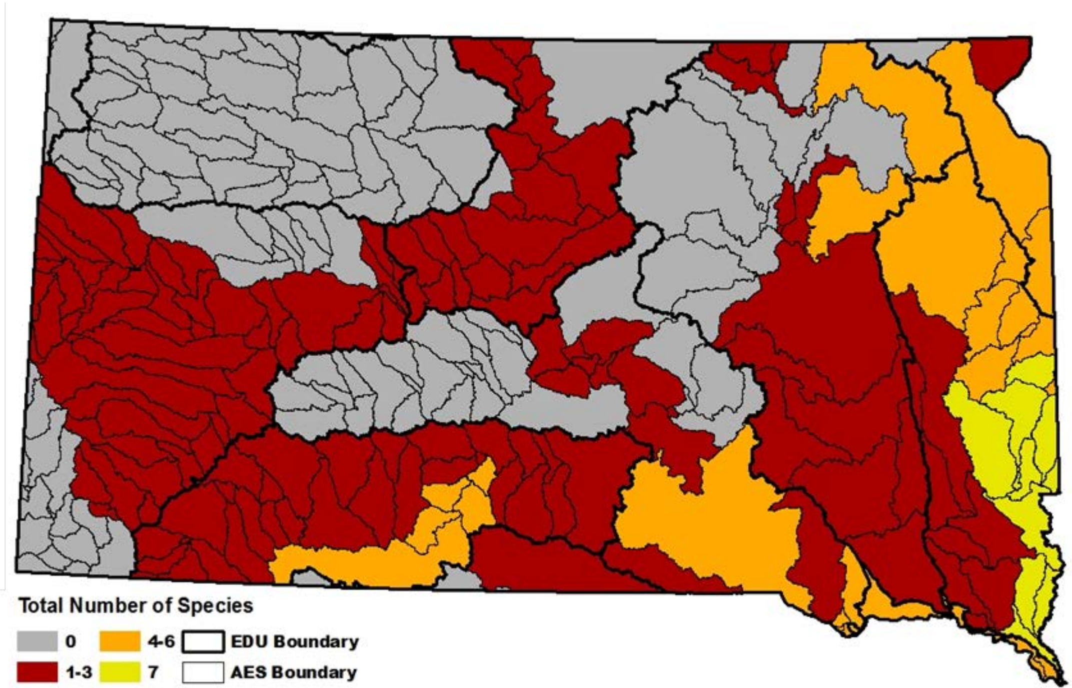


Figure 4-8. Map of fish species richness for species of greatest conservation need by aquatic ecological system (AES) units.

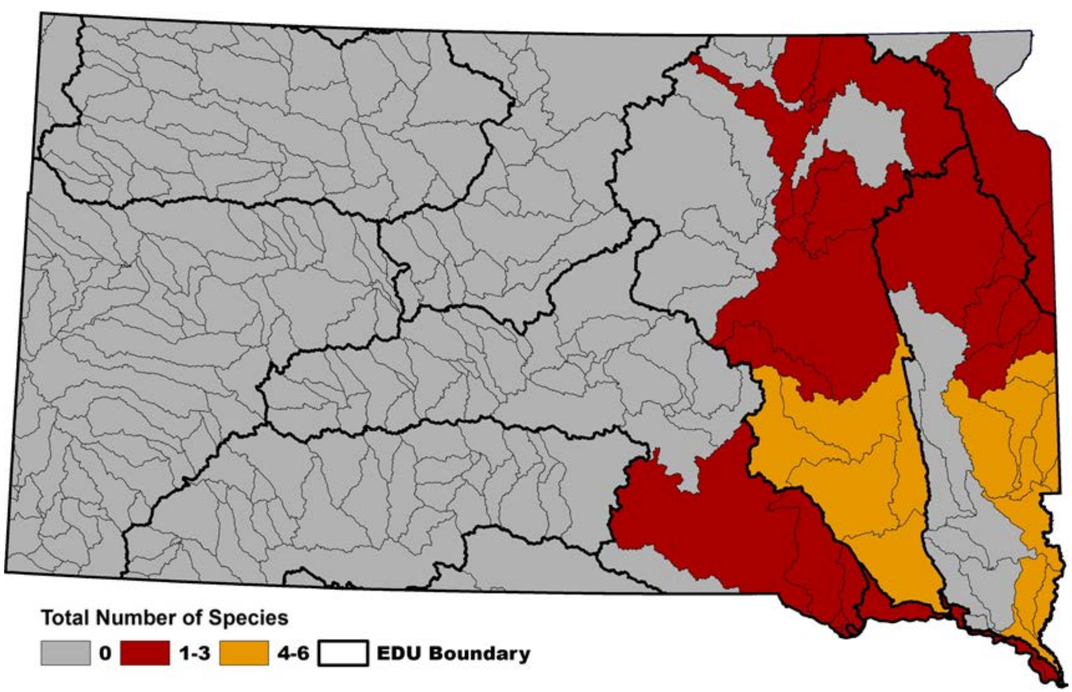


Figure 4-9. Map of mussel species richness for species of greatest conservation need by aquatic ecological system (AES) units.

Limitations of Species Distributional Data

All species distribution maps are a combination of known and predicted occurrences across South Dakota and reflect general ranges. Some data limitations exist for aquatic SGCN, as large information gaps exist. Consistent long-term monitoring and surveys are rare and many areas of the state have never been sampled or sampled only for a specific species or taxonomic group. There is also a need for the spatial integration of biological survey data among individuals and agencies. The SDNHD is part of a nationally standardized geospatial database that would benefit from increased coordination related to species and habitat research and monitoring.

4.5 Watershed Ownership/Stewardship Status

Land ownership/stewardship management can help provide information to decision makers in the selection of new conservation opportunity areas (COAs) and/or identify changes in management of existing public land holdings. Digital coverage of public land boundaries was obtained from various agencies (Table 4-5). Thirteen land ownership/stewardship categories were identified and mapped, including but not limited to, lands owned by the U.S. Fish and Wildlife Service (USFWS), the U.S. Forest Service (USFS), South Dakota Game, Fish and Parks (SDGFP), the Bureau of Land Management (BLM), Bureau of Reclamation, the National Park Service (NPS), tribal, and privately owned lands (Figure 4-10). Ownership/stewardship layers did not include Conservation Reserve Program (CRP) lands, Conservation Reserve Enhancement Program (CREP) lands, or wetland and grassland easements. Additionally, CRP and CREP lands were not included due to their management status. These lands lack permanent protection status and have relatively short enrollment periods.

Table 4-5. List of the geographic information system (GIS) coverages, their sources, and percent coverage obtained or created to account for local and watershed ownership/stewardship in South Dakota.

Ownership/Stewardship Data Layer	Source	Percent Cover
Game Production Areas	SDGFP	<1%
Parks and Recreation Areas	SDGFP	<1%
School and Public Lands	State of South Dakota	1.5%
Tribal Lands	Bureau of Indian Affairs (2005)	10.2%
United States National Forest	USFS	2.3%
United States National Grasslands	USFS	1.7%
Bureau of Land Management	BLM	<1%
Bureau of Reclamation	Bureau of Reclamation	<1%
United States Army Corps of Engineers	USACE	<1%
National Park Service	NPS	<1%
National Wildlife Refuge	USFWS	<1%
Waterfowl Production Areas	USFWS	<1%
The Nature Conservancy	The Nature Conservancy	<1%

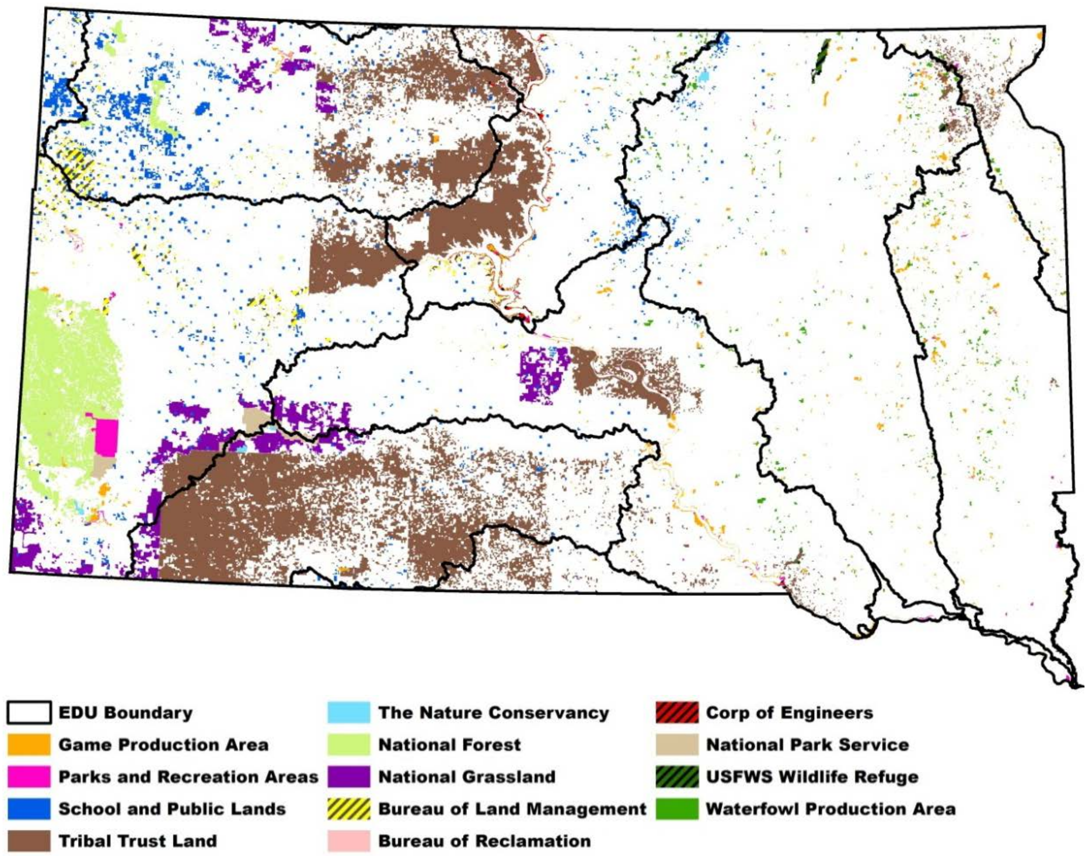


Figure 4-10. South Dakota land ownership/stewardship map with ecological drainage units (EDUs) overlaid.

Over 80% of the land area in South Dakota is privately owned and managed. Federal and state agencies own approximately 5.7% and 2.3% of the land area in South Dakota, respectively. Additionally, tribal lands account for approximately 10.2% of the land area in South Dakota (Table 4-5). Most of the public lands in South Dakota are located west of the Missouri River in the Cheyenne River EDU (Figure 4-10).

Limitations of Ownership/Stewardship Data

The land ownership/stewardship map represents a collection of stewardship maps provided by a variety of sources, however by no means does it represent the full array of conservation initiatives across South Dakota. These maps were created solely for the purpose of the final selection criteria in the selection of COAs when similarities existed among other metrics examined.

Land ownership/stewardship changes as parcels of land are bought, sold, or traded. The land stewardship map provides a “snapshot” of the land ownership in South Dakota.

CHAPTER 5 CONSERVATION CHALLENGES

5.1 Terrestrial Systems

Introduction

Native ecosystems and habitats of South Dakota have and continue to be directly and indirectly altered by human activities. Although Native Americans interacted and influenced this landscape for thousands of years, those influences are incorporated in the historical reference. It is the extent of human influence over the last 100 years that is of primary interest when considering the cumulative impacts to native ecosystem diversity and the associated biodiversity of South Dakota. Better understanding the extent of these impacts can help guide conservation practitioners in designing actions to address conservation challenges. Land conversion to cropland, domestic pasture, urban uses, and roads are the most obvious changes. However, there are also less obvious changes. The implications of a century of alterations to and interruptions of natural disturbance regimes on native ecosystem diversity have only begun to be assessed and much is still unknown. As stated previously, studies have shown that the suppression, alteration, or cessation of natural disturbance has gradually changed ecosystem processes and the species composition, structure, and function of ecosystems.

More specifically, two primary types of human impacts have occurred across South Dakota and have contributed to the cumulative changes to native terrestrial ecosystem diversity observed in the landscape today. These are: 1) the direct conversion of native ecosystems to some other land type or use, and 2) the indirect alteration of native ecosystems through the suppression of natural disturbance processes or alteration of species compositions, structures, or functions resulting from human activities and spread of nonnative species. The primary causes for direct conversion of native ecosystems in South Dakota include agriculture and to a lesser extent urbanization (including roads and other infrastructure). Agriculture is sometimes used as a broad category to also include grazing and timber harvest but for this effort, agriculture is defined relative to those activities that essentially replace native ecosystems with a crop or domestic plant community. For riparian-wetland ecosystems, additional causes of direct conversion may include draining, surface water diversion, water impoundments, dams, ponds for water supply, and stream channelization. The primary causes of indirect alteration of ecosystems include fire suppression, altered grazing regimes, timber harvest as well as accidental or intentional introduction of nonnative species that degrade the quality and function of native species habitats and native ecosystems. Over the past century, the primary causes for indirect alteration of native ecosystems in South Dakota have been fire suppression, altered grazing regimes, timber harvest in forested ecosystems, prairie dog control, and additionally flood control and beaver control/dam removal in riparian-wetland ecosystems.

Both direct conversion and indirect alteration of native ecosystems can result in habitat loss to associated native wildlife species. Habitat loss and its effects on biological diversity can be viewed as having four aspects associated with it:

1. the actual loss or conversion of habitat from favorable conditions that support a species to unfavorable conditions that will not support a species (Ehrlich and Ehrlich 1981, Noss et al. 1995),
2. changes in ecosystem structure, function, or composition (Noss et al. 1995, Franklin et al. 1981) that severely reduce habitat quality of an ecosystem for a particular species,
3. the reduction in the size of the remaining patches that may not provide enough area in one patch to support a species (MacArthur and Wilson 1967), and
4. habitat changes that slowly or quickly cause a single population within the landscape to become a metapopulation, consisting of many independent populations that only interact with occasional dispersal of individuals; metapopulations may then be further influenced by continued habitat loss to the point that interruption of demographic or genetic support to the metapopulation occurs (Hanski and Gilpin 1997), resulting in the subsequent loss of the entire population.

Developing a better understanding of the ecosystem conditions present in South Dakota today is an important step toward identifying and quantifying cumulative changes to native ecosystem diversity and its corresponding influence on the habitat conditions of native wildlife species.

In the last 30 years, a growing recognition of the threat of climate change as a causal agent for indirect conversion has also accelerated. A conclusion of the report of the U.S. Global Change Research Program (2009) is that “global warming is unequivocal and primarily human-induced.” While there is a preponderance of scientific evidence on the occurrence and causes of climate change, understanding its likely effects at state and local levels is more challenging. This is especially so for fish and wildlife populations as our knowledge of their habitat needs is often limited and understanding stressors to populations is difficult enough without having to incorporate the additional projected effects of climate change.

Responding to climate change will require considerations at multiple scales and collaborative approaches. Fish and wildlife habitat often encompasses large areas containing multiple ownerships. Management actions must consider not only site level conditions but also the influences of the surrounding landscape. As the effects of climate change make these considerations more complex, agencies such as SDGFP will need to work collaboratively with conservation partners and at larger scales to develop appropriate actions and strategies that emphasize adaptation and mitigation to minimize the potential negative consequences.

The SDWAP was approved in 2006. Climate change was a concern at that time but information on its likely effects and possible responses still contained enough uncertainty to preclude its incorporation in the SDWAP. However, when considering the various conservation strategies available at that time, South Dakota selected an ecosystem-based approach with the recognition that it would provide a good foundation for supporting adaptation and mitigation for climate change as more understanding of its effects emerged. Since 2006, modeling efforts have improved our understanding of the potential effects of climate change. This information is being combined with our understanding of ecosystem processes, community dynamics, and species needs to provide the information needed by South Dakota to incorporate climate change into its revised SDWAP.

The ability to fully quantify the changes to today's ecosystem diversity relative to historical ecosystem diversity (i.e. cumulative impacts) requires three essential layers of mapped information maintained in a geographic information system (GIS): 1) ecological site, 2) current land use categories, and 3) vegetation disturbance state. The ecological site layer overlaid with the current land use layer provides the ability to quantify direct conversion of native ecosystem diversity to other land uses. The ecological site layer overlaid with the vegetation disturbance state layer provides the ability to quantify today's potentially remaining native or altered ecosystem diversity.

The following sections present additional discussion on the conservation challenges associated with maintaining native ecosystem diversity in South Dakota. Further, the results of an assessment to quantify the changes to native ecosystem diversity relative to direct conversion, and a discussion of the challenges associated with trying to quantify the amount of native ecosystem diversity remaining in the landscape today using existing data and information are also presented for both terrestrial and riparian and wetland ecosystems.

Direct Conversion of Native Ecosystems

The primary causes for direct conversion of native ecosystems in South Dakota are identified as agriculture and to a lesser extent urbanization that includes roads and other infrastructure. To evaluate the level of direct conversion of native ecosystems in South Dakota, the National Land Cover Database (NLCD 2006) was overlaid with the ecological site layer developed for the SDWAP. NLCD 2006 is a Landsat-based, 30 meter resolution, land cover database developed for the entire United States. Overall accuracy levels for the NLCD are identified as 78% but it is considered less accurate when differentiating the context of grass, which is a large component of the South Dakota landscape.

Overall direct conversion of native ecosystems at the state-level is moderate at 15,967,072 acres or 38%, with agriculture representing 14,822,533 acres or 35.3% of that amount and urban development representing 1,144,538 acres or 2.7%. When evaluating the distribution of direct conversion by MLRA, a clear pattern exists for higher conversion occurring in eastern South Dakota relative to western South Dakota (Figure 5-1).

Table 5-1 presents the level of direct conversion that has occurred on each terrestrial ecological site within each MLRA. The table is further color coded to more easily identify those ecological sites that have received >=60% conversion (red shading), >=30% to 59% (yellow shading), and <30% (green shading). Not surprisingly, the most heavily converted ecological sites are those that also currently present the best conditions for agricultural productivity, particularly those MLRAs located in eastern South Dakota. The percent of direct conversion varied widely by MLRA with as much as 97.5% direct conversion in MLRA 56 to as low as 0.8% in MLRA 65.

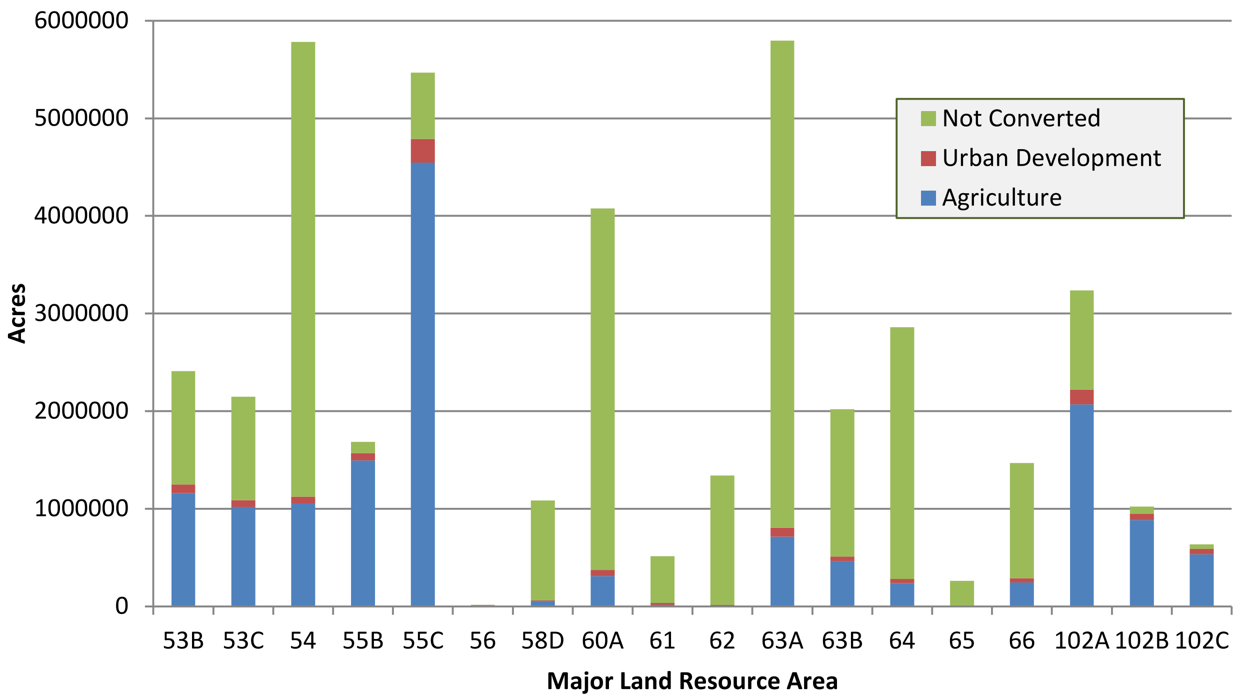


Figure 5-1. Amount of direct conversion of native terrestrial ecosystems resulting from agriculture and urban development by Major Land Resource Area. The "not converted" category may include native or altered ecosystem conditions.

Table 5-1. Percent direct conversion (both agriculture and urban development) for each terrestrial ecological site and Major Land Resource Area in South Dakota. Reddish shade highlights those sites where direct conversion of native ecosystems is >=60%, yellow highlights those sites where native ecosystem loss is >= 30% and <60%; and green highlights those sites where native ecosystem loss is <30%.

Ecological Site	53B	53C	54	55B	55C	56	58D	60A	61	62	63A	63B	64	65	66	102A	102B	102C
Grass/Shrub																		
LOAMY	49.0%	61.7%	36.7%	93.3%	90.6%	97.4%	13.4%	29.1%	19.3%	8.4%	32.6%	47.9%	20.3%	23.3%	45.9%	70.7%	94.6%	94.4%
CLAYEY	76.4%	37.9%	33.3%	97.1%	83.8%	98.8%	6.1%	7.7%	4.9%	1.4%	22.8%	36.1%	7.1%		23.4%	88.5%	88.9%	96.1%
SHALLOW CLAY			<1%		5.3%		<1%	1.3%	2.6%		1.0%	1.2%	<1%		2.8%			
SANDY	51.6%	10.9%	17.9%	89.8%	86.6%	97.2%	6.7%	28.2%	13.8%		20.6%	22.5%	12.8%	8.5%	17.4%	75.9%	95.1%	94.8%
THIN UPLAND	25.0%	17.5%	6.8%	48.3%	56.5%	93.1%	3.3%	4.5%	7.3%	7.3%	7.5%	23.2%	1.3%		7.2%	34.4%	76.8%	85.9%
THIN CLAYPAN	64.4%	26.3%	6.6%	90.6%	66.8%		4.4%	4.3%	20.7%		10.0%	17.1%	4.0%	9.3%	6.1%			
CLAYPAN	94.3%	41.4%	15.3%	95.1%	91.6%		7.6%	7.2%			28.8%	43.0%	10.7%	7.6%	25.5%	56.7%		
DENSE CLAY		2.4%						2.9%			2.7%	4.3%	2.1%					
SANDS	21.3%		3.7%	76.6%	40.7%	83.8%	1.9%	6.2%	1.6%		2.3%	13.9%	2.1%	<1%	3.7%	62.6%		65.0%
SHALLOW LOAMY			5.5%	13.0%			1.7%	2.1%	4.3%	7.3%			1.2%					
SHALLOW								1.1%		2.0%	<1%	2.4%	1.9%	5.1%	4.0%			
SHALLOW TO GRAVEL	41.9%	32.9%		92.0%	91.1%	95.4%					10.6%	10.5%	14.7%		8.8%	53.1%	94.2%	76.4%
SHALLOW SANDY			2.0%				<1%	1.2%										
VERY SHALLOW	24.3%	10.1%	9.0%	81.1%	55.6%		2.1%	6.1%	9.3%	5.0%	2.1%	2.9%	2.3%		3.9%	19.7%	83.9%	73.4%
SHALLOW DENSE CLAY								1.2%										
SHALLOW LIMY												<1%	3.1%	<1%	1.8%			
SANDY CLAYPAN	94.8%		5.7%	94.6%			4.8%	<1%										
SALINE UPLAND								1.6%										
SHALLOW POROUS CLAY								1.7%										
MOUNTAIN PRAIRIE										3.6%								
CHOPPY SANDS												<1%		<1%	<1%			
HIGH COUNTRY LOAMY										<1%								
POROUS CLAY								5.6%										
Forested																		
WARM SLOPES								<1%	<1%	<1%								
ROCKY SIDESLOPES										1.4%								
SHALLOW RIDGE								<1%	<1%	<1%								
MOIST WARM SLOPES										<1%								
COOL SLOPES			<1%				<1%	<1%	1.4%	<1%								
STONY HILLS			<1%				<1%	<1%	3.4%	5.1%								
SAVANNAH								<1%	7.3%	2.8%								
SILTY FOOTSLOPES								1.3%	1.1%									
Sparsely Vegetated																		
BADLANDS			<1%				<1%	<1%			1.5%	<1%	<1%					
ROCK OUTCROP		<1%	<1%		<1%		<1%	<1%	<1%	<1%	<1%	<1%						
SLICKSPOTS			5.6%	15.3%			<1%	2.5%			<1%							

A recent change in commodity prices for agricultural products has led to an increase in conversion of grasslands to corn and soy agricultural land use across South Dakota. Wright and Wimberly (2012) compared crop data layers for 2006 and 2011 and found that 1,561,706 acres of grasslands had been converted to corn or soy fields during that time in South Dakota. A higher rate of conversion is occurring in eastern South Dakota as compared to western. It was not possible to differentiate native grasslands from domestic grasslands with the data layers used but the results of this analysis suggest additional concern for maintaining native grassland ecosystems in South Dakota.

Alteration of Native Ecosystems

The ability to quantify the cumulative effects of indirect alteration on today's ecosystem diversity is currently not possible with existing information and data. While information on ecological sites has been developed and mapped for this effort, information on disturbance states as described for the SDWAP is not currently available. As better satellite imagery and processing methods become available, future SDWAP updates may be able to better assess cumulative impacts relative to indirect alteration of native ecosystem diversity. In the absence of this information, indirect alteration is discussed more generally in terms of the conservation challenges it presents to maintaining South Dakota's native terrestrial ecosystem diversity.

Natural disturbance processes

Since European settlement, many changes have occurred in the natural disturbance regimes that influence native ecosystem diversity across South Dakota. Fire still occurs, however the amount of land that is influenced by naturally occurring wildfire is greatly reduced due to fire suppression efforts. Where wildfire does occur today, a century of altered vegetation conditions have changed the magnitude and intensity of how wildfire now occurs in the landscape compared to what occurred historically. Future climate change is expected to exacerbate this problem. In some instances where feasible, managers are trying to use prescribed fire to reintroduce this natural process but there are considerable challenges to replicating the timing and intensity of natural fire regimes to reproduce the desired effects on vegetation.

In addition, the important interaction of fire and grazing animals has been altered. Historically, grazing animals like bison would preferentially select recently burned areas on grass-shrub ecological sites and graze these areas heavily for 1-2 seasons after a fire. This fire and grazing relationship is not typically used in current ranching practices for prescribed burning and cattle grazing programs. In general, fire suppression and grazing alteration have had a profound impact on landscape heterogeneity and dynamic ecosystem processes. Grazing trends on private land in the Great Plains, on average, have been toward moderate levels. Grasses that benefit from this grazing approach have increased, while grasses that require different levels or timing of grazing have been reduced (Truett 2003). The patchy mosaic of different grazing intensities interacting with natural fire regimes is all but gone from grass-shrub systems of South Dakota. In addition to changes in fire and grazing regimes, the loss of thousands of acres of prairie dog colonies has further impacted many wildlife species dependent on their disturbance influence for suitable habitat conditions.

In the forested systems of South Dakota, the suppression of natural fire regimes over the last 100 or more years coupled with the emphasis for timber production caused significant changes to the ecological processes, structure, and species composition, particularly in the low to mid-elevation ponderosa pine forests. The forest conditions documented by early explorers and trappers in their journals, drawings, and in some instances, black and white photographs, often depict conditions quite different from those observed today (Parrish et al. 1996). Starting in the late 1800s, several activities occurred that changed these ecosystems. First, intensive grazing by cattle and sheep reduced the understory vegetation that carried fires across the landscape. Second, logging began with an emphasis on removing the large ponderosa pines. Third, fire exclusion policies initiated in the early 1900s further reduced the occurrence of the high-frequency fires. The ponderosa pine ecosystems, characterized by large pine trees, were adapted to the short-interval fire regime, having thick bark that protected them from the frequent understory fires. The suppression of natural wildfire has resulted in a dramatic increase in the number of trees per acre occurring today, particularly ponderosa pine, on many low to mid elevation ecological sites. Timber harvest methods that emphasize clear-cutting also contribute to even-aged stands of dense ponderosa pine. Without the natural thinning effect of frequent wildfires, the favorable growing conditions for ponderosa pine will frequently lead to extremely dense stand conditions that exclude other plant species from occurring on these sites. Further, these dense stand conditions will stress the trees thereby making them more vulnerable to insect outbreaks such as the pine beetle. The result is an overall decrease in plant species and structure diversity on these ecological sites throughout low to mid elevation forest ecosystems. When fires do occur, they are usually lethal, stand replacing fires. As these fires burn the remaining stands containing remnant large trees, the ability to restore historical conditions in the near future decreases. Thus, the risk of further impacts and population declines for species dependent upon historical ponderosa pine forests is very high. Forest management and fire suppression programs that emphasize the return of the historical stand conditions are needed to provide the structure and plant species composition of native forest ecosystems in the short- and long-term as well as their spatial arrangement on the landscape.

Mid- to high-elevation forests have been less impacted by fire suppression activities as long-interval fires are more similar to their historical range of variability. However, the size and distribution of these fires have decreased with improvements in modern firefighting capabilities. While the patterns and distributions of stand-replacing fire may have arguably changed in the landscape, the impacts at the ecosystem level have been much less evident in terms of species composition and structure than those observed for low- to mid-elevation forests. In general, the heterogeneous conditions produced from the combined influences of short-, mixed-, and long-interval fire regimes have been significantly reduced on the landscape with the majority of fire occurring today as long-interval, stand replacing events. Forest management can help restore some landscape heterogeneity but frequently forest management objectives do not encompass all the historical structures and species compositions required to maintain native ecosystem and biological diversity.

Nonnative species

More recently, the accidental or intentional introduction of nonnative species has had major impacts on native species and ecosystems. Nonnative invasive plant species are a challenge in all South Dakota ecoregions and across all ecosystem types. They are of particular concern to maintaining the ecological integrity of historical ecosystems. Nonnative invasive species will often reduce the overall biodiversity of a vegetative community by displacing native species and altering the normal ecological processes (e.g., nutrient and water cycles) (Mack et al. 2000). Where heavy infestations of nonnative invasive plants occur, many of the habitat values of that ecosystem will be converted to conditions no longer favorable to native wildlife. For example, Canada thistle and leafy spurge are found throughout South Dakota and cover thousands of acres of previously native ecosystems.

Climate Change

While there are still many unknowns related to the effects of climate change, understanding how ecosystems will respond to climate change is important to evaluating the potential effects on fish and wildlife habitat (Saxon 2003). Terrestrial ecosystems are expected to change relative to plant species compositions, structures, and processes. Site-level changes to species compositions may result from temperature and/or precipitation changes that no longer allow a particular species to occur or through shifts in competitive advantages with other species at that site. Some ecosystems may become more vulnerable to invasion by nonnative invasive species. Primary productivity of ecosystems may increase or decrease depending on changes to available water or temperatures. Natural disturbance regimes will likely change in terms of frequency and severity in response to changes in temperature and precipitation as well. The presence or amounts of some plant communities may change as a result of these influences. Similarly, riparian and wetland ecosystems may change in amounts and types resulting from changes to available water and temperatures. While many potential changes from climate change may be difficult to predict with great accuracy, models of projected climate change can be used to inform future management planning.

Downscaled Global Climate Model (GCM) datasets were used for the updated SDWAP to develop a regional dataset of monthly average precipitation and temperature values for each of the 18 MLRAs in South Dakota for two future periods – 2021 to 2050 and 2070 to 2099. The methods used to develop this information and the results are summarized in the report (Appendix N) “Past, Present, and Future Climates for South Dakota: Observed climate variation from 1895-2010 and projected climate change to 2099” (Cochrane and Moran 2011). This Plan contains the executive summary only. The entire report can be found on the SDGFP website. The work conducted by Cochrane and Moran at South Dakota State University was funded by a grant from the Plains and Prairies Landscape Conservation Cooperative (LCC). In addition to being provided with the final results, the findings were presented to the LCC’s Steering Committee by EMRI Executive Director Jon Haufler.

The following charts (Figure 5-2 through Figure 5-6) represent the results of the predicted A2 climate change values as evaluated against present conditions. The charts represent annual and seasonal temperature and precipitation comparisons for past conditions representing 1961 to 1990 versus projected conditions representing 2021 to 2050 and 2070 to 2099. The A2 model results are considered the higher rate of change scenario and were utilized over the B1 data for these comparisons as this scenario more closely represents the current political environment that is influencing global response to moderating projected climate change impacts and the finding that recent monitoring of rates of change have generally exceeded even the A2 model predictions.

South Dakota's primary terrestrial ecosystems are grass dominated systems. This climate change assessment is conducted for terrestrial grass-shrub ecosystems through its emphasis on grass species, and does not include an assessment for forest ecosystems at this time. More information is available on the photosynthetic pathway of grass species than other lifeforms and most of the climate research in the Great Plains has emphasized grasses due to their dominance in plant communities. As more information becomes available on other lifeforms, such as forbs, shrubs, and trees, future WAP revisions will incorporate those results.

For the purposes of evaluating climate change impacts on the grass-shrub ecosystems of the Great Plains, one approach has concentrated on evaluating the response of species by traits such as photosynthetic pathway (Dukes 2007). There are two photosynthetic pathways, C_3 and C_4, which characterize most of the grass species in the Great Plains. The primary difference between these two functional types is the difference between the photosynthetic pathway where C_3 grasses produce 3 carbon molecules and C_4 grasses produce 4 carbon molecules during photosynthesis.

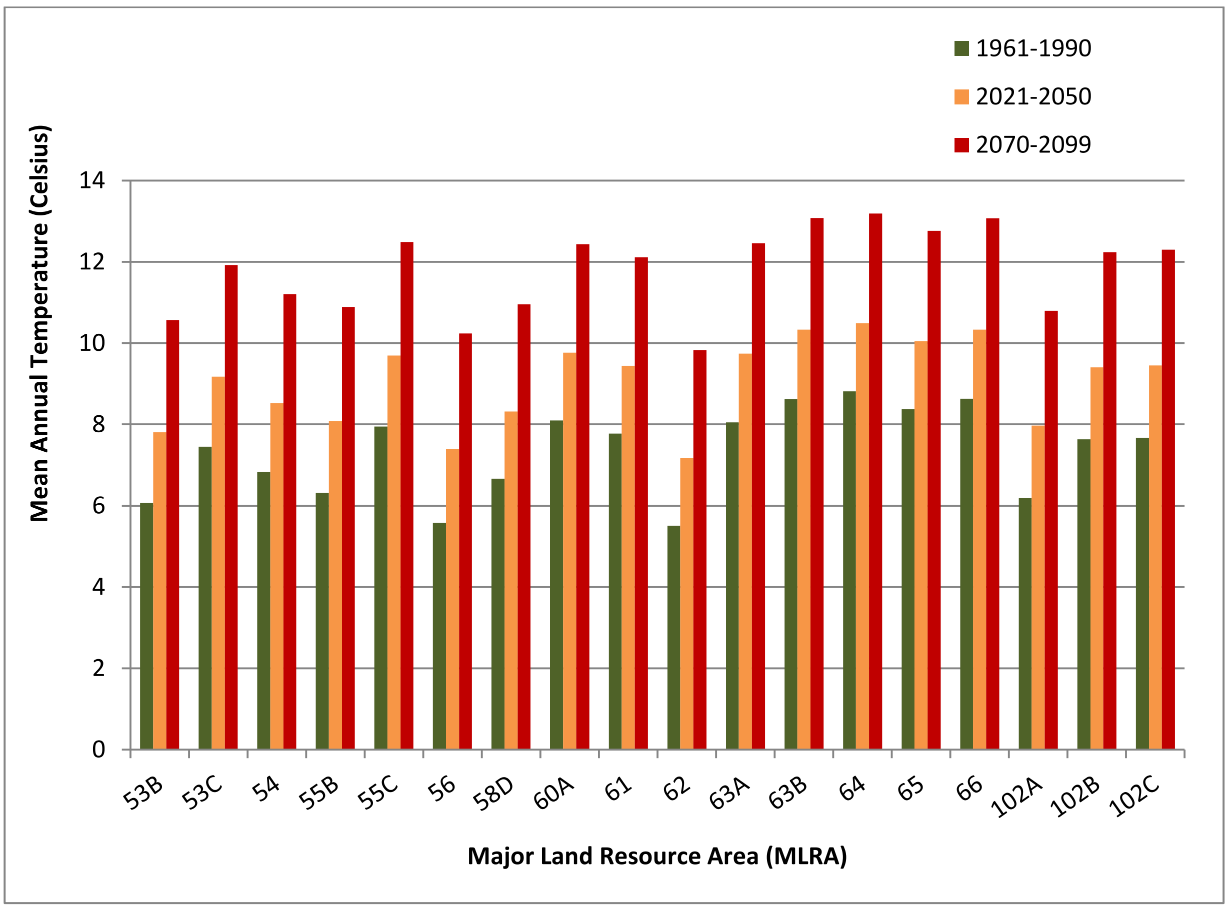


Figure 5-2. Predicted climate change values for mean annual temperatures by Major Land Resource Area relative to recent conditions.

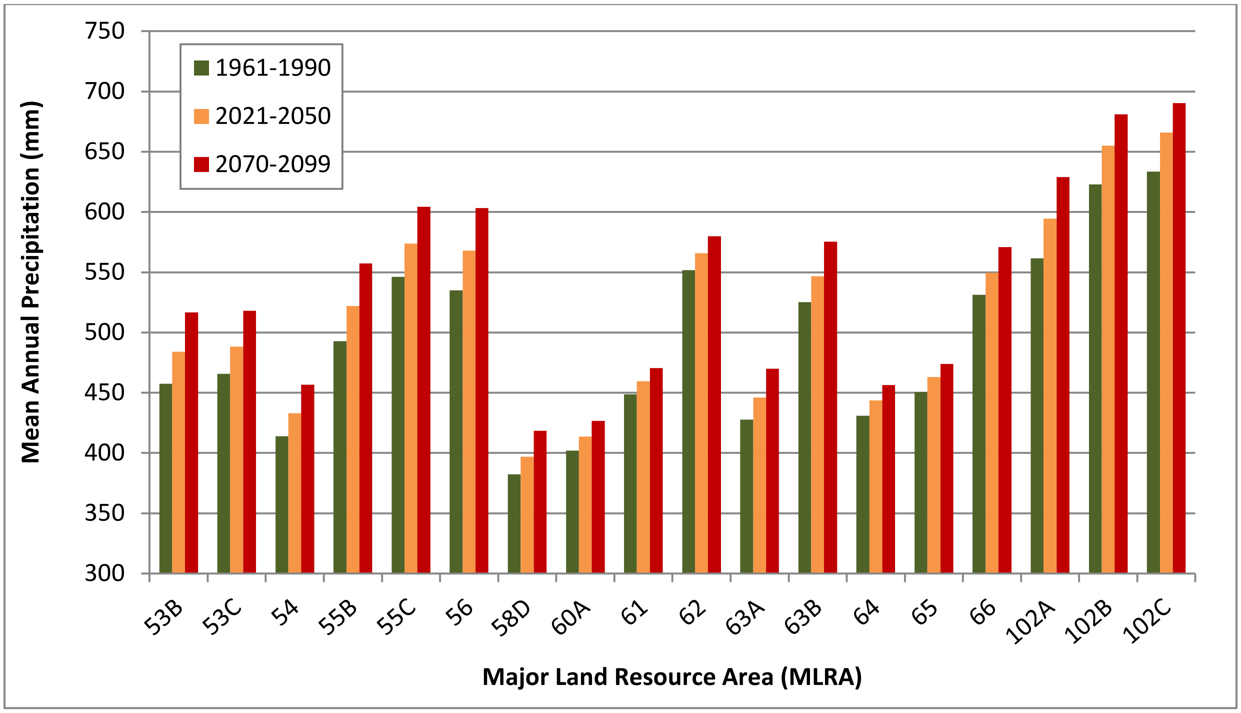


Figure 5-3. Predicted climate change values for mean annual precipitation by Major Land Resource Area relative to recent conditions.

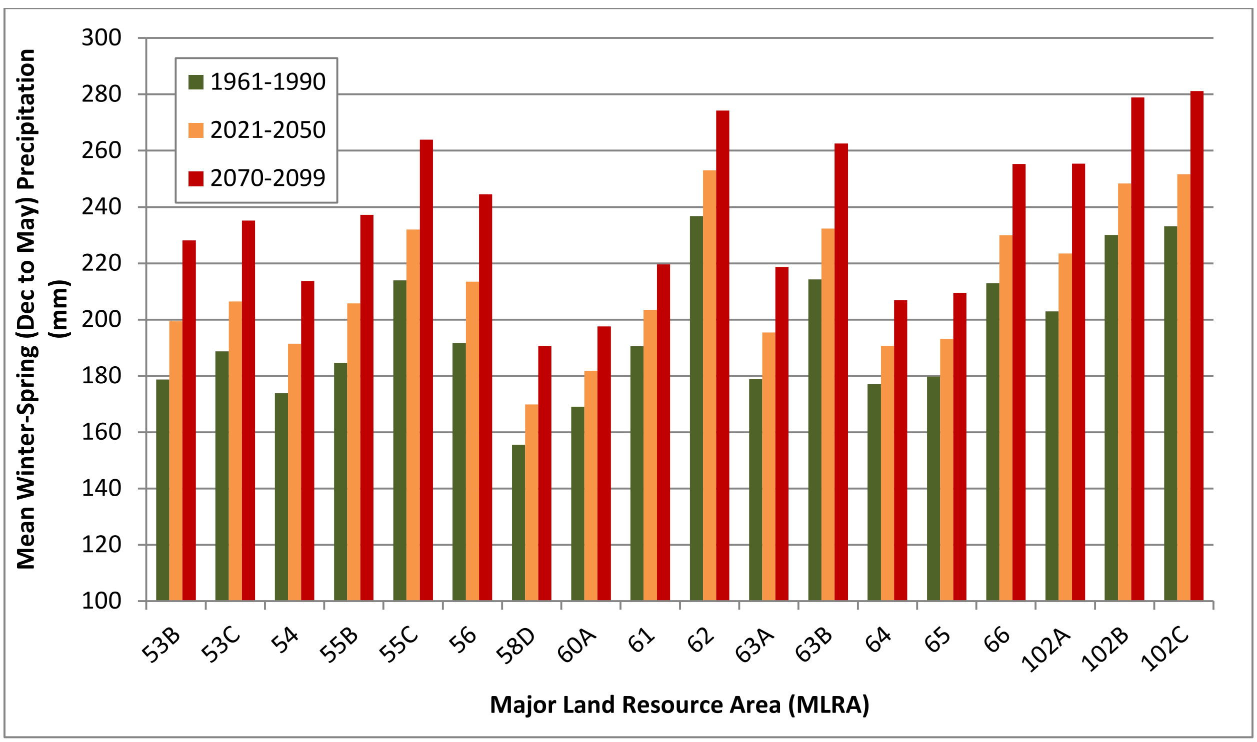


Figure 5-4. Predicted climate change values for mean winter and spring precipitation by Major Land Resource Area relative to recent conditions.

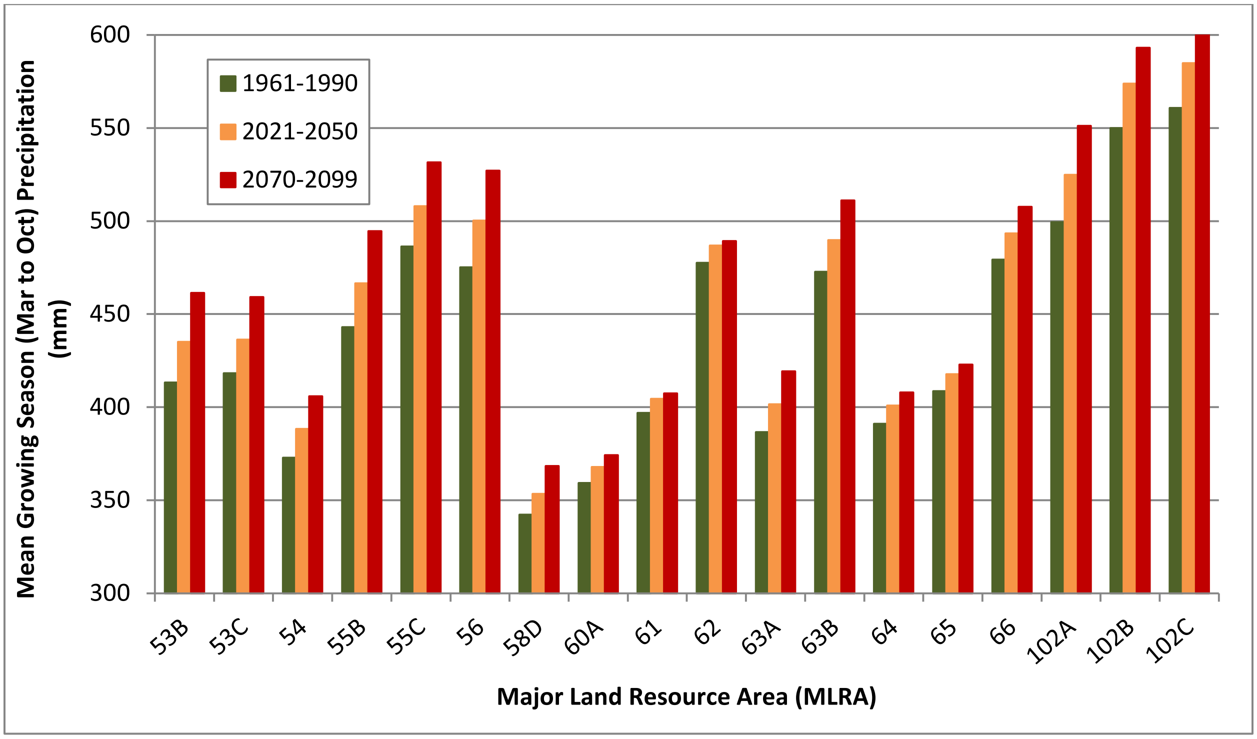


Figure 5-5. Predicted climate change values for mean growing season precipitation by Major Land Resource Area relative to recent conditions.

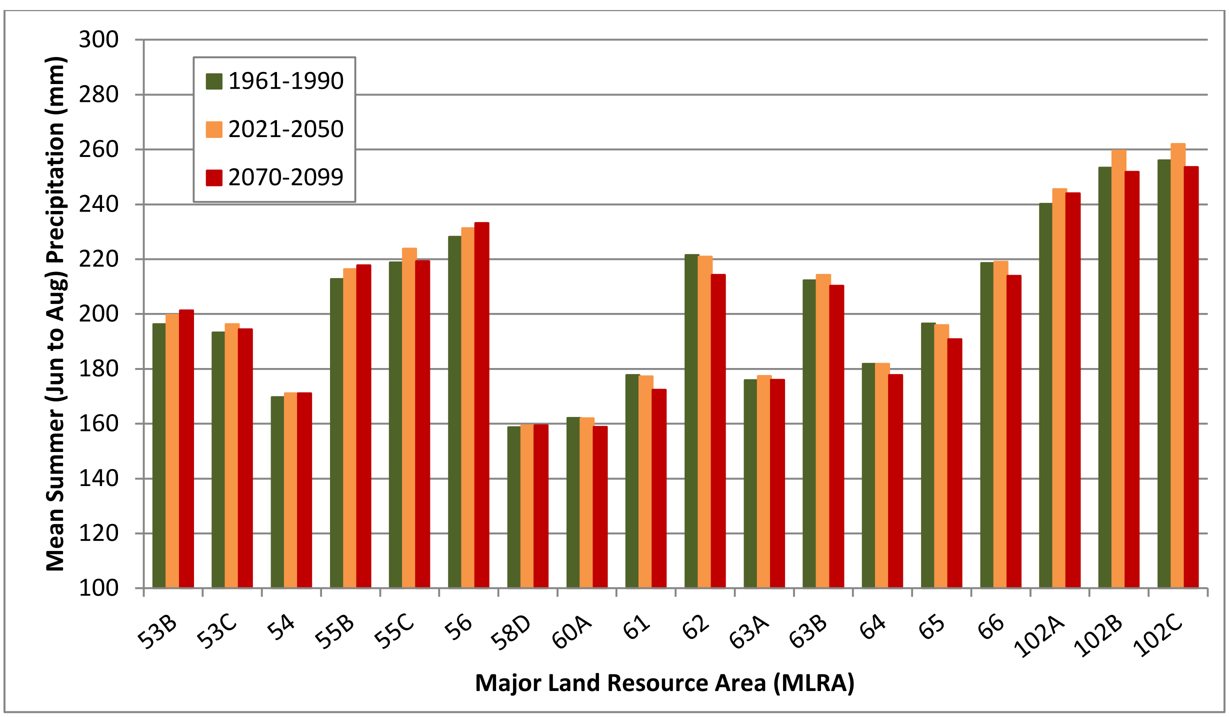


Figure 5-6. Predicted climate change values for mean summer precipitation by Major Land Resource Area relative to recent conditions.

C_3 grass species are also frequently referred to as cool season grasses and C_4 species are referred to as warm season grasses. Both cool and warm season grasses occur in South Dakota in what is often referred to as a mixedgrass condition. Today, the distribution of cool season to warm season grasses occurs within a general gradient within the state with cool season grasses increasing from south to north and warm season grasses increasing from north to south (Sage et al. 1999). Put more simply, warm season grasses generally occur in warmer locations and cool season grasses generally at cooler locations. In addition, the physical characteristics of each functional type also vary on a general gradient within the state with the warm season grasses appearing taller than the cool season grasses in the eastern portion of the state but then appearing shorter than the cool season grasses as they move westward across the state. Table 5-2 presents another view of these results by presenting the actual change in annual and seasonal temperature and precipitation values when comparing present day conditions to the projected 2070 to 2099 period.

As the balance between C_3 and C_4 dominance within a plant community is believed to be responsive to climate change, this is often the focus of discussions aiming to predict future climate change conditions in the Great Plains (Collatz et al. 1998, Hattersley 1983, von Fischer et al. 2008). In general, there are three primary consequences of climate change on plant communities, elevated levels of CO_2 in the atmosphere and changes in average temperatures and precipitation. Elevated CO_2 improves photosynthesis in C_4 plants but also leads to higher productivity in C_3 plants. However, increasing temperatures generally decrease productivity of C_3 plants, potentially counteracting the advantages of elevated CO_2 levels. Precipitation, depending on when it occurs, can have positive effects on productivity levels for both C_3 and C_4 species.

Table 5-2. Results of change in annual and seasonal temperature and precipitation values when comparing recent conditions to the projected 2070 to 2099 period.

MLRA	Mean Temperature (°C)				Mean Precipitation (mm)							
	ANNUAL		JULY		ANNUAL		SPRING[a]		GROW SEASON[b]		SUMMER[c]	
	1961-1990	2070-2099	1961-1990	2070-2099	1961-1990	2070-2099	1961-1990	2070-2099	1961-1990	2070-2099	1961-1990	2070-2099
53B	6.1	10.6	22.2	27.4	457.4	516.7	149.0	191.2	413.4	461.4	196.3	201.4
53C	7.5	11.9	23.5	28.7	465.7	517.9	155.9	194.5	418.3	459.2	193.3	194.4
54	6.8	11.2	22.5	27.7	414	456.7	144.6	177.3	372.9	405.9	169.7	171.1
55B	6.3	10.9	22.6	27.7	492.8	557.3	150.8	194.9	443.0	494.6	212.8	217.8
55C	8	12.5	23.8	29	546.1	604.4	174.9	216.2	486.3	531.6	218.8	219.3
56	5.6	10.2	22	27.1	535.1	603.2	151.8	194.0	475.2	527.2	228.2	233.1
58D	6.7	11	21.7	27	382.4	418.6	127.1	154.1	342.3	368.5	158.8	159.5
60A	8.1	12.4	23	28.3	402.1	426.6	139.1	159.8	359.3	374.2	162.1	158.9
61	7.8	12.1	21.9	27.3	448.7	470.5	154.6	174.2	397.0	407.4	177.8	172.4
62	5.5	9.8	18.6	24	551.9	579.9	182.6	206.0	477.7	489.3	221.6	214.3
63A	8	12.5	23.8	29.1	427.7	469.9	150.0	182.9	386.6	419.4	175.9	176.0
63B	8.6	13.1	24.2	29.5	525.2	575.3	178.5	218.2	472.8	511.0	212.3	210.4
64	8.8	13.2	23.7	29	431	456.3	149.6	172.6	391.2	407.9	181.9	177.8
65	8.4	12.8	23	28.3	450.7	473.9	150.9	173.5	408.7	423.0	196.5	190.8
66	8.6	13.1	23.6	28.9	531.3	570.8	178.4	212.6	479.4	507.6	218.6	214.0
102A	6.2	10.8	22.2	27.4	561.6	628.9	162.5	205.1	499.4	551.2	240.2	244.1
102B	7.6	12.2	23.3	28.6	623	681	183.7	223.0	550.0	593.1	253.4	251.9
102C	7.7	12.3	23.3	28.6	633.6	690.3	187.3	226.0	560.8	602.7	256.1	253.6

[a] December to May
[b] March to October
[c] June to August

Morgan et al. (2008) described the expected effects of climate change on North America and the Great Plains:

> *"Along with rising global temperatures, predictions are for more frequent and longer-lasting heat waves, higher atmospheric humidity, more intense storms, and fewer and less severe cold periods. Warming in North America is expected to be greater than for the overall planet. Precipitation will tend to increase in Canada and the northeastern United States, and decrease in the southwestern United States. Seasonality of precipitation is also predicted to change, with relatively more precipitation falling in winter and less in summer. The desiccating effect of higher temperatures is expected to more than offset the benefit of higher precipitation, resulting in lower soil water content and increased drought throughout most of the Great Plains."*

Review of the downscaled climate change data indicates that over the next 80 years precipitation will be greater in the winter for most MLRAs in South Dakota, variable but slightly reduced during the growing season especially summer, and temperatures will increase fairly significantly. The combination of higher temperatures during the growing season coupled with slightly decreasing precipitation will mean that available moisture for plants is likely to be reduced. An additional confounding effect is that weather events are expected to be more extreme (Ojima and Lackett 2002) including heavier but shorter rain storms and prolonged drought. All of these will add stressors to plant communities that make accurate projections of changes in plant compositions and structures difficult.

While some believe the ability to predict how climate change will impact plant community compositions is limited (Morgan et al. 2008), other researchers have been evaluating variables that may be used to help predict how change may occur. Common variables which have been and continue to be evaluated are the use of temperature and precipitation to predict the future balance of C_3 to C_4 plant communities in the Great Plains. Some researchers believe temperature plays a major role in determining the C_3/ C_4 balance of grasslands (Ehleringer 1978, Epstein et al. 1997). As an example, von Fischer et al. (2008) analyzed the soil organic matter (SOM) and fine roots from 55 native grassland sites widely distributed across the US and Canadian Great Plains to examine possible indicators of the relative production of C_3 vs. C_4 plants at the continental scale. They observed the following:

> *"Our results reveal that not all climate indices are equally strong predictors of %C_4. In particular, the results…. indicate that %C_4 in the North American Great Plains grasslands are especially sensitive to the climate in July, suggesting that the outcome of competition between C_3 and C_4 plants was particularly sensitive to climate during this narrow window of time. Mixed C_3 and C_4 systems persist in Great Plains grasslands where July average temperature is 70.7 $\pm$ 5.6 ^{O}F; systems* are *C_3 dominated (<33% C_4) below this range and C_4 dominated (>66% C_4) above it."*

Figure 5-7 identifies the recent and predicted average July temperatures by MLRA in South Dakota under climate change. Using von Fischer et al.'s (2008) range for C_3 vs. C_4 dominance, we see that presently nearly all MLRAs are within the mixed C_3 and C_4 ranges identified by 65.1 to 76.3 ^{O}F. This is consistent with the fact that South Dakota is presently considered primarily a mixedgrass C_3/C_4 condition.

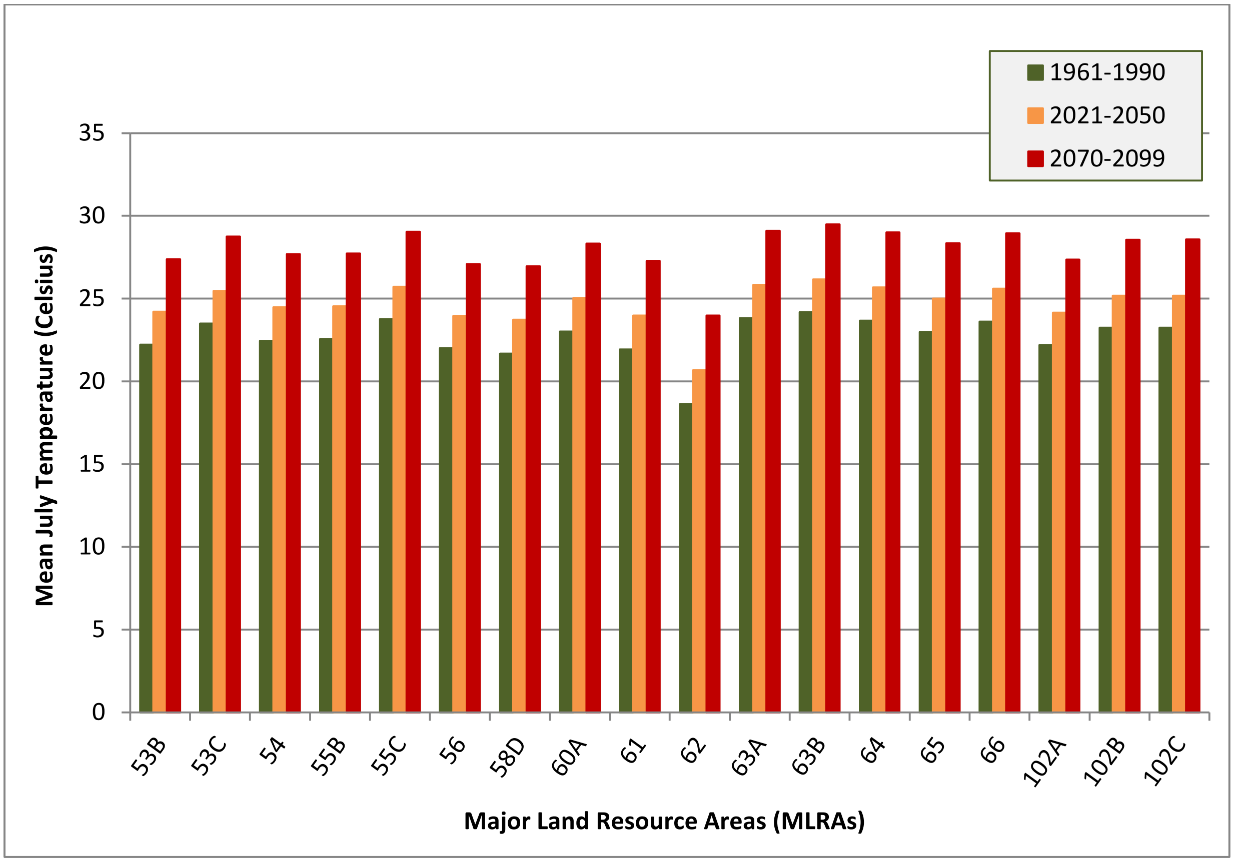


Figure 5-7. Predicted climate change values for average July temperatures by Major Land Resource Area relative to recent conditions.

However, predicted climate change models indicate that all but one MLRA will move above the 76.3 ^{O}F (24.6 ^{O}C) upper bounds by 2099. Although precipitation appears to play a secondary role in determining competitive advantage, C_4 grasses are also able to use the reduced summer moisture resources more effectively than C_3 species, indicating that C_4 species will likely become more dominant under the von Fischer et al. (2008) model.

Where available, information was compiled from ecological site descriptions on plant communities for each ecological site within each MLRA as described in Section 3.4. This information provides the basis for identifying desired restoration conditions for each ecological site. Given the above discussion of possible effects of climate shifts on plant community species composition, it would seem prudent to be aware of these possible impacts so we can evaluate whether to plan for including species that will be supportable in the future, while maintaining similar function and habitat structures for wildlife species.

The goal of the SDWAP for terrestrial ecosystems is to maintain and restore large blocks of native vegetation in appropriate locations throughout the state. Ecological sites provide the basis for identifying desired reference plant communities, and climate change analysis can suggest shifts in conditions to provide for sustainable plant communities in the future. Some SGCN will be able to use these adjusted conditions, as efforts should be made to maintain similar structures to their current reference communities even with a shift in species compositions. Other SGCN may be fully dependent on the specific C_3 plant compositions, and these species may not be able to persist in their current locations. However, if similar shifts in restoration practices are followed in neighboring states or provinces, then these species may be able to use new areas representing favorable plant communities where they will occur in the future under climate change.

5.2 Riparian-Wetland Systems

Direct Conversion of Native Ecosystems

Using the same methods described for evaluating direct conversion of terrestrial systems in South Dakota, estimates of direct conversion of riparian and wetland systems were also developed. Statewide, direct conversion of riparian and wetland ecosystems is estimated at 43% or 3,157,642 acres due to agriculture and 3% or 236,598 acres due to urban development. Acres that have not been converted to another land use and represent native or altered conditions are estimated at 54% or 3,990,211 acres. Figure 5-8 further presents these estimates for each of the 18 MLRAs in South Dakota. Similar to the results observed for terrestrial systems, more direct conversion of riparian and wetland ecosystems has occurred in the eastern half of the state where crop-based agriculture is more prevalent. Depressional wetlands in particular were historically a common feature in eastern South Dakota. For many years, these wetlands were drained, filled, and plowed to increase the amount of farmable acreage. Riparian and wetland areas adjacent to agricultural fields were often degraded by agricultural runoff and sedimentation. In recent years, the Wetland Reserve Program and Swampbuster provisions of the Farm Bill have helped to reduce the rate of conversion and some of the impacts from adjacent runoff. Excavation, to increase water storage capacity for livestock and irrigation purposes, can also change the hydrology and vegetation communities.

The methods used in the direct conversion assessment for riparian and wetland ecosystems do not provide the ability to quantify the impacts of water control structures such as dams on riverine systems in South Dakota. Water control structures, in many instances, have had the effect of converting flowing water to non-flowing water systems on some of the larger rivers and streams, while also inundating the adjacent riparian ecosystems. For example, many of the historical riparian and wetland ecosystems of the Missouri River system have been inundated and lost to the series of dams and large reservoirs present today. The river has also been impacted by channelization and maintenance dredging activities, as well as construction of impoundments by private interests and government agencies that have isolated the river from its historical floodplain. Water impoundment and channelization activities have led to a:

- 98% reduction in the number of islands and sandbars,
- elimination of riparian forests and stream channels in areas of flooded reservoirs,
- reduction in channel diversity through the loss of side channels, backwater sloughs, and meandering,

- change in shoreline substrate in some areas from a dominance of silt, sand, and wood to rock riprap (rock and concrete),
- decline in suspended sediment causing channels to deepen and banks to erode, and drainage of remnant backwaters downstream from dams, and
- modification to the natural flow regime - eliminating the periodic flood pulse thereby substantially changing the annual hydrograph, sediment loads, temperature regime, and nutrient budgets.

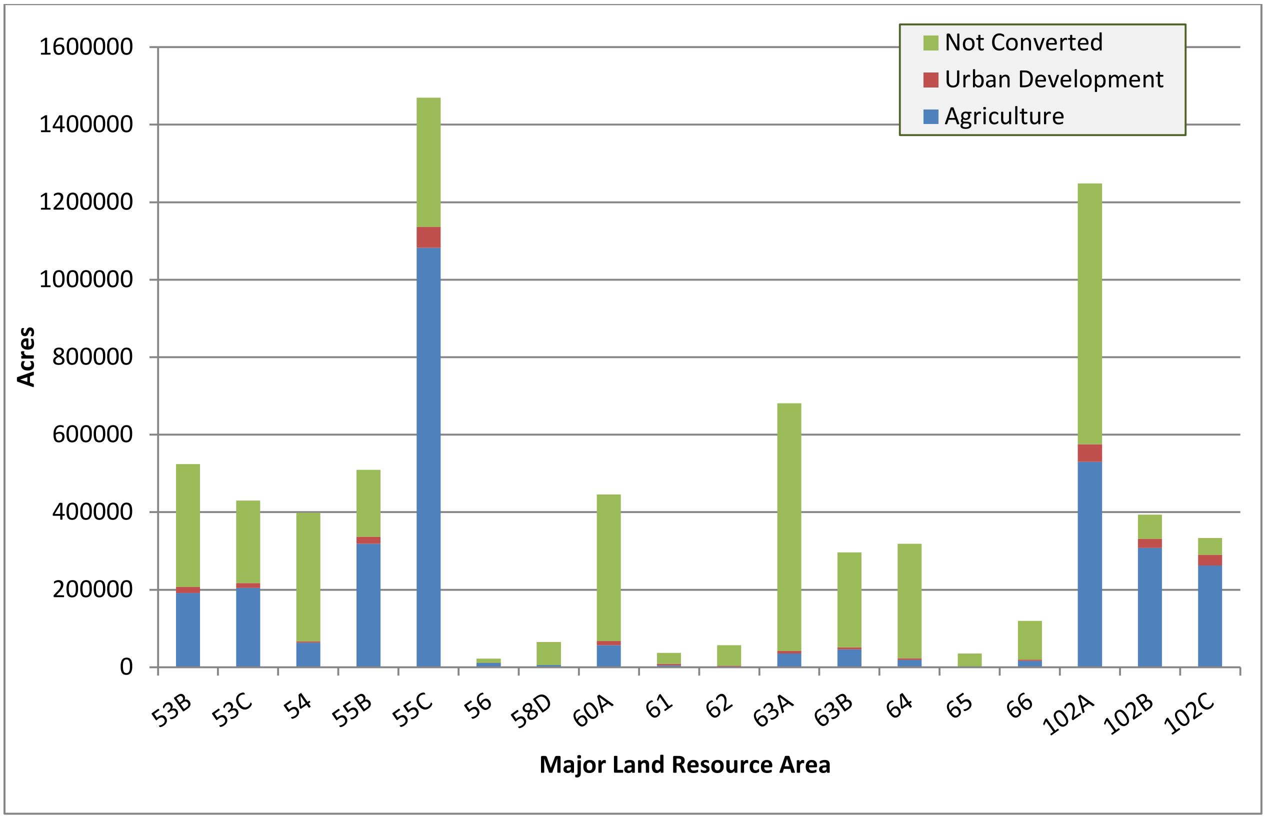


Figure 5-8. Amount of direct conversion of native riparian and wetland ecosystems resulting from agriculture and urban development by Major Land Resource Area. The "not converted" category may include native or altered ecosystem conditions.

Table 5-3 presents the level of direct conversion that has occurred on each riparian and wetland ecological site within each MLRA. The table is further color coded to more easily identify those ecological sites that have received >=60% conversion (reddish shading), >=30% to 59% (yellow shading), and <30% (green shading). Again, the most heavily converted sites are those that also currently present the best conditions for agricultural productivity, particularly those MLRAs located in eastern South Dakota.

Alteration of Native Ecosystems

As with terrestrial systems, the ability to quantify the cumulative effects of indirect alteration on today's riparian and wetland ecosystem diversity is currently not possible with existing information and data. While information on ecological sites has been developed and mapped for this effort, information on disturbance states is currently not available. As better information on the effects of natural disturbance processes on native ecosystem diversity is developed and better satellite imagery and processing methods become available, future SDWAP updates may be able to better assess cumulative impacts relative to indirect alteration of riparian and wetland systems. In the absence of this information, indirect alteration is discussed more generally in terms of the conservation challenges it presents to maintaining South Dakota's native riparian and wetland ecosystem diversity.

Natural Disturbance Processes

Similar to the discussion of impacts to terrestrial ecosystems, the suppression or alteration of natural disturbance processes in South Dakota has reduced the heterogeneity of riparian and wetland ecosystems. Dams have been placed on some streams to provide livestock water, control flooding and store water for irrigation, and other human uses. Water management programs reduce the effects of flood events and thereby prevent many flood adapted plant species from regenerating. The result is more homogenous riparian and wetland ecosystems. Channelization and water diversion projects can impact the extent, species composition, and structure of the remaining ecosystems. Cottonwood reproduction has been significantly impacted due to a river's inability to flood its banks, as well as meander and create new land for cottonwoods to colonize. Those remaining cottonwood stands, historically the most abundant and ecologically important species on the floodplain, are maturing and new groves are not appearing to replace them. In addition, the loss of the river - floodplain connection has reduced the amount of shallow water riparian and wetland ecosystems remaining that supports emergent and shrub plant communities that, in turn, support many wildlife species.

Off-stream water impounding and diversion for stock ponds and urban areas have also led to changes in levels and timing of in-stream flows. Reduced in-stream flow impacts the function and integrity of vegetation communities as well as the size and extent of the riparian zone adjacent to streams and drainages. The cumulative effects of thousands of small impoundments (such as stock dams) in arid environments are poorly understood but may be having major impacts on the hydrologic regime of thousands of miles of small, intermittent prairie streams (Sauer and Masch 1969). Potential groundwater recharge into an aquifer is expected to occur primarily in intermittent alluvial stream channels. Therefore, reducing the amount of water that enters a downstream alluvial channel implies a loss of potential groundwater recharge. Further, the introduction of nonnative fish/aquatic species to these stock ponds can also negatively impact native species in the event of a dam blow-out or overflow that enables stock pond waters to enter streams and rivers during heavy precipitation events.

A review of National Wetland Inventory data indicates beaver ponds are relatively rare in the landscape today. Although beaver numbers have been increasing in recent years, beaver populations and their impoundments have been reduced on perennial systems from historical levels resulting in the loss of associated pond habitat for many plant and animal species, and a reduction in the amount of surrounding vegetation influenced by a higher water table. For some MLRAs, particularly those in eastern South Dakota, grazing by herbivores is no longer as common as it was historically, further reducing the diversity of plant species and structures within riparian and wetland communities. Where cattle grazing occurs today, land use objectives frequently utilize a season-long moderate grazing level that also contributes to reducing the diversity of species and structures within riparian and wetland ecosystems when compared to historical conditions (Fuhlendorf and Engle 2001). Bison grazing is known to have historically caused streambank erosion where herds congregated near water but they were typically migratory, so it is believed that revegetation occurred periodically. Today's cattle herds are often re-grazing the same pastures over and over again often contributing to continuous or frequently recurring streambank erosion in riparian and wetland areas, so the long-term impact to water quality is expected to be greater. In addition to groundwater pumping and water diversion projects, fire suppression efforts have increased the adjacent woodland areas, or in the case of the Black Hills region, increased tree densities of surrounding forests, resulting in a reduction to in-stream flows. Consequently, the water available to adjacent riparian vegetation has been reduced and the width of the riparian zone has decreased in response to reduced soil moisture.

Nonnative species

The accidental or intentional introduction of invasive nonnative species has had a major impact on native riparian and wetland ecosystems in South Dakota. Nonnative invasive plant species are a cause for concern in all South Dakota ecoregions and across all ecosystem types. They are of particular concern to maintaining the ecological integrity of native ecosystems. Nonnative invasive species will often reduce the overall biodiversity of a vegetative community by displacing native species and altering the normal ecological processes (e.g., nutrient and water cycles) that occur there. Where heavy infestation/populations of nonnative invasive plants occur, many of the habitat values of that ecosystem will be altered to conditions no longer favorable to native wildlife. For example, European common reed and purple loosestrife have invaded thousands of acres of previously native ecosystems (Deneke et al. 2010).

Table 5-3. Percent direct conversion (both agriculture and urban development) for each riparian and wetland ecological site and Major Land Resource Area in South Dakota. Reddish shade highlights those sites where direct conversion of native ecosystems is >=60%, yellow highlights those sites where native ecosystem loss is >= 30% and <60%; and green highlights those sites where native ecosystem loss is <30%.

Ecological Site	53B	53C	54	55B	55C	56	58D	60A	61	62	63A	63B	64	65	66	102A	102B	102C
DEPRESSION																		
EPHEMERAL	53.4%	75.7%	49.4%	96.0%	95.7%		9.2%	26.1%	11.6%	<1%	57.9%		28.0%	11.1%	68.1%	85.1%	95.3%	97.4%
TEMPORARY	58.9%	63.4%	35.7%	91.9%	92.6%	98.0%	3.8%	23.4%	32.4%	6.2%	44.0%	40.7%	30.1%	<1%	46.4%	83.3%	97.6%	96.6%
SEASONAL	37.6%	45.8%	31.4%	79.0%	81.8%	92.0%	4.5%	21.4%	5.4%	9.4%	30.3%	37.3%	51.7%	<1%	35.9%	54.7%	91.4%	88.2%
SEMI-PERMANENT	29.5%	45.4%	40.7%	67.7%	75.5%	91.4%	7.0%	8.0%	6.7%	5.6%	19.9%	21.0%	14.8%	<1%	17.5%	25.5%	72.8%	70.6%
PERMANENT	15.1%	70.6%	8.3%	61.3%	67.4%	100.0%	1.7%	6.0%	7.2%	<1%	7.1%	7.4%	2.4%	<1%	3.6%	12.7%	57.6%	57.0%
INTERMITTENT	14.9%	60.5%	<1%	44.6%	75.1%	74.1%				<1%	3.6%	13.7%		<1%		48.7%	34.1%	48.3%
LACUSTRINE																		
EPHEMERAL					<1%							<1%					<1%	
TEMPORARY	25.0%	<1%	37.5%	100.0%	6.7%		<1%	37.9%			<1%			<1%	<1%		45.0%	100.0%
SEASONAL	50.0%	16.7%	2.4%	<1%	46.8%		<1%	20.1%			9.1%	<1%						
SEMI-PERMANENT	8.2%	11.7%	24.6%	70.5%	26.6%		<1%	<1%			<1%	6.7%	<1%	<1%	<1%	3.6%	24.8%	
PERMANENT	6.9%	10.4%	6.6%	7.7%	13.1%	<1%	<1%	1.8%	3.6%	1.4%	<1%	1.3%	1.8%	<1%	4.6%	7.6%	13.5%	13.9%
RIVERINE																		
INTERMITTENT	52.5%	40.4%	15.2%	68.8%	78.6%	49.6%	5.4%	11.9%	21.9%	6.8%	7.3%	34.7%	5.1%	<1%	12.8%	55.8%	84.7%	93.3%
PERMANENT	39.7%	51.3%	14.4%	33.1%	54.3%		11.9%	20.1%	33.0%	31.5%	7.2%	21.6%	5.3%	2.9%	11.1%	73.3%	90.4%	83.6%

Climate Change

As with terrestrial ecosystems, understanding how riparian and wetland ecosystems will respond to climate change is important to evaluating the potential effects on fish and wildlife habitat. To evaluate the potential effects of climate change on riparian and wetland ecosystems in South Dakota, the Downscaled Global Climate Model (DGCM) datasets and results (Cochrane and Moran 2011 – Appendix N) – see Figures 5-2 through 5-6 for summary charts of temperature and precipitation by MLRA – were again used for this evaluation. Further, existing literature was reviewed for its applicability to the DGCM results and is summarized as follows.

Several studies have investigated the significance of temperature increases on wetlands, with the following findings:

- An increase in spring precipitation and snowmelt runoff amounting to 10% of the total growing season precipitation was the only condition that compensated for increased water loss from evapotranspiration due to a 2^{o}C temperature increase. (Poiani et al. 1995)
- “It is apparent from this simulation that a 20% increase in precipitation would generally compensate for a 3^{o}C rise in temperature if applied uniformly” (Johnson et al. 2005), which is consistent with the findings of Johnson et al. (2010) “simulations showed that all three permanence types of wetlands lost significant hydroperiod under both 2^{o}C and 4^{o}C warming scenarios, unless accompanied by a minimum increase in precipitation of 5% to 7% per degree of warming.”

When these relationships are graphed in comparison to the projected climate conditions, in terms of both temperatures and precipitation amounts across MLRAs in South Dakota, overall effects on wetlands can be evaluated. Figure 5-9 shows the relationship of wetlands based on the projected downscaled climate conditions for MLRAs from this report compared to a 2^{o}C rise in temperature and a 10% increase in spring precipitation (Poiani et al. 1995), while Figure 5-10 shows a comparison to a 3^{o}C increase in temperature with a 20% increase in precipitation (Johnson et al. 2010).

Understanding the influence of the HGM class on riparian and wetland ecosystems within South Dakota is critical to understanding some of the potential impacts of climate change. Results of the DGCM evaluation indicate precipitation levels across South Dakota will be higher overall, particularly during winter and spring, but slightly lower than or similar to present levels for most MLRAs during the summer months. A pattern of slightly greater precipitation increases in the eastern part of the state and smaller increases in the western portions is expected. This, coupled with much higher temperatures during the growing season, will lead to higher levels of evaporation/evapotranspiration occurring during the summer months. What this will mean for South Dakota riparian-wetland ecosystems within each MLRA will likely vary depending on the HGM class and hydrology sub-class. The increase in winter-spring precipitation levels should result in more runoff to riparian-wetland ecosystems. For those wetlands such as depressional-ephemeral, temporary, and seasonal, whose hydroperiods primarily span the spring or early summer time-frames, the increased winter-spring precipitation could result in additional

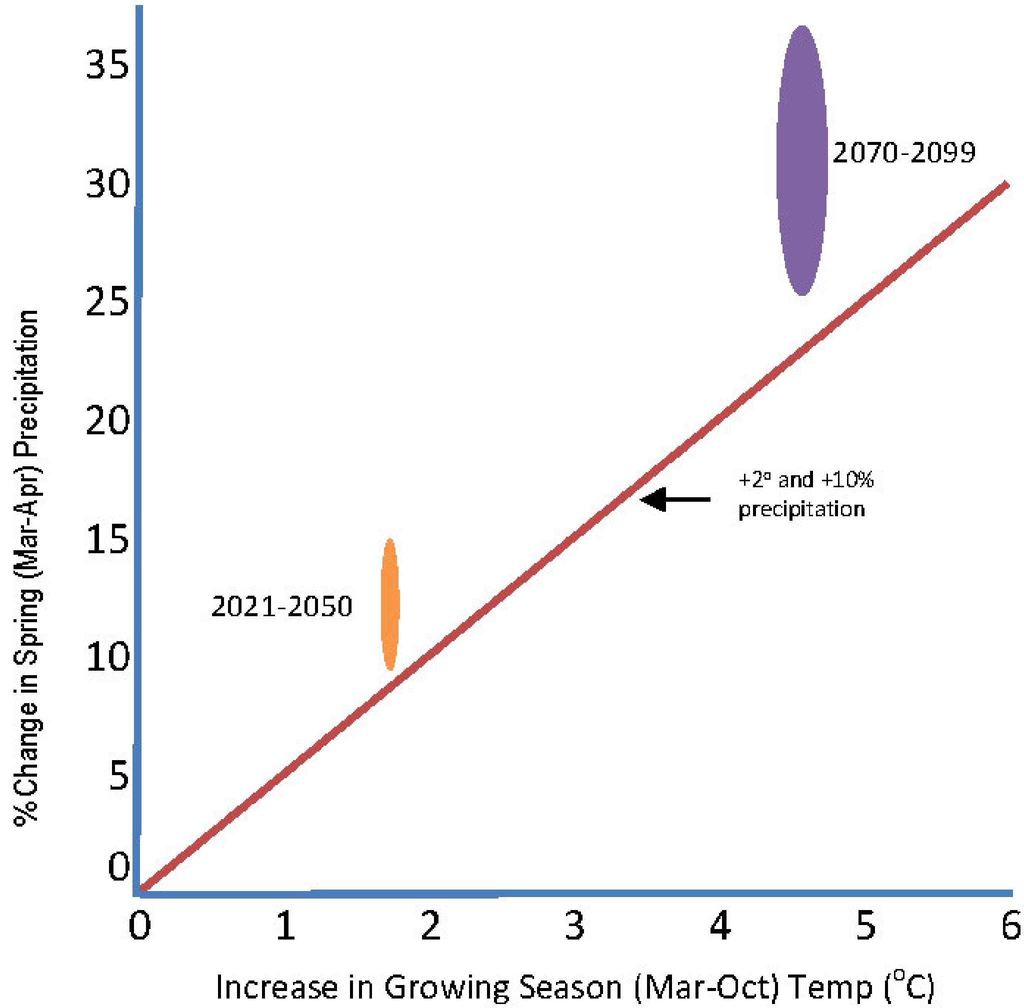


Figure 5-9. Comparison of projected climate change for the range of conditions projected for 2021-2050 and 2070-2099 from the downscaled climate change analysis of this report compared to the findings that a 10% increase in spring precipitation is needed to offset effects on wetlands of a 2°C increase in temperature reported by Poiana et al. (1995).

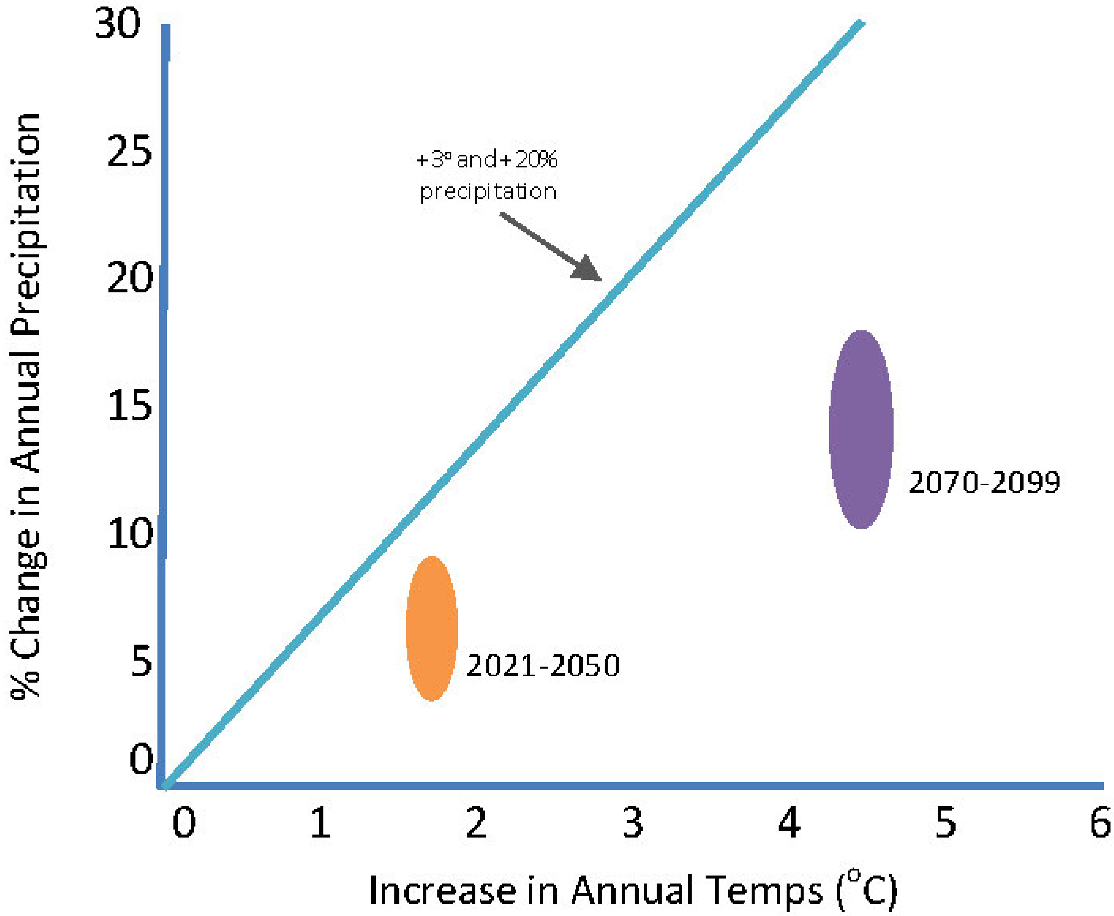


Figure 5-10. Comparison of projected climate change for the range of conditions projected in 2021-2050 and 2070-2099 from the downscaled climate change analysis of this report compared to the findings that a 20% increase in overall precipitation is needed to offset effects on wetlands of a 3°C increase in temperature reported by Johnson et al. (2005), and similar to the relationship reported by Johnson et al. (2010).

water inputs to those basins that have the capability to capture and hold additional water, possibly even pushing a basin into the next hydrology sub-class of greater size and depth. Wetlands that have terrain features that allow for greater water capture would fall into this category. For those wetlands that do not have terrain features that would allow capture of the additional winter-spring water, the effects are likely to be an increased rate of drying as the increased evaporation rates are expected to occur mid- to late summer with the increasing temperatures (Johnson et al. 2010). For those wetlands with hydroperiods that span the full summer, such as depressional semi-permanent and permanent, higher temperatures and similar or reduced precipitation in the summer may result in more rapid rates of evaporation and a shortening of the overall hydroperiod for these sub-classes (Johnson et al. 2010) unless they are able to capture the increased winter-spring precipitation.

Depressional basins receiving groundwater inputs may benefit from the increased winter-spring precipitation rates especially during periods of drought. Likewise, riparian-wetland ecosystems that are associated with the riverine and lacustrine HGM class will potentially have additional surface and sub-surface water inputs from increased winter-spring precipitation that may ameliorate the increased evaporative rate during the summer months and moderate the effects of drought on surface wetlands.

These findings are generally consistent with modeling results of Johnson et al. (2010). They found reduced hydroperiods for temporary and seasonal wetlands, and a reduction in functional semipermanent wetlands in much of the Prairie Pothole Region under a potential 4^{o} C rise in temperature. When combined with a 10% increase in precipitation, there was a shift in location of functional wetlands. In their modeling, they did not analyze the different projected amounts of precipitation increases across MLRAs. If the projections of greater increases in precipitation amounts in MLRAs in the eastern part of South Dakota prove to be correct, the impact on wetlands in the western part of the state is likely to be even more pronounced (similar to the 4^{o} C rise in temperature without the 10% increase in precipitation as modeled by Johnson et al. 2010), while changes to wetlands in the eastern part of South Dakota may be similar to the predictions of Johnson et al. (2010).

Thus, projected increases in temperatures coupled with the projected increases and decreases in seasonal precipitation amounts are likely to have substantial effects on wetlands in South Dakota. Negative effects to biodiversity and waterfowl productivity are likely in the western part of South Dakota. Effects in the eastern part of the state are likely to be ameliorated by increases in precipitation amounts particularly in the spring (Poiani et al. 1995), but only in those wetland complexes that are able to capture and hold this additional precipitation and runoff. More rapid evaporation during the summer will shorten the hydroperiod of wetlands not able to capture the additional precipitation or that are not fed from groundwater or riparian sources, reducing the productivity and functionality of these wetlands. Protecting and restoring wetlands in the eastern part of the state, particularly in locations that can capture and hold additional spring precipitation, are important conservation activities to help address projected climate change effects.

5.3 Species-level Conservation Challenges

There are two primary challenges associated with the persistence of species in South Dakota: 1) the loss or degradation of habitat resulting from impacts to native ecosystem diversity, and 2) non-habitat related impacts. Conservation actions are needed to address the many conservation challenges facing South Dakota's biodiversity. To facilitate this discussion, conservation challenges and actions will be discussed relative to the categories of habitat related or non-habitat related.

Habitat Related

For terrestrial and riparian/wetland habitat dependent SGCN, habitat-based conservation challenges were described earlier in this section, and habitat-based conservation challenges for aquatic SGCN will be described later in this section.

For the SDWAP, a goal for representation will be identified as maintaining more than or restoring at least 10% of the primary historical ecosystems for each ecological site within each of South Dakota's ecoregions (MLRAs). By providing a minimum of 10% of the historical/native ecosystem diversity across South Dakota's ecoregions as described in Chapter 3, habitat conditions for the majority of SGCN dependent on terrestrial or riparian-wetland systems will be improved. Habitat conditions for SGCN dependent on aquatic systems will benefit from the conservation actions identified for aquatic GAP strategy. Although 10% is not necessarily a recommended level of representation, it has often been used as a conservation goal under various national and international programs. Empirical studies of ecosystem loss and resulting effect on species viability reveal that at very high levels of loss (>95%), loss of species is likely. A level of 10 – 12% representation is consistent with several recommendations. The initial goal of 10% representation will require on-going evaluation and monitoring to determine its effectiveness in conserving South Dakota's biological diversity."

Table 5-4 identifies those SGCN that are expected to benefit from the native ecosystem diversity strategy for terrestrial systems and that will benefit from the aquatic GAP strategy. Although aquatic COAs were developed using location data for SGCN that were aquatic insects, freshwater mussels, and fishes, it is assumed that additional species tied to aquatic habitats will also benefit from this approach. Two species, the peregrine falcon and the black-footed ferret, are not included in this table. Peregrine falcons are not considered habitat limited but rather limited by human impacts such as pesticides in the environment. Black-footed ferrets are considered dependent on prairie dog colonies for their habitat. Restoration goals relative to prairie dog colonies are not a component of the SDWAP but are addressed through a separate South Dakota Black-tailed Prairie Dog Conservation and Management Plan (Cooper and Gabriel 2005).

Several SGCN are on the fringe of their historical range in South Dakota. The habitat needs of these species should be provided through ecosystem representation, but providing sufficient habitat to assure population viability within South Dakota alone may be problematic for these species. Providing sufficient habitat to ensure habitat viability for a species on the fringe of its range may actually be counterproductive to native species at the core of their range and may conflict with the conservation goals for native ecosystem diversity. Intensive habitat management programs to increase a relatively rare species on the fringe of its range may meet with marginal success and use limited, valuable resources in the process. To address these species needs, South Dakota will monitor the progress of adjacent states more centrally located to a species' historical range, in their recovery efforts, to determine the appropriate level of participation by South Dakota.

Table 5-4. South Dakota species of greatest conservation need and their relationship to the native ecosystem diversity strategy and/or the aquatic gap analysis project strategy used in the South Dakota Wildlife Action Plan to improve or maintain habitat for a respective species.

Common Name	Native Ecosystem Diversity Strategy		Aquatic GAP Strategy
	Terrestrial	Riparian-Wetland	
BIRDS			
American Dipper		X	X
American Three-toed Woodpecker	X		
American White Pelican		X	X
Baird's Sparrow	X	X	
Bald Eagle	X	X	X
Black Tern		X	
Black-backed Woodpecker	X		
Burrowing Owl	X		
Chestnut-collared Longspur	X		
Ferruginous Hawk	X		
Greater Prairie-Chicken	X	X	
Greater Sage-Grouse	X	X	
Interior Least Tern		X	
Lark Bunting	X		
Le Conte's Sparrow	X	X	
Lewis's Woodpecker	X		
Long-billed Curlew	X	X	
Marbled Godwit	X	X	
Northern Goshawk	X		
Osprey	X	X	X
Piping Plover		X	
Ruffed Grouse	X	X	
Sprague's Pipit	X		

Table 5-4 (continued). South Dakota species of greatest conservation need and their relationship to the native ecosystem diversity strategy and/or the aquatic gap analysis project strategy used in the South Dakota Wildlife Action Plan to improve or maintain habitat for a respective species.

Common Name	Native Ecosystem Diversity Strategy		Aquatic GAP Strategy
	Terrestrial	Riparian-Wetland	
Trumpeter Swan		X	X
White-winged Junco	X		
Whooping Crane		X	
Willet	X	X	
Wilson's Phalarope	X	X	
GASTROPODS			
Cooper's Rocky Mountainsnail	X	X	
Dakota Vertigo	X		
Frigid Ambersnail	X		
Mystery Vertigo	X		
AMPHIBIANS AND REPTILES			
Black Hills Redbelly Snake	X		
Blanchard's Cricket Frog		X	X
Cope's Gray Treefrog		X	X
Eastern Hognose Snake	X	X	
False Map Turtle		X	X
Lesser Earless Lizard	X	X	
Lined Snake	X		
Many-lined Skink	X		
Sagebrush Lizard	X		
Short-horned Lizard	X		
Smooth Softshell		X	X
Western Box Turtle	X		

Table 5-4 (continued). South Dakota species of greatest conservation need and their relationship to the native ecosystem diversity strategy and/or the aquatic gap analysis project strategy used in the South Dakota Wildlife Action Plan to improve or maintain habitat for a respective species.

Common Name	Native Ecosystem Diversity Strategy		Aquatic GAP Strategy
	Terrestrial	Riparian-Wetland	
MAMMALS			
Black Hills Red Squirrel	X		
Franklin's Ground Squirrel	X		
Fringe-tailed Myotis	X	X	
Northern Flying Squirrel	X	X	
Northern Myotis	X	X	
Northern River Otter		X	X
Richardson's Ground Squirrel	X		
Silver-haired Bat	X	X	
Swift Fox	X		
Townsend's Big-eared Bat	X	X	
TERRESTRIAL INSECTS			
American Burying Beetle	X	X	
Dakota Skipper	X		
Great Plains Tiger Beetle	X		
Indian Creek Tiger Beetle		X	X
Iowa Skipper	X		
Little White Tiger Beetle	X	X	
Northern Sandy Tiger Beetle	X		
Ottoe Skipper	X		
Pahasapa Fritillary	X	X	
Poweshiek Skipperling	X		
Regal Fritillary	X		

Table 5-4 (continued). South Dakota species of greatest conservation need and their relationship to the native ecosystem diversity strategy and/or the aquatic gap analysis project strategy used in the South Dakota Wildlife Action Plan to improve or maintain habitat for a respective species.

Common Name	Native Ecosystem Diversity Strategy		Aquatic GAP Strategy
	Terrestrial	Riparian-Wetland	
AQUATIC INSECTS			
A Mayfly			X
Dakota Stonefly			X
Dot-winged Baskettail			X
Elusive Clubtail – A Dragonfly			X
FRESHWATER MUSSELS			
Creek Heelsplitter			X
Elktoe			X
Hickorynut			X
Higgins Eye			X
Mapleleaf			X
Pimpleback			X
Rock Pocketbook			X
Scaleshell			X
Yellow Sandshell			X
FISHES			
Banded Killifish			X
Blacknose Shiner			X
Blackside Darter			X
Blue Sucker			X
Carmine Shiner			X
Central Mudminnow			X
Finescale Dace			X
Hornyhead Chub			X

Table 5-4 (continued). South Dakota species of greatest conservation need and their relationship to the native ecosystem diversity strategy and/or the aquatic gap analysis project strategy used in the South Dakota Wildlife Action Plan to improve or maintain habitat for a respective species.

Common Name	Native Ecosystem Diversity Strategy		Aquatic GAP Strategy
	Terrestrial	Riparian-Wetland	
FISHES (continued)			
Lake Chub			X
Logperch			X
Longnose Sucker			X
Mountain Sucker			X
Northern Pearl Dace			X
Northern Redbelly Dace			X
Pallid Sturgeon			X
Shovelnose Sturgeon			X
Sicklefin Chub			X
Southern Redbelly Dace			X
Sturgeon Chub			X
Topeka Shiner			X
Trout-perch			X

Climate Change

South Dakota's SGCN will each have different responses to climate change and will require an individual assessment of possible outcomes based on expected changes to native ecosystem diversity. Some species may have a positive response and expand their range in South Dakota in response to climate change. Others may have a neutral response without any realized changes in a species' range and yet other species may have a negative response with a contraction or shift in their range of occurrence in South Dakota. While these changes depend on many variables, the use of the coarse-filter provides the foundation for making an informed prediction of possible outcomes while also providing opportunities to identify possible mitigations that could reduce or minimize overall impacts.

Using the results of the climate change assessment developed for the SDWAP, Table 5-5 provides a summary of the projected effects of climate change on terrestrial and riparian-wetland SGCN for South Dakota. See Table 5-6 for a summary of expected effects of climate change on aquatic SGCN. This information was developed using the projected changes to native ecosystem diversity resulting from climate change predictive models as described earlier in this section. The projected effect is described as positive, neutral, or negative for each species. A reason for the assessment is provided and is dependent on the expected change in habitat conditions for that species within South Dakota. Conservation actions that may help mitigate negative impacts to a species are also presented in this table.

Non-habitat Related - Overview

A number of SGCN have additional, non-habitat related conservation challenges. These non-habitat related conservation challenges have been summarized in each of the SGCN profiles presented in Appendix C. Non-habitat related impacts are typically characterized by direct human-influences on a species normal life cycles, reproduction, or existence. A summary of these challenges is presented later in this section, following challenges to aquatic systems.

Table 5-5. Expected effects of climate change on native ecosystems and habitat of terrestrial and riparian-wetland species of greatest conservation need in South Dakota and suggested mitigation actions where possible impacts are identified.

Common Name	Expected Effects	Reason	Possible Mitigation Actions
American Burying Beetle	Neutral	Soil structure appears to be more important than vegetation structure or composition	Not Needed
American Dipper	Positive	In-stream flows may increase with increased winter/spring precipitation, improving early-mid nesting season habitat quality and quantity	Not Needed
American Three-toed Woodpecker	Positive	Increasing fire frequency and severity will increase habitat, at least for the short-term	Not Needed
American White Pelican	Neutral to negative	Neutral on riverine/lacustrine systems; negative on depressional systems	Known key depressional sites should be individually evaluated for possible mitigation actions
Bald Eagle	Neutral	More closely associated with riverine and lacustrine systems	Not Needed
Baird's Sparrow	Negative	Prefers cool season grass (C3) dominated conditions or mixed-cool/warm (C4) season conditions	Where possible, select for native warm season (C4) grass species that are taller in stature
Black-backed Woodpecker	Positive	Increasing temperatures will lead to increased fire frequency and severity resulting in more habitat for this species, at least for the short-term	Not Needed
Blanchard's Cricket Frog	Neutral to negative	Neutral for riverine/lacustrine systems; negative for depressional systems	Known key depressional sites should be individually evaluated for possible mitigation actions
Black-footed Ferret	Variable	This species is associated with prairie dog and ground squirrel populations, therefore, effect is dependent on applicable rodent species response	See black-tailed prairie dog, Richardson's ground squirrel, and Franklin's ground squirrel for possible actions
Black Hills Redbelly Snake	Negative	Prefers cool season grass (C3) dominated conditions or mixed-cool/warm (C4) season conditions	Where possible, select for native warm season (C4) grass species that are taller in stature

Table 5-5 (continued). Expected effects of climate change on native ecosystems and habitat of terrestrial and riparian-wetland species of greatest conservation need in South Dakota and suggested mitigation actions where possible impacts are identified.

Common Name	Expected Effects	Reason	Possible Mitigation Actions
Black Hills Red Squirrel	Negative	Increasing fire frequency; forest management policies that do not allow adequate thinning will reduce late seral conditions and large trees in the landscape	Implement forest policy to allow ecosystem restoration based on historical reference conditions and climate change adjustments for species composition
Black Tern	Neutral to negative	Neutral for riverine/lacustrine systems; negative for depressional systems	Known key depressional sites should be individually evaluated for possible mitigation actions
Burrowing Owl	Variable	This species is associated with prairie dog and ground squirrel populations, therefore, climate change effect is dependent on their response	See black-tailed prairie dog, Richardson's ground squirrel, and Franklin's ground squirrel for possible actions
Chestnut-collared Longspur	Positive	Prefers warm season grass (C4) dominated conditions	Not Needed
Cope's Gray Treefrog	Neutral to negative	Neutral for riverine/lacustrine systems; negative for depressional systems	Known key depressional sites should be individually evaluated for possible mitigation actions
Cooper's Rocky Mountainsnail	Negative	Increasing temperatures will lead to increased fire frequency and severity, resulting in less habitat for this species	Forest stands that have the best potential for calcareous soils and future moist forest conditions should be protected
Dakota Skipper	Positive	Prefers moist and dry prairies containing warm (C4) season grasses, particularly little bluestem	Not needed
Dakota Vertigo	Negative	Increasing fire frequency; forest management policies that do not allow adequate thinning will reduce late seral conditions and large trees in the landscape	Implement forest policy to allow ecosystem restoration based on historical reference conditions and climate change adjustments for species composition
Eastern Hognose Snake	Neutral to negative	Prey base: Neutral on riverine/lacustrine systems; negative on depressional systems	Known key depressional sites should be individually evaluated for possible mitigation actions
Ferruginous Hawk	Positive	More closely associated with warm season grass (C4) dominated conditions	Not Needed
Franklin's Ground Squirrel	Negative	Prefers cool season grass (C3) dominated conditions or mixed-cool/warm (C4) season conditions	Where possible, select for native warm season (C4) grass species that are taller in stature

Table 5-5 (continued). Expected effects of climate change on native ecosystems and habitat of terrestrial and riparian-wetland species of greatest conservation need in South Dakota and suggested mitigation actions where possible impacts are identified.

Common Name	Expected Effects	Reason	Possible Mitigation Actions
False Map Turtle	Neutral to negative	Neutral for riverine/lacustrine systems; negative for depressional systems	Known key depressional sites should be individually evaluated for possible mitigation actions
Frigid Ambersnail	Negative	Increasing temperatures will lead to increased fire frequency and severity, resulting in less habitat for this species	Moist forest stands that are associated with limestone talus should be protected from fire or disturbance
Fringe-tailed Myotis	Negative	Increasing fire frequency; forest management policies that do not allow adequate thinning will reduce late seral conditions and large trees in the landscape	Implement forest policy to allow ecosystem restoration based on historical reference conditions and climate change adjustments for species composition
Greater Prairie-Chicken	Neutral	Associated with both warm (C4) and cool (C3) season grass dominated conditions	Not Needed
Greater Sage-Grouse	Negative	Prefers cool season grass (C3) dominated conditions	Where possible, select for taller stature native warm season (C4) grass species and/or allow only intermittent heavy grazing
Great Plains Tiger Beetle	Positive	Prefers warm season grass (C4) dominated conditions	Not Needed
Indian Creek Tiger Beetle	Neutral	Increased winter/spring precipitation may reduce impacts to intermittent streams	Not Needed
Iowa Skipper	Negative	Prefers cool season grass (C3) dominated conditions or mixed-cool/warm (C4) season conditions	Where possible, select for native warm season (C4) grass species that are taller in stature
Lark Bunting	Positive	Prefers warm season grass (C4) dominated conditions	Not Needed
Long-billed Curlew	Positive	Prefers warm season grass (C4) dominated conditions	Not Needed
Le Conte's Sparrow	Neutral to negative	Neutral for riverine/lacustrine systems; negative for depressional systems	Known key depressional sites should be individually evaluated for possible mitigation actions
Lesser Earless Lizard	Positive	Prefers warm season grass (C4) dominated conditions	Not Needed

Table 5-5 (continued). Expected effects of climate change on native ecosystems and habitat of terrestrial and riparian-wetland species of greatest conservation need in South Dakota and suggested mitigation actions where possible impacts are identified.

Common Name	Expected Effects	Reason	Possible Mitigation Actions
Interior Least Tern	Neutral to negative	Neutral on riverine/lacustrine systems; negative on depressional systems	Known key depressional sites should be individually evaluated for possible mitigation actions
Lewis's Woodpecker	Negative	Increasing fire frequency; forest management policies that do not allow adequate thinning will reduce late seral conditions and large trees in the landscape	Implement forest policy to allow ecosystem restoration based on historical reference conditions and climate change adjustments for species composition
Lined Snake	Negative	Prefers cool season grass (C3) dominated conditions or mixed-cool/warm (C4) season conditions	Where possible, select for native warm season (C4) grass species that are taller in stature
Little White Tiger Beetle	Positive	Prefers warm season grass (C4) dominated conditions	Not Needed
Marbled Godwit	Neutral	Associated with both warm (C4) and cool (C3) season grass dominated conditions	Not Needed
Many-lined Skink	Positive	Prefers warm season grass (C4) dominated conditions	Not Needed
Mystery Vertigo	Negative	Increasing temperatures will lead to increased fire frequency and severity, resulting in less habitat	Moist forest stands associated with limestone or schist substrates should be protected from fire or disturbance
Northern Flying Squirrel	Negative	Increasing fire frequency; forest management policies that do not allow adequate thinning will reduce late seral conditions and large trees in the landscape	Implement forest policy to allow ecosystem restoration based on historical reference conditions and climate change adjustments for species composition
Northern Goshawk	Negative	Increasing fire frequency; forest management policies that do not allow adequate thinning will reduce late seral conditions and large trees in the landscape	Implement forest policy to allow ecosystem restoration based on historical reference conditions and climate change adjustments for species composition

Table 5-5 (continued). Expected effects of climate change on native ecosystems and habitat of terrestrial and riparian-wetland species of greatest conservation need in South Dakota and suggested mitigation actions where possible impacts are identified.

Common Name	Expected Effects	Reason	Possible Mitigation Actions
Northern Myotis	Negative	Increasing fire frequency; forest management policies that do not allow adequate thinning will reduce late seral conditions and large trees in the landscape	Implement forest policy to allow ecosystem restoration based on historical reference conditions and climate change adjustments for species composition
Northern River Otter	Neutral	More closely associated with riverine and lacustrine systems	Not Needed
Northern Sandy Tiger Beetle	Positive	Prefers warm season grass (C4) dominated conditions	Not Needed
Osprey	Neutral	More closely associated with riverine and lacustrine systems	Not Needed
Ottoe Skipper	Negative	Prefers cool season grass (C3) dominated conditions or mixed-cool/warm (C4) season conditions	Where possible, select for native warm season (C4) grass species that are taller in stature
Pahasapa Fritillary	Negative	Mid-to late summer depressional systems may be impacted	Known key depressional sites should be individually evaluated for possible mitigation actions; beaver ponds should be encouraged
Peregrine Falcon	Neutral	Associated with both warm (C4) and cool (C3) season grass dominated conditions	Not Needed
Piping Plover	Neutral	More closely associated with riverine and lacustrine systems	Not Needed
Poweshiek Skipperling	Positive	Prefers moist and dry prairies containing warm (C4) season grasses, particularly bluestems	Not needed
Regal Fritillary	Negative	Prefers cool season grass (C3) dominated conditions	Where possible, select for native warm season (C4) grass species that are taller in stature as well as violets and nectar producing forbs
Richardson's Ground Squirrel	Positive	Prefers warm season grass (C4) dominated conditions	Not Needed
Ruffed Grouse	Positive	Increasing fires will create better aspen regeneration and multiple age-class conditions, at least for the short-term	Not Needed

Table 5-5 (continued). Expected effects of climate change on native ecosystems and habitat of terrestrial and riparian-wetland species of greatest conservation need in South Dakota and suggested mitigation actions where possible impacts are identified.

Common Name	Expected Effects	Reason	Possible Mitigation Actions
Sagebrush Lizard	Positive	Increasing temperatures will lead to drier conditions, sparse vegetation, and increasing blowouts on sandy sites	Not Needed
Silver-haired Bat	Negative	Increasing fire frequency; forest management policies that do not allow adequate thinning will reduce late seral conditions and large trees in the landscape	Implement forest policy to allow ecosystem restoration based on historical reference conditions and climate change adjustments for species composition
Short-horned Lizard	Positive	Prefers warm season grass (C4) and shrub dominated conditions	Not Needed
Smooth Softshell	Neutral	More closely associated with riverine systems	Not Needed
Sprague's Pipit	Negative	Prefers cool season grass (C3) dominated conditions	Where possible, select for taller stature native warm season (C4) grass species and/or allow only intermittent heavy grazing
Swift Fox	Positive	Prefers warm season grass (C4)/shrub conditions	Not Needed
Townsend's Big-eared Bat	Positive	Forages over warm season grass (C4) and shrub conditions	Not Needed
Trumpeter Swan	Neutral to negative	Neutral on riverine/lacustrine systems; negative on depressional systems	Known key depressional sites should be individually evaluated for possible mitigation actions
Western Box Turtle	Positive	Prefers warm season grass (C4) dominated conditions	Not Needed
Whooping Crane	Neutral	Prefers riverine systems	Not Needed

Table 5-5 (continued). Expected effects of climate change on native ecosystems and habitat of terrestrial and riparian-wetland species of greatest conservation need in South Dakota and suggested mitigation actions where possible impacts are identified.

Common Name	Expected Effects	Reason	Possible Mitigation Actions
Willet	Neutral to negative	Neutral for riverine/lacustrine systems; negative for depressional systems	Known key depressional sites should be individually evaluated for possible mitigation actions
Wilson's Phalarope	Neutral to negative	Neutral for riverine/lacustrine systems; negative for depressional systems	Known key depressional sites should be individually evaluated for possible mitigation actions
White-winged Junco	Negative	Increasing fire frequency; forest management policies	Implement forest policy to allow ecosystem restoration based on historical reference conditions and climate change adjustments for species composition

5.4 Aquatic Systems

Many stressors directly and indirectly impact aquatic ecosystems and habitats (Richter et al. 1997). Considering the multitude of stressors and disturbances affecting riverine ecosystems, their cumulative nature, and the fact that they are often greatly removed from the site of interest, determining the primary causes for species loss and decline is difficult (McCartney 2002).

Three main stressors or challenges associated with maintaining aquatic ecosystem diversity in South Dakota include the direct alteration or conversion of ecosystems, the indirect alteration and/or suppression of natural disturbance processes, and the indirect alteration caused by human activities.

Direct alteration/conversion of ecosystems

The direct alteration or conversion of lands in South Dakota is primarily linked to the conversion of natural grasslands and prairies into agricultural practices and to a lesser degree, urbanization (including roads, impervious surfaces and other infrastructure). In South Dakota, approximately 80% of the landscape is privately owned. From 2007 to 2011, slightly more than 2.7 million acres of grassland were converted into agricultural croplands (Fry et al. 2011). With agriculture and livestock production as the predominant land use types, agricultural runoff of nutrients and sediment into streams affects aquatic habitats. In areas of intense cultivation, streams are often channelized for irrigation, reducing their habitat value for aquatic communities as temperature, aquatic vegetation, and stream flow are significantly altered. In addition, watersheds dominated by row-crop agriculture, hay production, and cattle grazing have increased sedimentation and nutrient loads to aquatic ecosystems. Stream flow alteration also includes flooding reduction, control or cessation, which may negatively impact aquatic species that require effects of a more natural hydrograph.

In particular, stressors that directly affect aquatic ecosystems include surface water diversion, impoundments, dams, stream channelization, and hydrologic modifications. These stressors degrade, alter, and fragment aquatic habitats and can eventually lead to species loss and extirpation (Williams et al. 1989, Ricciardi and Rasmussen 1999, Fischer and Paukert 2008).

Indirect alteration and/or suppression of historical disturbance processes

The primary causes of indirect alteration and/or suppression of historical disturbance processes include fire suppression, altered grazing regimes, flood control, and removal of beaver and beaver dams in aquatic ecosystems.

Both direct and indirect alterations to aquatic ecosystems negatively impact aquatic habitats and communities. Loss of natural grasslands to agricultural practices and increased grazing along riparian areas has resulted in degradation of aquatic habitats due to increased sedimentation and agricultural runoff. Flood control has resulted in migration barriers for fish and has led to the channelization of rivers and loss of important spawning, feeding, and natal nursery grounds. Removal of beaver and beaver dams has limited critical pool and backwater habitats.

Indirect alteration caused by human activities

Indirect alterations caused by human activities in South Dakota are linked primarily to the accidental and intentional introduction of nonnative species and more recently climate change. Aquatic nonnative species, commonly called aquatic invasive species (AIS), have had major impacts on native species and ecosystems (Collares-Pereira et al. 2000, Rahel and Thel 2004, Fischer and Paukert 2008). The introduction of nonnative species increases competition with and predation on native species and may expose native species to new parasites and diseases, for which they may lack defenses (Soule 1990, Richter et al. 1997). The invasion of Silver Carp, *Hypophthalmichthys molitrix*, in South Dakota has the potential to negatively impact native fish and invertebrate communities through competition for food resources.

Climate Change

In more recent years, greater emphasis has been put on climate change as an indirect alteration caused by human activities. While scientific evidence supporting climate change and its causes continues to grow, understanding the impacts that climate change will have on aquatic biodiversity is more challenging, due to the limited understanding of individual habitat needs and limiting factors. It is expected that lakes, rivers, and streams will become warmer and water levels will change. For cold water species, we may see a decline in distribution; however for warmer water species on the northern edge of their distribution we may see a range expansion. Stronger storms are expected to bring short duration, high intensity precipitation, which will increase flooding and increase nutrient runoff from agricultural lands. Along with these short duration storms, we are also likely to see an increase in drought and an increase in human demands for water. The resulting habitat loss will affect nursery grounds and spawning areas for aquatic communities.

In addition, combining the impacts of climate change with other stressors such as structural migration barriers may prohibit some species from making the necessary distributional shifts in response to the warmer and drier conditions predicted for South Dakota (Burgess 2013). Additional information on individual aquatic species vulnerability to climate change can be found in Table 5-6. A full draft of the aquatic species vulnerability to climate change (Burgess 2013) is available on the SDGFP website. An Executive Summary of the report can be found in Appendix O.

Table 5-6. Expected effects of climate change on aquatic species of greatest conservation need (SGCN) in South Dakota.

Common Name	Scientific Name	Global Rank[a]	State Rank[a]	SD range relative to Global range	CCVI Score[b]	Reason
FRESHWATER MUSSELS						
Creek Heelsplitter	*Lasmigona compressa*	G5	S1	Southern edge	PS	NA
Elktoe	*Alasmidonta marginata*	G4	S1	Western edge	MV	Anthropogenic barriers to dispersal
Hickorynut	*Obovaria olivaria*	G4	S1	Northern edge	MV	Anthropogenic barriers to dispersal
Higgins Eye	*Lampsilis higginsii*	G1	S1	Northern edge	HV	Natural & anthropogenic barriers to dispersal
Mapleleaf	*Quadrula quadrula*	G5	S2	Western edge	PS	NA
Pimpleback	*Quadrula pustulosa*	G5	S1	Western edge	PS	NA
Rock Pocketbook	*Arcidens confragosus*	G4	S1	Western edge	PS	NA
Scaleshell	*Leptodea leptodon*	G1	S1	Western edge	HV	Anthropogenic barriers to dispersal
Yellow Sandshell	*Lampsilis teres*	G5	S1	Northern edge	PS	NA
AQUATIC INSECTS (not included due to limited data)						
A Mayfly	*Analetris eximia*	G3	SNR	Eastern edge	IE	NA
A Stonefly	*Perlesta dakota*	G3	SNR	South Dakota Only	IE	NA
Dot-winged Baskettail - A Dragonfly	*Epitheca petechialis*	G4	SNR	Northern edge	IE	NA
Elusive Clubtail - A Dragonfly	*Stylurus notatus*	G3	SNR	Western edge	IE	NA
FISHES						
Banded Killifish	*Fundulus diaphanus*	G5	S1	Western edge	PS	NA
Blacknose Shiner	*Notropis heterolepis*	G4	S1	Western edge	MV	Anthropogenic barriers to dispersal, sensitivity to historical & physiological hydrological niche
Blackside Darter	*Percina maculata*	G5	S2	Western edge	PS	NA
Blue Sucker	*Cycleptus elongatus*	G3G4	S3	Northern edge	MV	Anthropogenic barriers to dispersal
Carmine Shiner	*Notropis percobromus*	G5	S2	Western edge	MV	Natural barriers to dispersal
Central Mudminnow	*Umbra limi*	G5	S2	Western edge	MV	Sensitivity to historical hydrological niche

Table 5-6. (continued). Expected effects of climate change on aquatic species of greatest conservation need (SGCN) in South Dakota.

Common Name	Scientific Name	Global Rank[a]	State Rank[a]	SD range relative to Global range	CCVI Score[b]	Reason
FISHES						
Finescale Dace	*Chrosomus neogaeus*	G5	S1	Southern edge	EV	Natural & anthropogenic barriers to dispersal, sensitivity to physiological thermal & hydrological niche, dependence on other species to generate habitat
Hornyhead Chub	*Nocomis biguttatus*	G5	S3	Center	PS	NA
Lake Chub	*Couesius plumbeus*	G5	S1	Southern edge	EV	Natural & anthropogenic barriers to dispersal, sensitivity to physiological hydrological niche
Logperch	*Percina caprodes*	G5	S3	Western edge	MV	Sensitivity to historical hydrological niche
Longnose Sucker	*Catostomus catostomus*	G5	S1	Center	HV	Natural & anthropogenic barriers to dispersal, sensitivity to physiological thermal niche
Mountain Sucker	*Catostomus platyrhynchus*	G5	S3	Eastern edge	EV	Natural & anthropogenic barriers to dispersal
Northern Pearl Dace	*Margariscus nachtriebi*	G5	S2	Southern edge	EV	Natural & anthropogenic barriers to dispersal, sensitivity to physiological hydrological niche, dependence on other species to generate habitat
Northern Redbelly Dace	*Chrosomus eos*	G5	S2	Southern edge	EV	Anthropogenic barriers to dispersal
Pallid Sturgeon	*Scaphirhynchus albus*	G2	S1	Center	MV	Anthropogenic barriers to dispersal
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*	G4	S4	Center	PS	NA
Sicklefin Chub	*Macrhybopsis meeki*	G3	S1	Northern edge	MV	Anthropogenic barriers to dispersal, sensitivity to historical hydrological niche
Southern Redbelly Dace	*Chrosomus erythrogaster*	G5	S1	Northwestern edge	EV	Anthropogenic barriers to dispersal, sensitivity to physiological thermal niche
Sturgeon Chub	*Macrhybopsis gelida*	G3	S2	Center	HV	Anthropogenic barriers to dispersal
Topeka Shiner	*Notropis topeka*	G3	S2	Northern edge	PS	NA

Table 5-6. (continued). Expected effects of climate change on aquatic species of greatest conservation need (SGCN) in South Dakota.

Common Name	Scientific Name	Global Rank[a]	State Rank[a]	SD range relative to Global range	CCVI Score[b]	Reason
FISHES						
Trout-perch	*Percopsis omiscomaycus*	G5	S2	Western edge	PS	NA
TURTLES (included in terrestrial climate change table)						
False Map Turtle	*Graptemys pseudogeographica*	G5	S3	Western edge	NA	NA
Smooth Softshell	*Apalone mutica*	G5	S2	Western edge	NA	NA

[a]NatureServe Global and State Conservation Status Ranks

- G1, S1 = Critically imperiled globally or in the state because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as a steep population decline making it especially vulnerable to extirpation.
- G2, S2 = Imperiled globally or in the state because of rarity due to very restricted range, very few populations (often 20 or less), steep population declines, or other factors making it very vulnerable to extirpation.
- G3, S3 = Vulnerable globally or in the state due to restricted range, relatively few populations (often 80 or less), recent and widespread declines, or other factors making it vulnerable to extinction.
- G4, S4 = Apparently secure species are uncommon but not rare but there is some cause for concern due to declines or other factors.
- G5, S5 = Secure species are common, widespread, and abundant globally or in the state.

[b]CCVI Vulnerability Index Scores

- EV = Extremely Vulnerable – Abundance and/or range extent within geographical area assessed extremely likely to substantially decrease or disappear by 2050.
- HV = Highly Vulnerable – Abundance and/or range extent within geographical area assessed likely to decrease significantly by 2050.
- MV = Moderately Vulnerable – Abundance and/or range extent within geographical area assessed likely to decrease by 2050.
- PS = Not Vulnerable/Presumed Stable – Available evidence does not suggest that abundance and/or range extent within geographical area assessed will change (increase/decrease) substantially by 2050. Actual range boundaries may change.
- IL = Not Vulnerable/Increase Likely – Available evidence suggests that abundance and/or range extent within geographical area assessed is likely to increase by 2050.
- IE = Insufficient Evidence – Available information about a species' vulnerability is inadequate to calculate an Index score.

Human Stressor Index (HSI)

The selection process for identifying aquatic COAs considered a number of relevant threats. The quantified data on human stressors assisted in identifying relatively high quality locations for future conservation efforts and helped identify areas where the biological diversity and associated habitats are more threatened in South Dakota.

Working primarily with the Missouri Aquatic GAP (MOGAP) dataset and working with a team of GIS and aquatic staff, a list was generated of the primary human activities known to negatively impact the ecological integrity of South Dakota rivers and streams (Annis et al. 2010). From this dataset the highest resolution and most recent geospatial data were assembled for each of those stressors (Table 5-7). Most of the geospatial data were acquired from the U.S. Environmental Protection Agency (US EPA), U.S. Army Corps of Engineers, U.S. Geological Survey (USGS), South Dakota Department of Environment and Natural Resources (SD DENR), South Dakota Game, Fish and Parks (SDGFP), and MOGAP.

Table 5-7. List of the global information system (GIS) coverages and their sources obtained or created to identify existing and potential future stressors to the aquatic species of greatest conservation need in South Dakota.

HUMAN STRESSOR DATA LAYER	DESCRIPTION	SOURCE
Impervious surfaces	Artificial structures (i.e. pavement, roads, sidewalks, driveways, parking lots).	MOGAP (Modified from 2001 NLCD data)
% Land cover in cropland	% of the land that is used in the cultivation of crops (i.e. corn, soybeans, etc.).	MOGAP (USGS, 2006 NLCD data), http://www.mrlc.gov/nlcd06_data.php
Confined Animal Feeding Operations (CAFOs)	An animal agricultural facility that concentrates a large number of animals in a relatively small and confined place.	SD DENR
Road stream crossings	Man-made, stabilized structures (i.e. culverts, bridges, dams, etc.) that allow livestock, people, vehicles, etc. to cross streams via roadways.	MOGAP
Major hydrologic modifications	Major physical alterations to small or larger river (i.e. small, medium, large, and grand rivers) channels and their associated corridors (i.e. widening, and channelizing rivers, reservoir construction, etc.).	MOGAP
Dams	Federally licensed barriers reported to the USACE that impound, collect or store water.	MOGAP (US Army Corps of Engineers, USACE)
Permitted discharges	Permits for companies to discharge wastewater into rivers. Permits detail what is allowed to be discharged and monitors how much.	MOGAP (2012 EPA), http://www.epa.gov/enviro/html/frs_demo/geospatial_data/geo_data_state_single.html
Active oil & gas wells	Currently producing wells designed to acquire and find petroleum oil and gas.	MOGAP (2012 SD DENR), http://www.sdgs.usd.edu/pubs.og/SDOILexport.zip
Gravel mining	Currently open pits (i.e. river floodplains) or streams being mined for gravel or sand.	SDGFP

Statistics for the 9 individual human stressors (i.e. % cover, degree of fragmentation, density per km^2) for each of the 298 Aquatic Ecological System (AES) units in South Dakota were generated. All metrics were calculated for each individual unit. Relativized rankings (range 1 to 4) were then developed for each of the 9 stressors (Table 5-8). These rankings are relative to the range of values obtained throughout South Dakota. A rank 1 denotes a relatively low disturbance value for that particular stressor, while a rank 4 indicates a relatively high level of disturbance. These rankings were based on information contained within MOGAP, literature, or equal intervals when no empirical evidence on thresholds was available (i.e. cropland land cover).

Table 5-8. Nine stressor metrics included in the human stressor index (HSI) and the specific criteria used to define the four relative ranking categories for each metric used to calculate the HSI for each aquatic ecological system (AES) unit.

	Relative Ranks			
Human Stressor Metric	**1**	**2**	**3**	**4**
% Impervious surfaces	0-5% of AES	6-10% of AES	11-20% of AES	>20% of AES
% Land cover in cropland	0-25% of AES	26-50% of AES	51-75% of AES	76-100% of AES
Confined Animal Feeding Operations (CAFOs) (#/km^2)	0	0.01-1.22	1.23-1.83	≥1.84
Density of road stream crossings (#/km^2)	0-0.17	0.18-0.29	0.3-0.49	≥0.5
**Degree of hydrologic modification and/or fragmentation by major impoundments	1	2-3	4-5	6
# of federally licensed dams	0	1-5	6-14	>14
Density of permitted discharges (#/km^2)	0	0.01-0.31	0.32-0.92	>0.92
Density of active oil & gas wells (#/km^2)	0	0.01-1.07	1.08-7.93	>7.93
Density of active gravel mining (#/km^2)	0	0.006-0.01	0.011-0.019	>0.019

**Note: A major impoundment was defined as those that occur on rivers classified as small or larger (i.e. small river, medium river, large river, or great river) and did not include waters classified as unclassified, headwater, or creek. The codes used to categorize the degree of hydrologic modification and/or fragmentation can be interpreted as follows.

1: No hydrologic alteration or fragmentation.

2: Externally fragmented: obligate aquatic biota could reach one or more adjacent watersheds, but not the MO or MS Rivers without passing through a major impoundment.

3: Hydrologically modified: included all inundated AES units and any area downstream of the dam known to have a significantly modified hydrologic regime.

4: Both externally fragmented and hydrologically modified: includes those AES units that contain stream segments situated in the interceding area between two major impoundments on the same stream.

5: Isolated: obligate aquatic biota could not reach any adjacent watershed without passing through a major impoundment.

6: Both isolated and hydrologically modified.

The relativized rankings for each of the 9 stressors were then combined into a three digit Human Stressor Index (HSI). The first number reflects the highest ranking across all 9 stressors (range 1 to 4). The last two numbers reflect the sum of the 9 stressors (range 9 to 36). This index value allows us to evaluate both individual and cumulative impacts. For example, a value of 412 indicates relatively low cumulative impacts (i.e. last two digits = 12 out of a possible 36), however, the first number is a 4, which indicates that one of the stressors is relatively high and potentially acting as a major human disturbance within that individual AES unit.

Figure 5-11 shows a map of the 298 AES units by the first value in the HSI (range 1 to 4). More than 75% of the AES polygons received a relative ranking value of 3 or 4, indicating that the vast majority of AESs are to some degree disturbed or impaired from at least one of the 9 human stressors in the HSI. Four AESs received the lowest value of 1 and just over 50 received a ranking of 2. The majority of these AESs occur west of the Missouri River in South Dakota, the area of the largest federal and state land holdings in South Dakota. The greatest stressor affecting the ecological integrity of riverine ecosystems in South Dakota is dams, second is hydrologic modification/fragmentation due to both large reservoirs and small impoundments. These stressors are spread fairly evenly across South Dakota with some higher concentrations of larger reservoirs along the Missouri River. Most of the AES units that contain multiple human stressors with a ranking of 4 occur within and adjacent to large towns (i.e. Sioux Falls, Rapid City) and along the Missouri River.

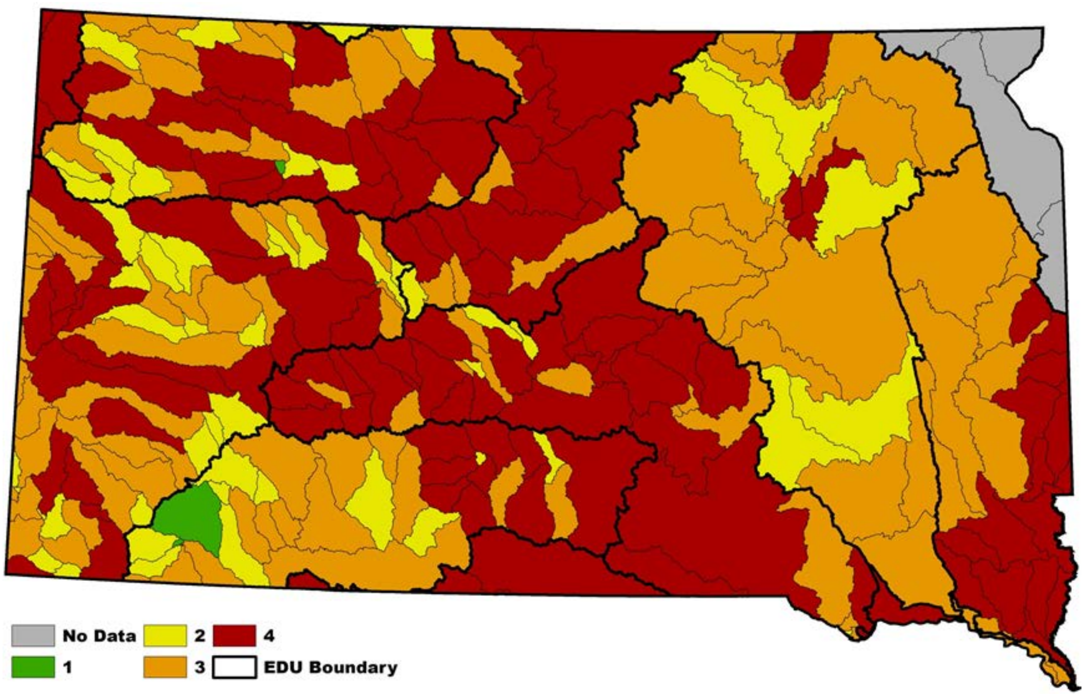


Figure 5-11. Map showing the first value in the human stressor index (HSI) for each of the aquatic ecological systems (AESs) in South Dakota. A value of 1 indicates relatively low human disturbance, while a value of 4 indicates a relatively high human disturbance. Only 4 AES polygons received a value of 1.

When examining the spatial pattern of the last two values in the HSI, we find that cumulative disturbance tends to be highest in southeastern South Dakota and along the Missouri River (Figure 5-12). The AES with the highest cumulative value of 21 lies within the most populated region of the state (i.e. Sioux Falls). This similar pattern holds true for the full 3-digit HSI across South Dakota (Figure 5-13). Whether examining the individual components of the HSI or the overall index value, western South Dakota appears to be less disturbed or more ecologically intact when compared to eastern South Dakota. Specifically, the White River EDU stands out as a major drainage that is relatively undisturbed. This may be partly explained by the fact that a large portion of this EDU is within public and tribal ownership, which illustrates the importance of public lands to the long-term protection of aquatic biodiversity.

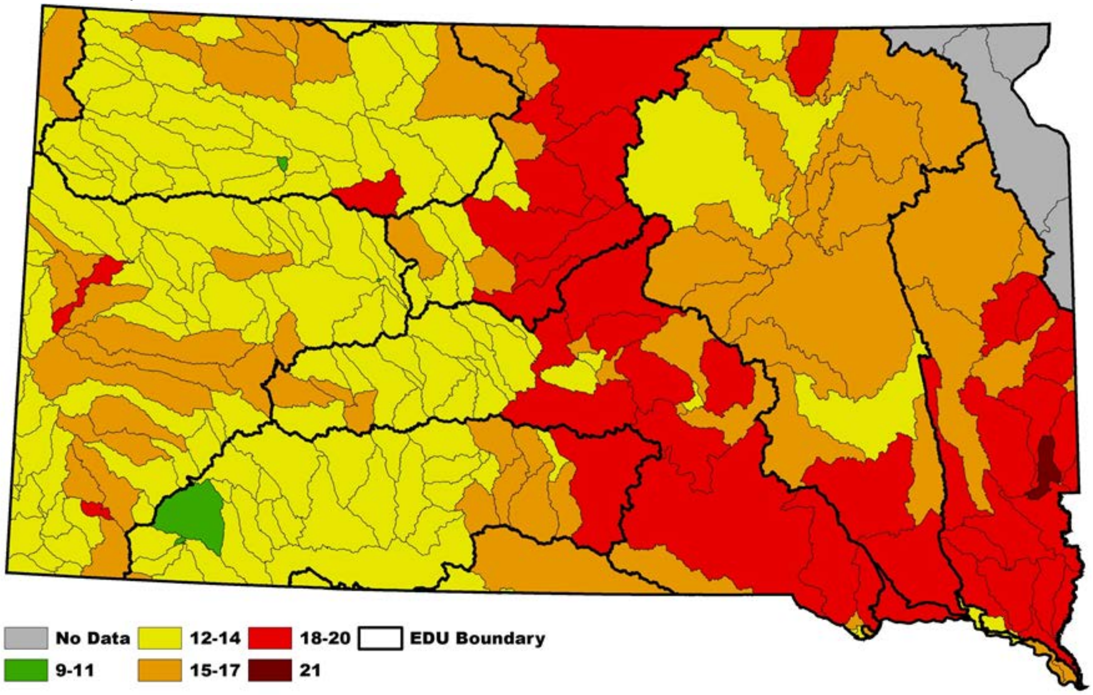


Figure 5-12. Map showing the last two values in the human stressor index (HSI) for each of the aquatic ecological systems in South Dakota. A value of 9 indicates an extremely low level of cumulative stress. The highest possible value was a 36; however the highest value in South Dakota was 21. The higher the value for the last two digits, the higher the degree of cumulative disturbance.

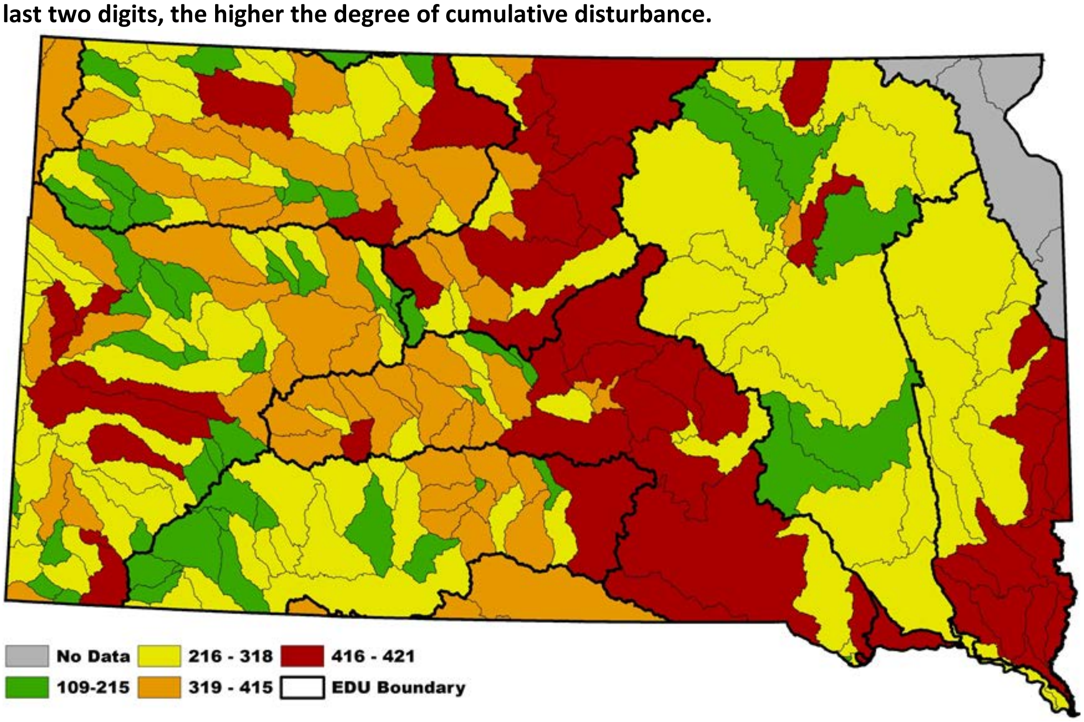


Figure 5-13. Map showing the cumulative human stressor index (HSI) for each of the aquatic ecological systems in South Dakota. The first number represents the highest value received across all 9 human stressor metrics, while the last two numbers represent the sum of the scores received for each of the 9 metrics.

5.5 Conservation Challenges Summary - Terrestrial and Aquatic Systems

Changing environments and resource demands present serious challenges to the future conservation of terrestrial and aquatic ecosystems and necessary disturbance regimes. In addition to the broader challenges previously described, the following section presents conservation challenges that may affect both terrestrial and aquatic resources. Many practices are land-based, but impacts affect both terrestrial and aquatic habitats.

Some of the practices listed below are components of cooperative programs between landowners and state, tribal, or federal land and resource agencies. Negative impacts of these practices vary with location and intensity. For example, managed grazing can be used to sustain a particular grassland, while overstocking leads to plant health decline and loss of native species diversity. Riparian restoration may require tree planting, whereas invasive or planted trees on the prairie negatively impact grassland-dependent birds. Ideally, use of these practices considers specific and compatible land management objectives, rare species occurrences, and threats to ecosystem health.

Land Use Practices

Agriculture:

- cultivating or mowing during nesting season can cause direct destruction of nests and mortality of adults
- poisons, pesticides and/or herbicides that impact the species directly or impact the prey a species feeds upon
- the distribution of agriculture on the landscape that isolates or fragments a species' habitat by impacting a species' normal movement or dispersal patterns due to the various stressors associated with crossing "non-habitat"
- increase in predatory species that adapt well to agricultural systems and structures such as red fox, raccoons, rats, skunks, and free-ranging domestic cats
- windbreak/shelterbelt plantings in native grassland environments

Grazing:

- concentrated grazing in critical nesting areas during the nesting season can result in trampled nests and/or eggs
- stock tanks that do not provide an appropriate escape mechanism for birds and mammals that are attracted to the water and may fall or fly into the tank
- contaminants from feedlot run-off
- increase in the numbers of cowbirds, a nest parasite of prairie bird species, that benefit from well-distributed domestic cattle

Forestry:

- direct disturbance by logging equipment and related activities in critical breeding areas during the breeding and nesting season

Mining:

- disturbance in critical breeding areas during the breeding and nesting season
- closure of old mine shafts and caves that can provide habitat to cave-dependent species
- contaminants from mining sites

Energy development:

- disturbance in critical breeding areas during the breeding and nesting season
- contaminants from developed sites
- increased densities of roads into undeveloped areas
- increased bird mortality associated with wind turbines placed in high-use or high-quality habitats
- bat mortality associated with wind turbines

Water level control:

- unnatural increases in water levels during the nesting season
- unnatural decreases in water levels during the nesting season that allow predators to reach nest sites

Soil Erosion

Accelerated soil erosion due to lack of conservation practices impacts terrestrial and aquatic resources. Examples include soil erosion into surrounding riparian/wetland and aquatic habitats caused by surface soil disturbance by logging equipment, road construction, heavy grazing along streams, row crop plantings immediately adjacent to streams, and increased erosion caused by wild fires. Examples of specific impacts to aquatic resources include pesticide runoff, increased turbidity, decreased aquatic vegetation, and increased water temperatures.

Movement barriers

Barriers to movement that are structural (e.g., dams, levees) or environmental (e.g., thermal or pollution) can disrupt normal life cycles (e.g. spawning) or the dispersal and interchange of individuals among populations.

Exotic/Introduced nonnative species

The accidental or intentional introduction of nonnative species that impact native species by: 1) being in direct competition for limited resources, 2) preying on a native species and/or their young, or 3) being a genetic threat through hybridization (cross-breeding) with a native species.

Recreational disturbance

Recreational activities that are disruptive during critical seasons/life cycles (e.g., nesting season) may cause a species to abandon an area or nest and possibly result in decreased reproductive capacity or overall fitness. For a species that is already struggling with low numbers or reproductive rates, recreational disturbance at key periods could be a stressor that prevents a species from recovering or contributes to its further decline.

Diseases

Infectious diseases that can “spill-over” from domestic animals into wild animal populations (e.g., canine distemper and parvovirus, feline leukemia) are particular threats to species of concern. Species with already low population numbers are particularly vulnerable to stochastic events such as disease outbreaks. Introduced diseases (e.g., sylvatic plague and West Nile virus) can also have devastating effects on low or declining populations and may, in some instances, completely wipe out local populations.

CHAPTER 6 CONSERVATION ACTIONS

The goal of the coarse filter strategy is to provide the framework to evaluate appropriate objectives for conserving ecosystem diversity. However, the amount of native ecosystem diversity maintained on the landscape that is sufficient to meet these objectives still remains a question. The SDWAP does not attempt to return South Dakota to an “historical” condition. The plan focuses on providing sufficient amounts of functionally similar ecosystems represented across all ecoregions in order for native species to continue to persist in South Dakota. The term used to describe this is “representation“. Under an historical range of variability-based approach, this identifies an estimate of the threshold level to “represent” each ecological community occurring under natural disturbance regimes. This threshold level identifies a minimum estimated amount of all native ecosystems needed to maintain biological diversity and ecosystem integrity within an acceptable level of risk. Scientific analysis can define and quantify the degree of risk associated with various levels of ecosystem representation so that appropriate policies and plans can be developed. However, it is important to understand that society will ultimately determine the acceptable level of risk. Thus, a scientific approach identifies probabilities for conserving biological diversity and ecosystem integrity given a proposed level of ecosystem representation, but society ultimately determines what is adequate.

Quantifying risk has many complexities that must be factored into its determination. The first and primary complexity is the recognition that our understanding of many ecological relationships still remains relatively poor and therefore problematic. These uncertainties require that the question of adequacy, or “how much is enough”, revolves around a discussion of the acceptable level of risk to ecosystem diversity and species persistence. Science based approaches strive to gather knowledge that reduces these uncertainties. Although the true answer will never be completely known, a science-based approach can place probabilities of risk on possible outcomes of different alternatives. Identifying the levels of risk associated with the selected level of representation is beyond the scope of this document but is included as a future action item to conserve biological diversity.

Habitat loss has been reported to be the leading threat to biological diversity at the species level (Barbault and Sastrapradia 1995, Temple 1986). As discussed previously, habitat loss and its effects on biological diversity result from the actual loss of habitat, alteration of disturbance processes that reduce the habitat quality of an ecosystem for a particular species, reduction in the size and connectivity of the remaining habitat patches for the occurrence of species, and shifting populations from being a single population within the landscape to being a metapopulation (i.e. consisting of many independent populations that only interact with occasional dispersal of individuals).

Each of these four areas of concern relative to habitat loss can influence the question of adequacy or “how much is enough”. The first two areas of concern, direct and indirect reduction in habitat, are both causes of habitat loss, although the indirect losses are more subtle, and not as readily identified. Obviously, as available habitat declines within a landscape, the ability of the landscape to support a certain population size of a species declines as well. The species-area relationship addresses the fact that each species requires a certain amount of habitat in one block or within a home range-sized area if the habitat is to be usable by the species. This is a question of whether the available habitat in a landscape is either of a sufficient quality or patch size, or whether it occurs in a close enough aggregate to support an individual or pair of the species. Obviously, the more habitat that is lost due to direct or indirect causes, the higher the likelihood that the remaining habitat will not occur in sufficient size to sustain the species.

The final concern addresses the distribution or arrangement of habitat within a landscape. When a landscape contains adequate habitat for a species, the species is distributed throughout the landscape and individuals interact in a relatively continuous and contiguous manner. If sufficient high quality habitat remains, and the species can move among areas of habitat, the landscape supports one population of the species, and the probability of persistence is fairly high. As available habitat is lost, through either natural or human-caused factors, fewer areas are available to support the species, and/or movement among areas of high quality habitat becomes more difficult. Habitat loss can lead to similar isolated patches in landscapes that previously supported relatively continuous distributions of a species. Species occurrences and distributions can be influenced by the number, size, and arrangement of habitat patches remaining within the landscape. In addition, the condition of the intervening areas that must be crossed by the species if it is to disperse to the remaining habitat patches will also play a major role in the status of the species within a landscape. It is desirable in landscape planning to provide suitable habitat and movement capabilities for species to minimize isolating conditions. If the occurrence of an isolated population is produced by alteration of the landscape, then the management of the resulting population becomes more complex.

Thus, the determination of representation from a species viability perspective is a complicated question. Because of this complexity, fine-filter, or species-based approaches to conservation of biological diversity have major shortcomings. The quantity of information needed to address the viability question of any single species is considerable. If the needs of all species were to be contemplated, the resulting information and analysis needs become staggering. In addition, meeting the needs of each species on landscapes altered significantly from historical conditions may result in conflicting plans for species that were once common under historical conditions and species that are common today due to these changes.

Maintaining or restoring an appropriate level of ecosystem diversity throughout South Dakota is an important first step toward addressing the habitat needs and future persistence of all South Dakota's species. It is important to note that although additional factors such as direct mortality, effects of pollutants, and competition from exotics will also need to be considered in conservation strategies of specific species, the question of habitat primarily involves the question of amounts, sizes, distributions, and quality of ecosystems. As such, the question of representation from a habitat standpoint also requires thorough evaluation of location, juxtaposition, and size of ecosystems selected for representation. In addition, considerable emphasis should be placed on ensuring the quality of a native ecosystem, either through maintenance or restoration actions, where feasible. Thus, the approach of providing ecosystem representation combined with consideration for species habitat needs will ultimately influence the adequacy of a coarse filter for ecosystem representation.

6.1 Representation Goals

For the SDWAP, a goal for representation will be identified as maintaining more than or restoring at least 10% of the primary historical ecosystems for each ecological site type within each of South Dakota's ecoregions (MLRAs). Table 6-1 presents the number of acres representing this 10% goal for terrestrial systems, and Table 6-2 represents the 10% goal for riparian and wetland systems. Although 10% is not necessarily a recommended level of representation, it has often been used as a conservation goal under various national and international programs. Empirical studies of ecosystem loss and resulting effects on species viability reveal that at very high levels of native ecosystem loss (>95%), loss of species is likely. A level of 10 -12% representation is consistent with several recommendations (IUCN 1980, Brundtland 1987, Virkkala and Toivonen 1999) but with the exception of one these sources (Virkkala and Toivonen 1999), these recommendations lacked a strong empirical basis. The initial goal of 10% representation will require on-going evaluation and monitoring to determine its effectiveness in conserving South Dakota's biological diversity. The monitoring strategy that will be utilized to determine effectiveness is discussed more fully in a later section. In addition, although this Plan makes recommendations on conservation goals in each ecoregion, information on existing amounts of historical ecosystems is not currently available in all ecoregions or for each ecosystem type. Obtaining better knowledge of historical conditions and estimates of historical ecosystem amounts will also be a primary conservation action identified in this Plan. As better information is obtained and developed on historical conditions and their amounts as well as the status of existing conditions, conservation goals and their prioritization will need to be revised and updated to reflect this improved knowledge. Achieving native ecosystem representation goals in South Dakota will face challenges as most lands are in private ownership. To reach the goals identified, restoration objectives must be implemented on lands of willing landowners, using innovative incentive-based programs and practices to address the restoration need while respecting and addressing the needs of the landowner (Haufler and Kernohan 2009). Opportunities for restoration on public lands should also be evaluated and coordinated between the appropriate land management agencies.

The potential native ecosystem disturbance states that can be maintained or restored on each ecological site have been described for this effort, where available. The disturbance state with the least representation on the landscape today when compared with the amounts likely to have occurred historically should be targeted for restoration. For most of South Dakota, with the exception of prairie dog colonies (disturbance states G and H), the historical grass-shrub disturbance state that is likely to be the least represented on the landscape today were conditions produced under frequent fire regimes and light grazing or Disturbance state A as previously described and presented in Figure 3-16. This is particularly true for the more productive grass-shrub ecological sites, as a higher percentage of these sites have been converted to other uses. Restoration of prairie dog colonies will not be addressed through the representation goals of the SDWAP but rather by the goals identified in the South Dakota Black-tailed Prairie Dog Conservation and Management Plan (Cooper and Gabriel 2005).

Further, it cannot be overemphasized that representation is only achieved if an ecosystem is functionally similar to the native species composition, structure, and disturbance processes targeted for an ecological site. Considerable emphasis and effort must be placed on ensuring native ecosystem conditions are maintained, restored, or adjusted where necessary, to achieve the goals of the coarse filter approach.

Table 6-1. Proposed representation goals (i.e. 10% of historical native ecosystem diversity) to meet coarse filter and biodiversity objectives on each terrestrial ecological site, by Major Land Resource Area in South Dakota. High restoration priority should be given to those sites highlighted by reddish shade, where direct native ecosystem loss is >= 60%; moderate priority to those sites highlighted by yellow where native ecosystem loss is >= 30% and <60%; and low priority to those sites highlighted by green where native ecosystem loss is <30%.

ECOLOGICAL SITES	53B	53C	54	55B	55C	56	58D	60A	61	62	63A	63B	64	65	66	102A	102B	102C	TOTAL
Grassland/Shrub	242,146	215,082	574,137	168,968	547,378	1,364	103,118	393,959	32,547	11,404	578,355	201,392	251,620	26,301	147,020	328,270	102,330	63,495	3,988,886
LOAMY	186,804	139,112	155,588	99,686	426,781	469	9,659	73,166	10,691	2,874	41,461	24,436	103,380	136	27,530	247,964	89,201	50,942	1,689,880
CLAYEY	26,737	38,243	69,110	37,277	35,307	483	1,172	103,873	2,174	167	250,854	84,173	22,646		8,496	24,165	120	1,885	706,882
SHALLOW CLAY			8,654		628		315	49,767	636		161,737	49,377	11,740		999				283,853
SANDY	4,074	126	85,867	5,536	17,583	222	31,926	6,898	206		2,512	3,997	20,409	1,192	66,622	6,617	340	1,613	255,740
THIN UPLAND	3,276	25,247	20,091	2,903	36,920	54	972	26,879	6,801	430	45,407	19,566	6,852		3,099	26,796	10,281	7,800	243,374
THIN CLAYPAN	1,113	1,952	116,064	7,721	2,055		16,981	25,695	36		16,762	3,524	6,954	103	567				199,527
CLAYPAN	3,420	6,452	26,180	12,011	20,490		18,696	2,518			4,072	3,955	8,924	46	3,098	56			109,918
DENSE CLAY		356						42,315			40,311	6,058	4,817						93,857
SANDS	1,997		5,486	2,277	161	9	8,952	7,922	132		1,842	1,099	7,561	23,320	26,376	209		843	88,186
SHALLOW LOAMY			45,656	140			10,538	11,802	11,254	281			160						79,831
SHALLOW								958		4,702	4,114	1,845	54,858	60	996				67,533
SHALLOW TO GRAVEL	8,566	1,907		1,215	6,588	127					544	1,290	194		2,777	19,375	2,109	365	45,057
SHALLOW SANDY			33,317				2,544	246											36,107
VERY SHALLOW	5,369	1,687	3,294	75	865		548	3,487	617	102	8,739	1,945	2,577		45	3,088	279	47	32,764
SHALLOW DENSE CLAY								30,851											30,851
SHALLOW LIMY												23	548	90	6,340				7,001
SANDY CLAYPAN	790		4,830	127			815	30											6,592
SALINE UPLAND								3,803											3,803
SHALLOW POROUS CLAY								3,487											3,487
MOUNTAIN PRAIRIE										2,146									2,146
CHOPPY SANDS												104		1,354	75				1,533
HIGH COUNTRY LOAMY										702									702
POROUS CLAY								262											262
Forested			226				2,499	2,166	18,032	121,947									144,870
DRY WARM SLOPES								291	9,028	41,276									50,595
ROCKY SIDESLOPES										28,286									28,286
SHALLOW RIDGE								215	5,921	13,464									19,600
MOIST WARM SLOPES										18,550									18,550
COOL SLOPES			79				1,201	59	277	16,592									18,208
STONY HILLS			147				1,298	15	1,240	3,114									5,814
SAVANNAH								1,465	80	665									2,210
SILTY FOOTSLOPES								121	1,486										1,607
Total	242,146	215,082	574,363	168,968	547,378	1,364	105,617	396,125	50,579	133,351	578,355	201,392	251,620	26,301	147,020	328,270	102,330	63,495	4,133,756

Table 6-2. Proposed representation goals (i.e. 10% of historical native ecosystem diversity) to meet coarse filter and biodiversity objectives on each riparian and wetland ecological site, by Major Land Resource Area in South Dakota. High restoration priority should be given to those sites highlighted by reddish shade, where direct native ecosystem loss is >= 60%; moderate priority to those sites highlighted by yellow where native ecosystem loss is >= 30% and <60%; and low priority to those sites highlighted by green where native ecosystem loss is <30%.

Ecological Site	53B	53C	54	55B	55C	56	58D	60A	61	62	63A	63B	64	65	66	102A	102B	102C	TOTAL
DEPRESSION	**35075**	**28887**	**4297**	**13388**	**87766**	**261**	**789**	**2729**	**105**	**50**	**7872**	**2451**	**2288**	**510**	**2498**	**34911**	**9768**	**517**	**234162**
EPHEMERAL	828	2234	509	243	2660		178	164	24	13	633		848	12	287	945	785	180	10543
TEMPORARY	4254	2699	518	4370	20031	55	187	223	11	9	522	166	193	52	445	5435	3016	187	42373
SEASONAL	16655	7267	1754	4300	26860	53	191	926	25	7	2635	909	996	86	936	9775	2977	71	76423
SEMI-PERMANENT	11264	9109	1375	3798	33362	133	124	688	36	15	2702	897	118	262	623	17797	2798	42	85143
PERMANENT	2025	7547	141	667	4536		109	728	9	2	1380	475	133	82	207	921	188	27	19177
INTERMITTENT	49	31		10	317	20				4		4		16		38	4	10	503
LACUSTRINE	**2493**	**1251**	**1442**	**943**	**4444**	**52**	**117**	**1563**	**12**	**201**	**32303**	**12972**	**475**	**372**	**698**	**18705**	**1496**	**152**	**79691**
EPHEMERAL					2							2							4
TEMPORARY				1			3	7											11
SEASONAL			51		4		9	24			14								102
SEMI-PERMANENT	96	428	45	19	293		4	29				4	2	45	4	34	25		1028
PERMANENT	2397	823	1346	923	4145	52	101	1503	12	201	32289	12966	473	327	694	18671	1471	152	78546
RIVERINE	**14862**	**12868**	**34073**	**36664**	**54869**	**1868**	**5596**	**40173**	**3542**	**5401**	**27968**	**14257**	**29078**	**2625**	**8804**	**71279**	**28133**	**32655**	**424715**
INTERMITTENT	13942	11605	18163	30452	48268	1868	1693	21381	2830	5357	21980	9331	19815	1856	5789	65651	19712	12512	312205
PERMANENT	920	1263	15910	6212	6601		3903	18792	712	44	5988	4926	9263	769	3015	5628	8421	20143	112510
Total	**52430**	**43006**	**39812**	**50995**	**147079**	**2181**	**6502**	**44465**	**3659**	**5652**	**68143**	**29680**	**31841**	**3507**	**12000**	**124895**	**39397**	**33324**	**738568**

Restoration conditions have not been identified for forested systems for this version of the SDWAP; however some information on historical forest structures has been developed by others and may be applicable for this purpose. Where available, riparian and wetland restoration conditions will also represent conditions produced by more frequent fire regimes and lighter grazing.

A combination of practices may need to be identified for each selected area and should be designed to produce the desired species composition, structure, and processes for an ecological site. As an example, for grass-shrub ecosystems these practices may include prescribed burning, control of introduced weeds, interseeding with desired native species appropriate for each ecological site, planting to establish appropriate native plant communities on any croplands to be restored, and prescribed grazing implemented through long-term grazing plans to produce and maintain the desired conditions. Each site should be individually evaluated to determine the combination of practices that is most likely to produce the desired conditions.

Treatments developed for a particular site should be based on consideration of the underlying ecological site and the current condition on the site. For many areas, incorporating prescribed burning will be an important practice. Where feasible, the prescribed burning should be planned to simulate historical fire patterns for the ecological site. Introduced species will likely never be totally eliminated from restoration sites, but they should be suppressed to the extent that is practical and feasible. Suppression of introduced species may be achieved through herbicide application, prescribed burning, prescribed grazing, interseeding or planting of desired native species, or a combination of these treatments. No single prescription is envisioned as a universal solution, as the combination of site differences, current conditions, weather patterns, landscape influences, and other factors mean that treatment selection must be flexible yet site specific and responses will undoubtedly be variable.

6.2 Web-Tool for Sharing Information on Species of Greatest Conservation Need

Appendix M illustrates a species web tool developed during the Plan revision. SDGFP intends to build on this tool with Plan information on each SGCN (distribution map, description, key habitats, conservation challenges and opportunities, relevant SWG projects), but supplemented with a link to the ecosite web tool. Additional species, such as game or other high-visibility species will be added, making this platform a dynamic information source for the public and for SDGFP's conservation partners.

6.3 Conservation Opportunity Areas - Overview

Conservation opportunity areas (COAs) were not proposed in the 2006 South Dakota Wildlife Action Plan, but SDGFP committed to completing this process during the Plan revision. The goal of this process was to use relevant variables to map areas in South Dakota where increased emphasis on habitat conservation, protection, or management will benefit rare species and remaining intact native habitats.

Identified areas may include lands owned or managed by federal, state, tribal, or private entities and areas that may already be managed to maximize species and habitat diversity. The COA maps are not intended to display a land acquisition blueprint, but are an attempt to identify areas that would help fulfill the specific objectives for terrestrial and aquatic systems in South Dakota, as described in this Plan.

The U.S. Geological Survey (2006) described key steps in strategic habitat conservation in the following adaptive management loop: biological planning, conservation design, conservation delivery, and monitoring and research. This approach's guiding principles emphasize that habitat conservation is a means of conserving populations and ecological functions, population objectives must be defined, biological planning should use the best available information, management activities must be defensible and well documented, strategies should be implemented in an adaptive management scenario, and partnerships are critical to success.

Advantages of COA delineation include the ability to address shortage of resources in a geographically large area and lack of specific biological information on species occurrences and habitat conditions and distribution. COAs allow conservation partners and public or private conservation programs and resources to be most effective in directing limited resources in the context of a shared set of priorities. As an example, various funding initiatives promoted by the NRCS could target specific COAs that are consistent with the particular initiative being promoted, whether it has a species or habitat focus. The selected COAs are simply a representation of some areas in South Dakota that could be considered as priorities for future conservation initiatives, protection, or enhancement.

Separate terrestrial and aquatic COAs were identified during this Plan revision. Each approach used the best available information to draft COA boundaries. Each of these processes is considered a first step to address the need to strategically identify areas within South Dakota that merit attention by agencies, tribes, NGOS, and landowners because they offer high quality habitats or provide important habitat for rare animal species.

Why Aquatic and Terrestrial COAs Were Developed Separately

Several challenges caused terrestrial and aquatic resources to be considered separately during the COA development process. In this Plan, MLRAs define terrestrial ecosystems. Watersheds and drainages define interacting freshwater systems and act as the primary evolutionary constraint to freshwater biodiversity. Therefore, defining ecosystems for freshwater biodiversity requires the integration of both ecoregion and drainage boundaries. This difference resulted in the use of different geographical frameworks in our selection process of COAs for terrestrial and aquatic systems.

6.4 Terrestrial Conservation Opportunity Areas

The goal of the terrestrial COA exercise was to attempt to provide for the 10% representation goals for each ecological site type within each MLRA (Figure 3-3; Table 3-2). Figure 6-1 depicts South Dakota's MLRA boundaries, with major cities and counties illustrated to aid in orientation. This description pertains to the process and resulting draft map and associated information for an initial arrangement of terrestrial COAs for South Dakota.

Preparation and coordination:

A variety of examples from other states were reviewed for applicability to South Dakota. SDGFP's GIS staff located available data sources that could assist in the COA analysis. Other land and resource agencies and tribes were contacted to seek their input on this process, to potentially help SDGFP benefit from lessons learned during other landscape planning efforts. A specific internal staff meeting with SDGFP land management and habitat staff was held to gather their input on COA identification.

Two specific contacts were made with land and resource management agencies and Native American tribes related to the identification of terrestrial COAs. A November 30, 2012 memo requested listings and descriptions of relevant conservation initiatives that should be considered during Plan preparation, with the expectation that this listing might be a data source for identifying COAs. The Science Team and internal SDGFP staff compiled a list of current conservation initiatives (Appendix P). However, the scope of these initiatives was typically too large or too small to assist in COA identification.

A March 6, 2013 memo outlined a previous draft approach to defining terrestrial conservation opportunity areas and requested COAs for inclusion in the Plan. Input was received from representatives of the U.S. Forest Service's Forest and Grassland Research Laboratory, the National Park Service's Missouri National Recreational River, the U.S. Fish and Wildlife Service's Habitat and Population Evaluation Team, and the U.S. Forest Service's Nebraska National Forest. All comments were considered during the terrestrial COA identification process.

The U.S. Fish and Wildlife Service's Habitat and Population Evaluation Team (HAPET) in Bismarck, North Dakota, provided certain components of the grassland and wetland easement layer to SDGFP for specific, agreed-upon purposes. This information allowed verification that the draft terrestrial COA map would reflect federal easement priorities for protection of these habitat types. The easement data were not used as a primary data source.

SDGFP GIS staff assembled the data sources listed in Table 6-3 and used the following process for terrestrial COA identification:

Data sources and manipulation:

1. A grid of 1-mile radius hexagons was created to cover South Dakota.
2. Ecosite data were provided by EMRI.
3. Land protection data, including ownership or permanent easement status, were collected from state and federal agencies and non-government organizations (Table 6-4).
4. Public lands and conservation easements were combined as the Protected Land variable and overlaid with the hexagon grid. Percent area of protected land was calculated for each hexagon (Figure 6-2).
5. Large Intact Blocks were taken from a WGA exercise to determine large areas of South Dakota that were relatively intact and had low levels of human impacts (Sasmal et al. 2014; Figure 6-3). Additional information on the WGA effort is available at: http://www.westgovchat.org/. A component of Figure 6-3 was the National Land Cover Dataset for 2006 (Figure 6-4). The most

recent depiction of land cover use is from 2011. Additional information on the National Land Cover Dataset is available at: (http://www.mrlc.gov/nlcd2011.php)

6. a. Species data points were collected from a variety of sources (Table 6-3) to create the Species Richness variable (Figure 6-5);
   b. NatureServe Explorer (http://www.natureserve.org/) provided separation distance values for suitable habitat for all species used in the species richness analysis (Appendix Q);
   c. Buffers were created for each species using the separation distance values; and
   d. Buffers were then overlaid with the hexagon layer to determine the number of species found within each hexagon.

COA Selection – COAs were selected using the following tiered criteria:

1. Round 1: Any hexagon with greater than or equal to 50% public land and/or conservation easements, a large intact block category of 1, a species richness total greater than or equal to 100, or a 1-mile buffer (riparian area) around South Dakota's major rivers (Bad, Belle Fourche, Big Sioux, Cheyenne, Grand, James, Little White, Missouri, Moreau, Vermillion, White).
2. Round 2: Any hexagon with greater than or equal to 25% public land and/or conservation easements or a species richness value greater than or equal to 50.
3. Round 3: Any hexagon with a large intact block category of 2.

The result of this process is illustrated in Figure 6-6 and numerically represented in Appendix R. This first attempt to identify terrestrial COAs used a data-based approach to accommodate the 10% representation goals identified earlier in this Plan. Representation goal of 10% was met for all ecological site types within each MLRA using the process described above. Figure 6-6 does not depict the current situation, but rather shows areas that may need more attention to management or protection to meet the terrestrial COA goal of providing for 10% representation for all ecological site types within each MLRA. The utility of terrestrial COAs will depend on future involvement of land and resource managers, landowners, and others to identify specific areas that are matched to local land management, participation in specific conservation initiatives or government programs, and wildlife conservation needs (e.g. Appendix S).

Future needs related to proposed COA delineation:

1. The approach should be proofed for whether unique habitats, such as caves and mines that provide bat habitat and colonial waterbird colonies, will be accommodated.
2. An additional refinement to this attempt is consideration of habitat size needed to accommodate SGCN, particularly for species such as prairie grouse and sage-grouse that require large intact blocks of grassland or grass-shrub habitats.
3. Improved information on habitat connectivity needs should be incorporated into future iterations of the COAs.
4. Information on SGCN with limited distributions should be used to proof the COAs to assure that the needs of these species are accommodated.

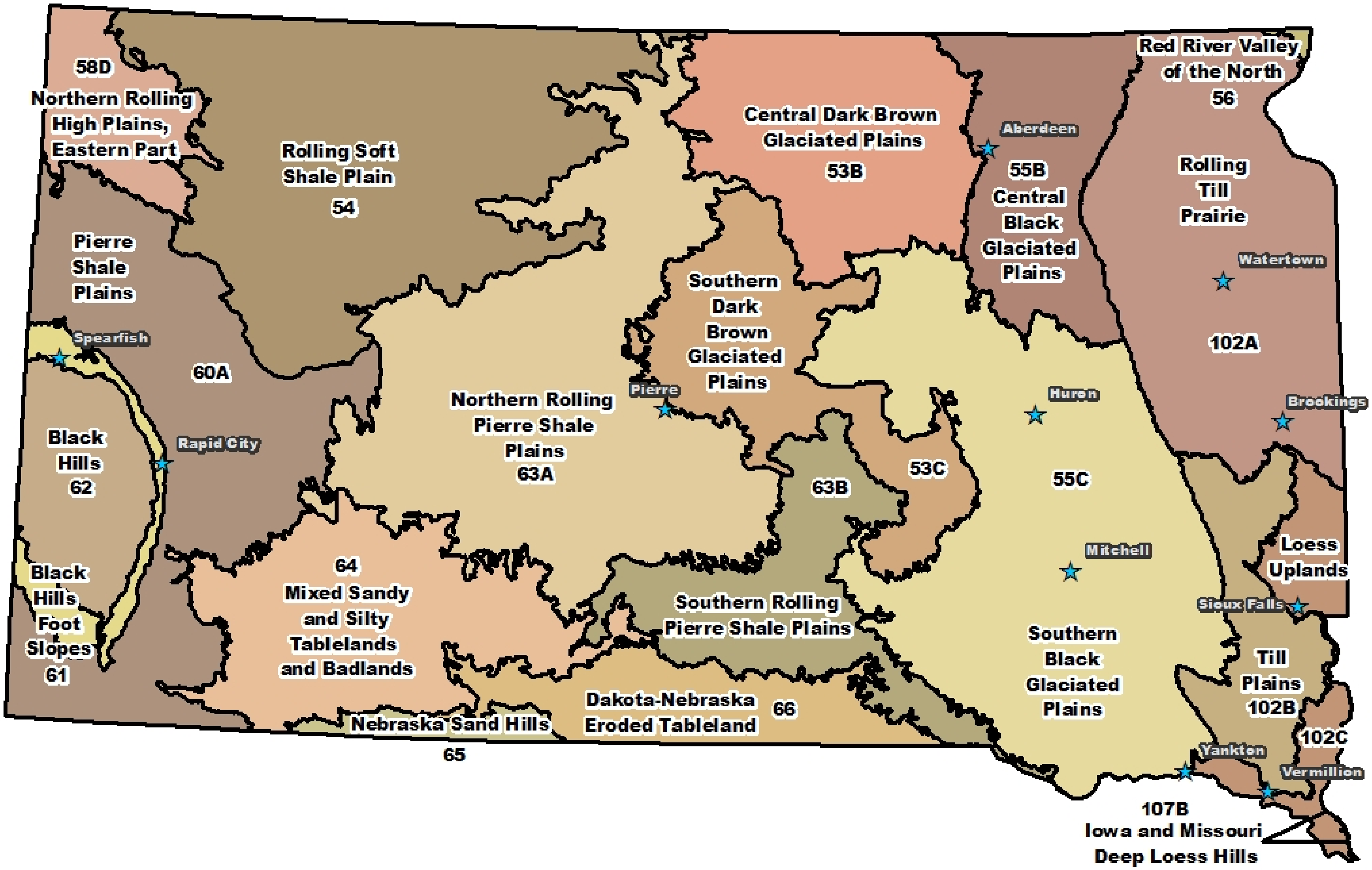


Figure 6-1. Map of Major land resource areas in South Dakota (USDA NRCS 2006).

Table 6-3. Plant and animal species data sources used in terrestrial conservation opportunity area identification.

Data	Data Provider
prairie grouse and sage-grouse lek data and other surveys	SDGFP, USFS and SDSU
data collected from a variety of State Wildlife Grant-funded projects	see Appendix F for list of State Wildlife Grant projects
golden eagle nest data from northwestern South Dakota	SDGFP
bald eagle nest data	SDGFP, USFWS and other cooperators
South Dakota Natural Heritage Database	SDGFP and NatureServe
colonial waterbird survey data	SDGFP and RMBO
river otter collection and observation data	SDGFP and cooperators
South Dakota breeding bird atlas data from first and second atlas	SDGFP, RMBO, SDOU, and cooperators
ruffed grouse occupied sites	SDGFP and USFS
various burrowing owl surveys	agencies, SDOU and cooperators
greater sage-grouse breeding and wintering data	SDGFP and USFS
butterfly collection data	Gary Marrone (SD lepidopterist) database and cooperators
black-footed ferret data	various entities involved in black-footed ferret reintroduction and prairie dog mapping; known ferret reintroduction sites were overlaid with prairie dog towns active in 2008 with 0.75 km buffer
Fort Pierre National Grassland winter raptor survey data	SDGFP and USFS

Table 6-3 (continued). Plant and animal species data sources used in terrestrial conservation opportunity area identification.

grouse survey data and research data	SDGFP
mammal trapping data	SDGFP
Fort Pierre National Grassland aerial mule deer surveys	SDGFP and USFS
aerial mule deer surveys from Meade and Pennington counties	SDGFP
active prairie dog colonies from 2008 that were greater than 10 acres	SDGFP
turkey flock counts	SDGFP

Table 6-4. Protected lands data sources for terrestrial conservation opportunity area identification.

Public Land Layers	**Permanent Conservation Easements**
national forest (USFS)	grassland and wetland easements (USFWS and Ducks Unlimited)
national grassland (USFS)	wetland, grassland, and emergency flood easements (NRCS)
wilderness areas (USFS)	South Dakota Parks and Wildlife Foundation easements
Bureau of Land Management	Northern Prairies Land Trust
U.S. Army Corps of Engineers	TNC easements
National Park Service	
national wildlife refuges (USFWS)	
waterfowl production areas (USFWS)	
game production areas (SDGFP)	
state park and recreation areas (SDGFP)	
SD Office of School and Public Lands	
TNC properties	

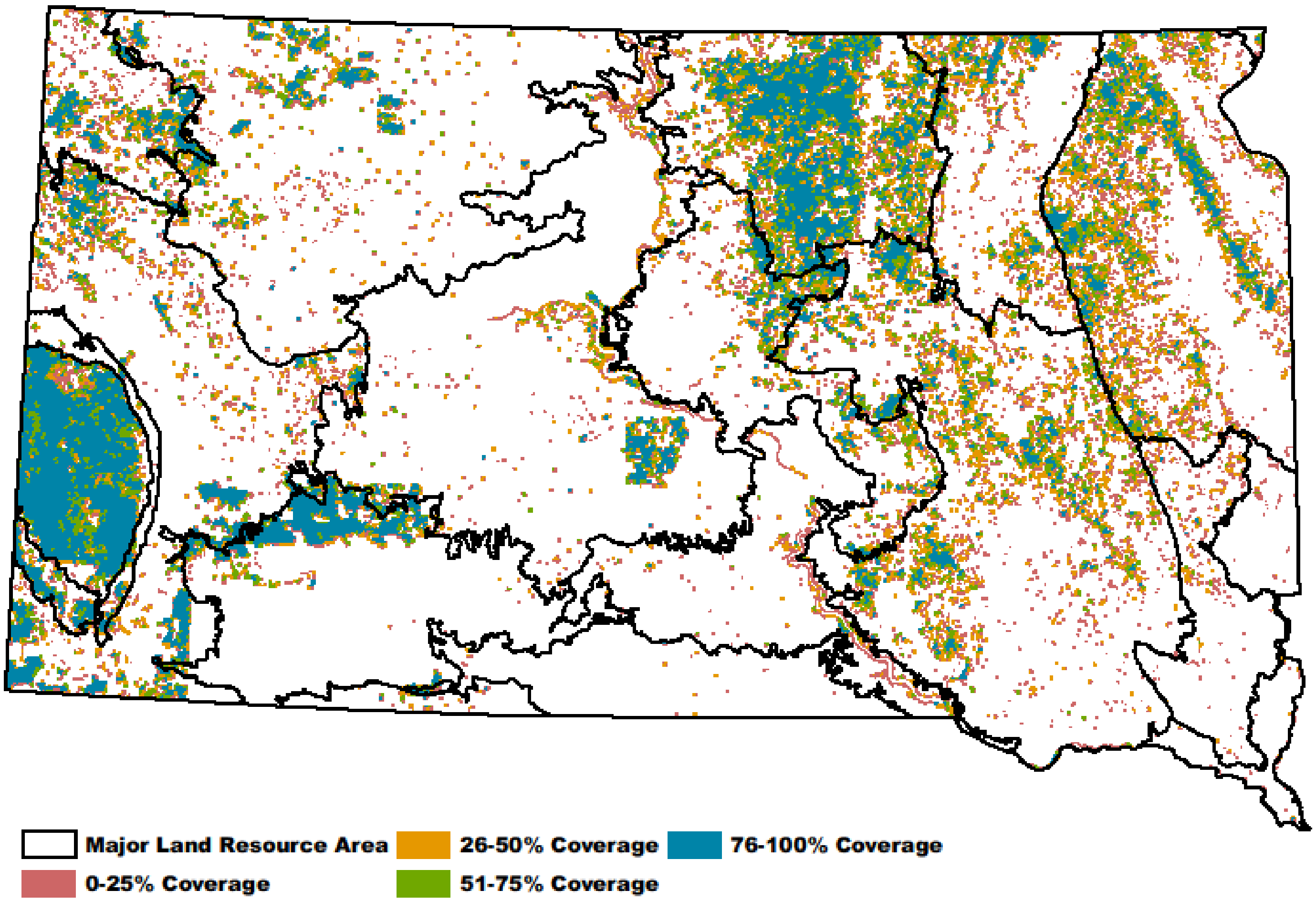


Figure 6-2. Map of percentage of public lands and conservation easements within 1-mile hexagon boundaries.

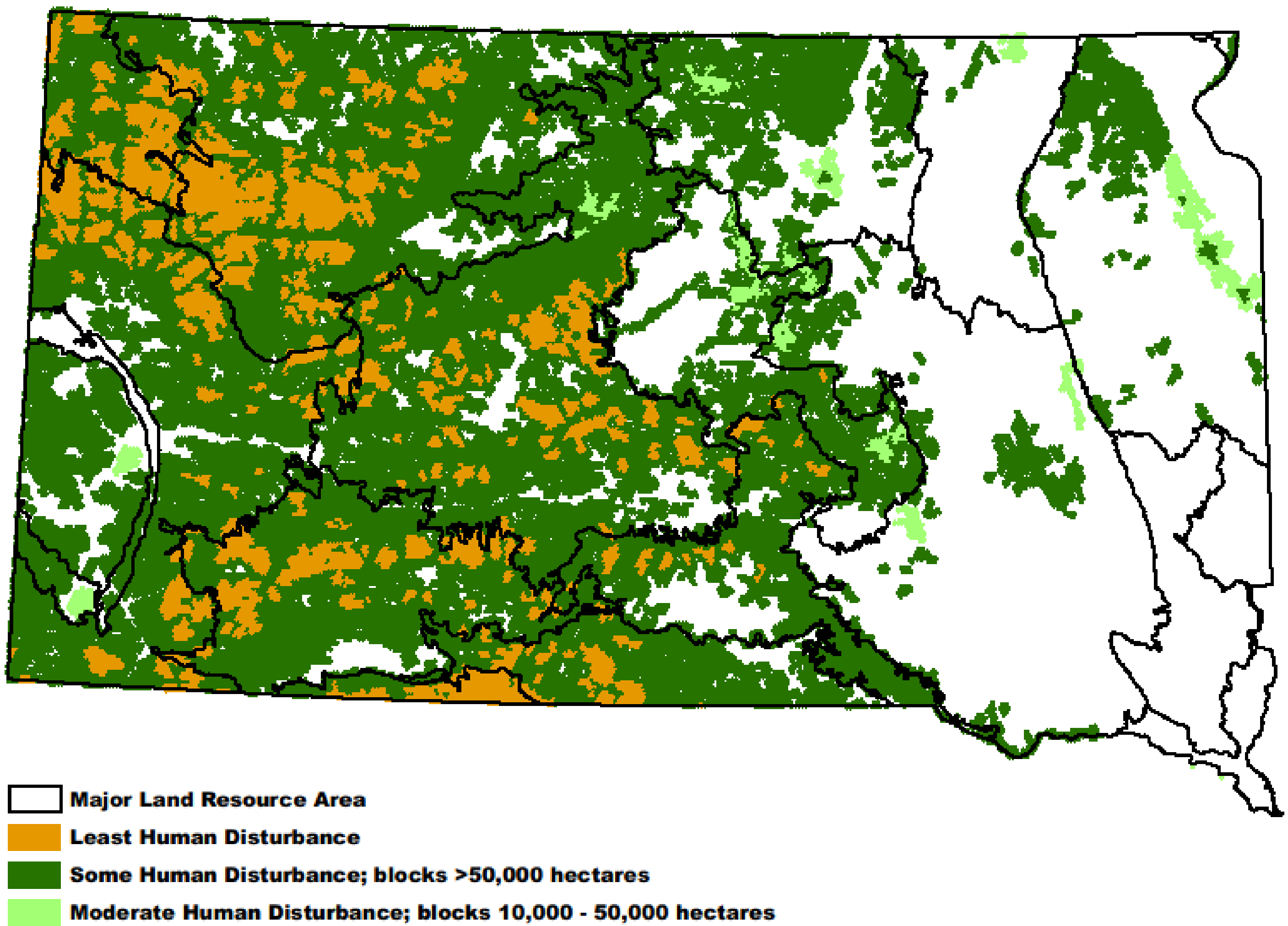


Figure 6-3. Map of large (>1,000 hectares) habitat blocks with limited amounts of human disturbance.

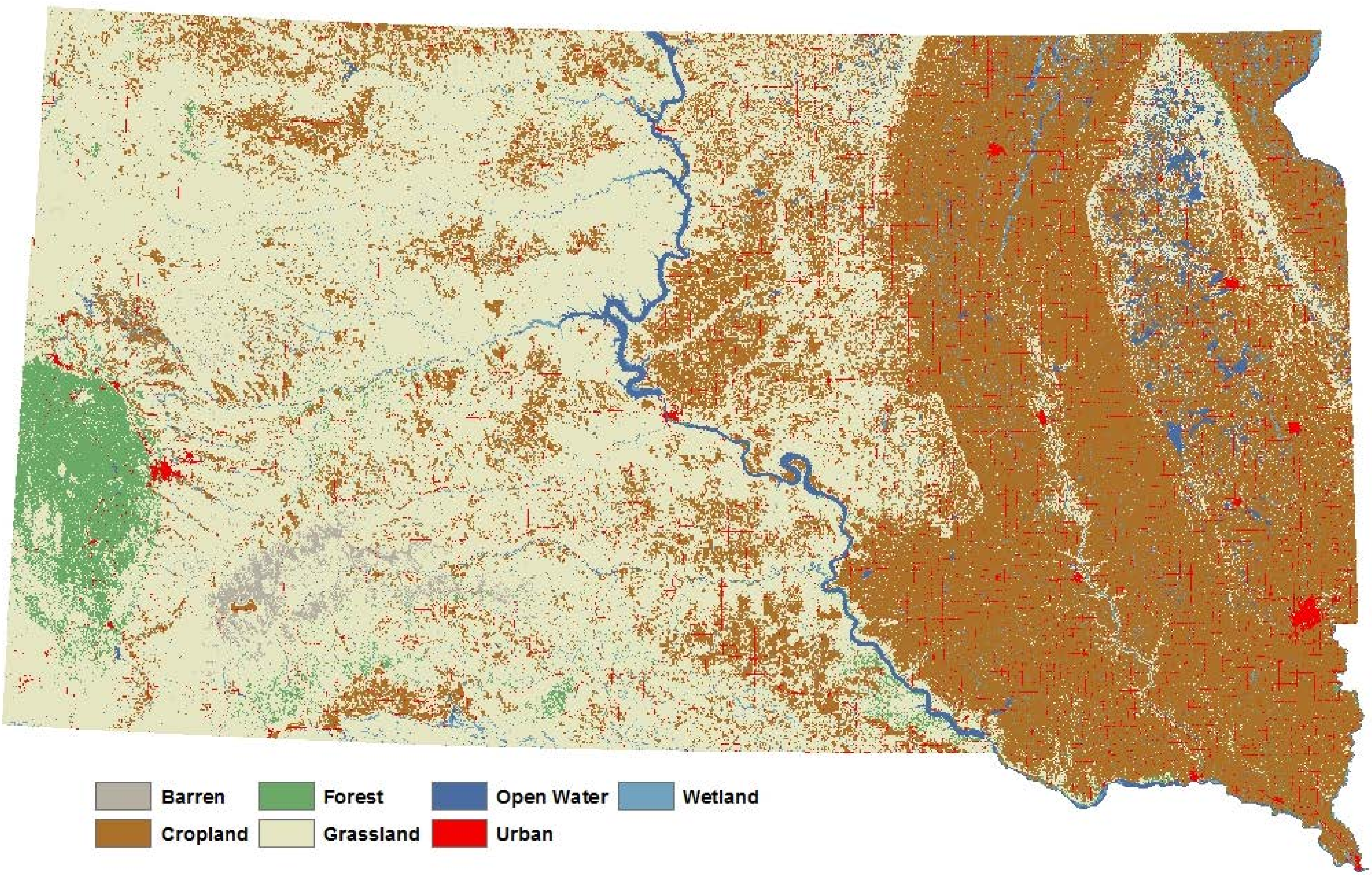


Figure 6-4. Simplified version of National Land Cover Dataset for 2006.

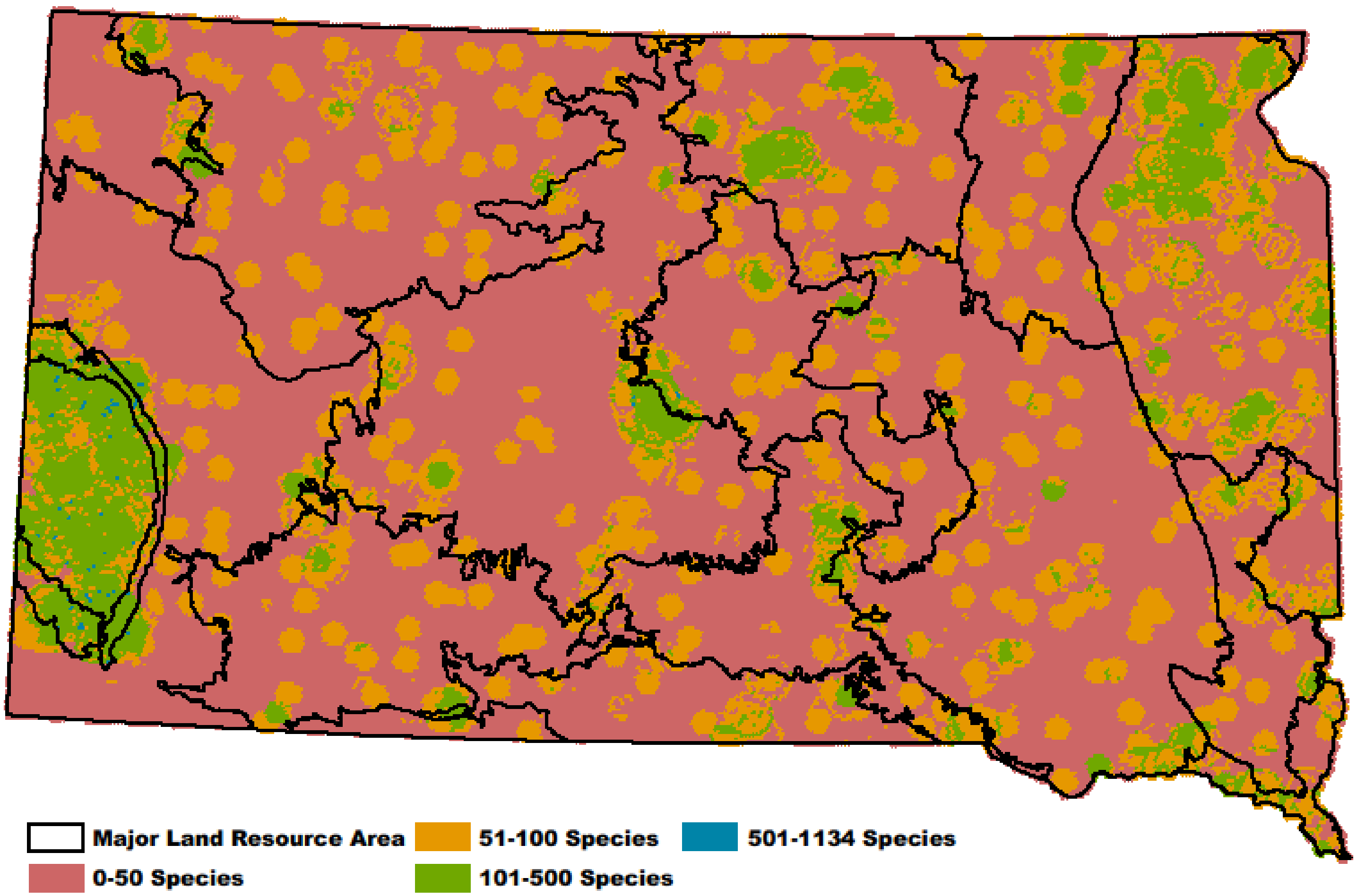


Figure 6-5. Map of terrestrial species richness.

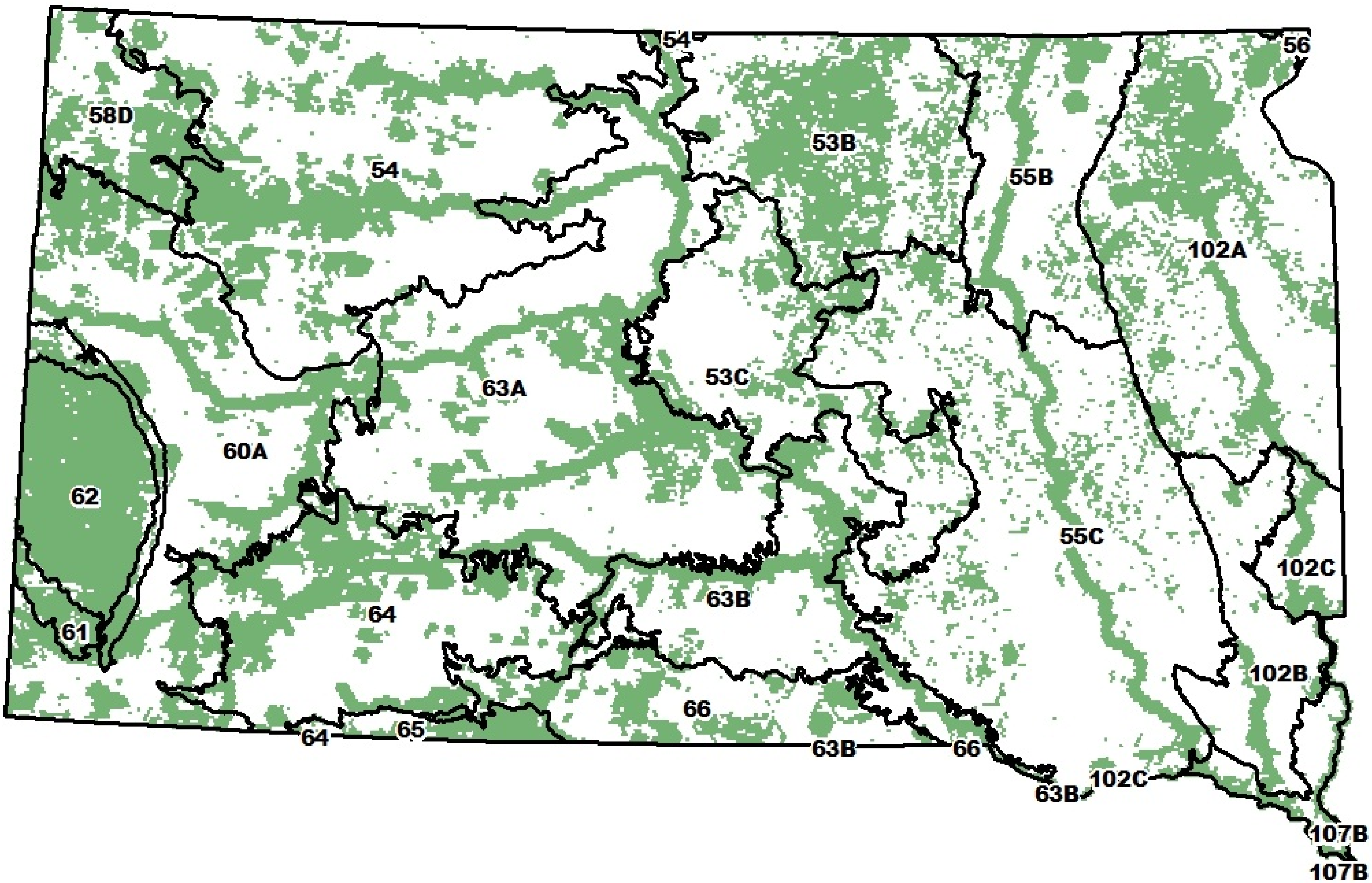


Figure 6-6. Map of terrestrial conservation opportunity areas.

6.5 Aquatic Conservation Opportunity Areas

To address the conservation needs of the aquatic biodiversity of South Dakota and their associated habitats, we produced a framework for focusing conservation efforts on key landscapes called Conservation Opportunity Areas (COAs). These priority areas represent the full extent of distinct aquatic habitats across the state and provide a way to direct and maximize limited resources to areas where SGCN will benefit.

The Missouri River Gap Analysis Program (MOGAP) aquatic riverine classification hierarchy was adopted as the geographic framework for developing COAs. From this classification system, Aquatic Ecological System (AES)-Types were selected as the abiotic conservation targets in the selection process for identifying COAs. To fully address the biotic targets, aquatic SGCN were used as the primary focus within the COA selection process.

Conservation Strategy

Combinations of factors were used to develop a conservation strategy. This strategy was used to identify and map a statewide map of COAs that collectively represent all of the distinct riverine ecosystems within South Dakota and the full array of SGCN distributions.

Basic Elements of the Conservation Strategy:

- Develop separate COAs for each Ecological Drainage Unit (EDU);
- Identify at least one COA for each AES-Type within each EDU;
- When an EDU was composed of a single AES-Type, identify one COA for individual AESs representing separate stream classes (i.e. upper, middle, lower):
    - Upper: includes headwater, creek and small river stream classes.
    - Middle: includes headwater, creek, and medium or large river stream classes.
    - Lower: includes headwater, creek, and great river stream classes.

Through this conservation strategy we provided an ecosystem approach to biological conservation and represented a wide spectrum of the diversity of macrohabitats across South Dakota. This strategy was developed to represent multiple populations for SGCN to select a wide range of COAs for protecting these species throughout South Dakota. We then established quantitative and qualitative assessment criteria for selecting COAs at the AES level.

Assessment Criteria

AES level COA selection criteria were selected on a hierarchical system (listed in order of importance):

- Highest confirmed/probable species richness for SGCN (Section 4.4 Aquatic SGCN);
- Lowest Human Stressor Index (HSI) value (Section 5.4 Aquatic Systems: HSI);

- Highest percentage of public ownership (Section 4.5 Ownership/Stewardship)

When necessary, additional aquatic COAs were selected to capture underrepresented SGCN with limited ranges (contained only within one or two individual AESs across the entire state). In that way all aquatic SGCN were represented by at least one COA.

Each selected COA was named to generally correspond with the name of the largest tributary stream contained within the boundary of the selected AES.

It is important to note, that in some instances, selected COAs did not contain current records for any aquatic SGCN. However, these COAs were selected to fulfill our conservation strategy and followed the latter portion of the assessment criteria. SGCN may be present within these selected COAs, but presence has not been confirmed due to gaps in monitoring efforts.

Walking through the Aquatic Conservation Strategy and Assessment Process

The Cheyenne EDU served as the pilot area for the statewide COA selection process and tested the conservation strategy and assessment process (Figure 6-7).

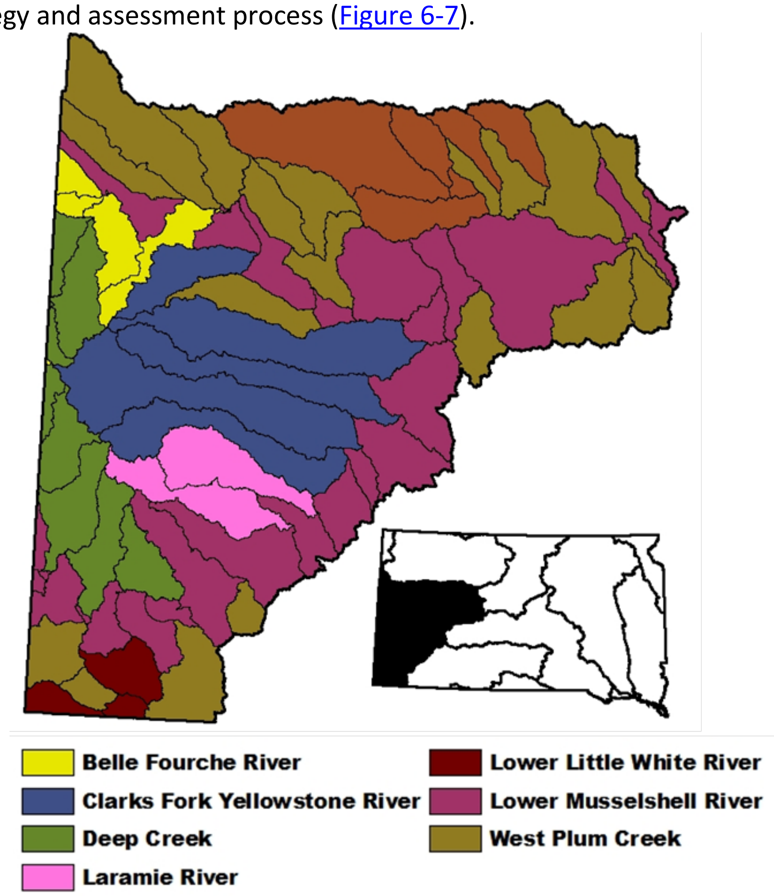


Figure 6-7. Map showing the Cheyenne Ecological Drainage Unit that was selected to meet all elements of the basic conservation strategy developed for the aquatic conservation opportunity area selection process in South Dakota. The figure also shows the seven associated aquatic ecological system-types found within the Cheyenne Ecological Drainage Unit.

The Cheyenne EDU contains seven separate AES-types: the Belle Fourche River, Clarks Fork Yellowstone River, Deep Creek, Laramie River, Lower Little White River, Lower Musselshell River, and West Plum Creek. At least one COA was identified for each AES-type within the Cheyenne EDU based on the assessment criteria.

The assessment criteria were used on all seven redundant AES-Types (i.e. Belle Fourche River, Clarks Fork Yellowstone River, Deep Creek, Laramie River, Lower Little White River, Lower Musselshell River, and West Plum Creek) to select individual AESs that warranted conservation (COAs). The Clarks Fork Yellowstone River AES-Type was further examined (Figure 6-8). COAs were selected based on the following hierarchical criteria in order of importance: highest species richness (confirmed and probable species occurrences) for SGCN, lowest human stressor index (HSI) value, and highest percentage of public ownership (Figure 6-8).

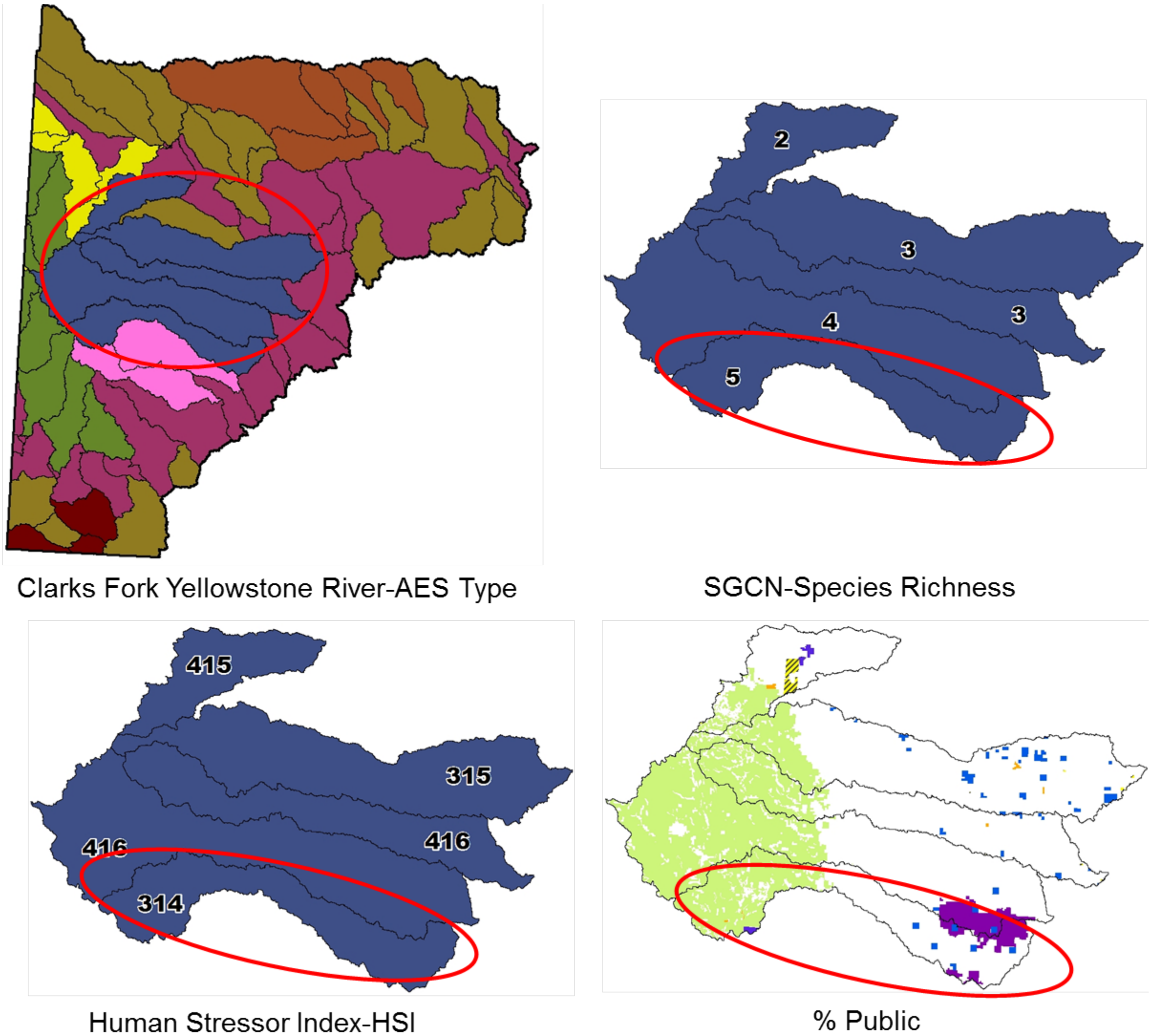


Figure 6-8. Map breaking down the assessment criteria for the Clarks Fork Yellowstone River aquatic ecological system-Type, within the Cheyenne Ecological Drainage Unit. Conservation Opportunity Areas were selected by a hierarchy system based on the highest species richness, lowest Human Stressor Index value, and highest percentage of public ownership.

Following the conservation strategy and assessment process for the Clarks Fork Yellowstone River AES-Type, two COAs were identified; one was selected based on limited species ranges (Figure 6-9). These two areas represent the broad diversity of watershed and stream types that occur throughout the Cheyenne EDU. The single AES that warranted conservation based on the assessment criteria is Newton Fork COA and is approximately 245,500 acres in size. This COA was selected based on a species richness of 5 and an HSI value of 314. More than half (52.5%) of this AES is privately owned with only a small percentage in public ownership. This is a common trend throughout South Dakota and particularly in the eastern portion of the state where public ownership is limited. One additional AES was selected within the Clarks Fork Yellowstone River AES-Type due to underrepresented SGCN presence with a limited range. This COA (Rapid Creek) was the only AES within the entire state that contain confirmed records for Elktoe mussels.

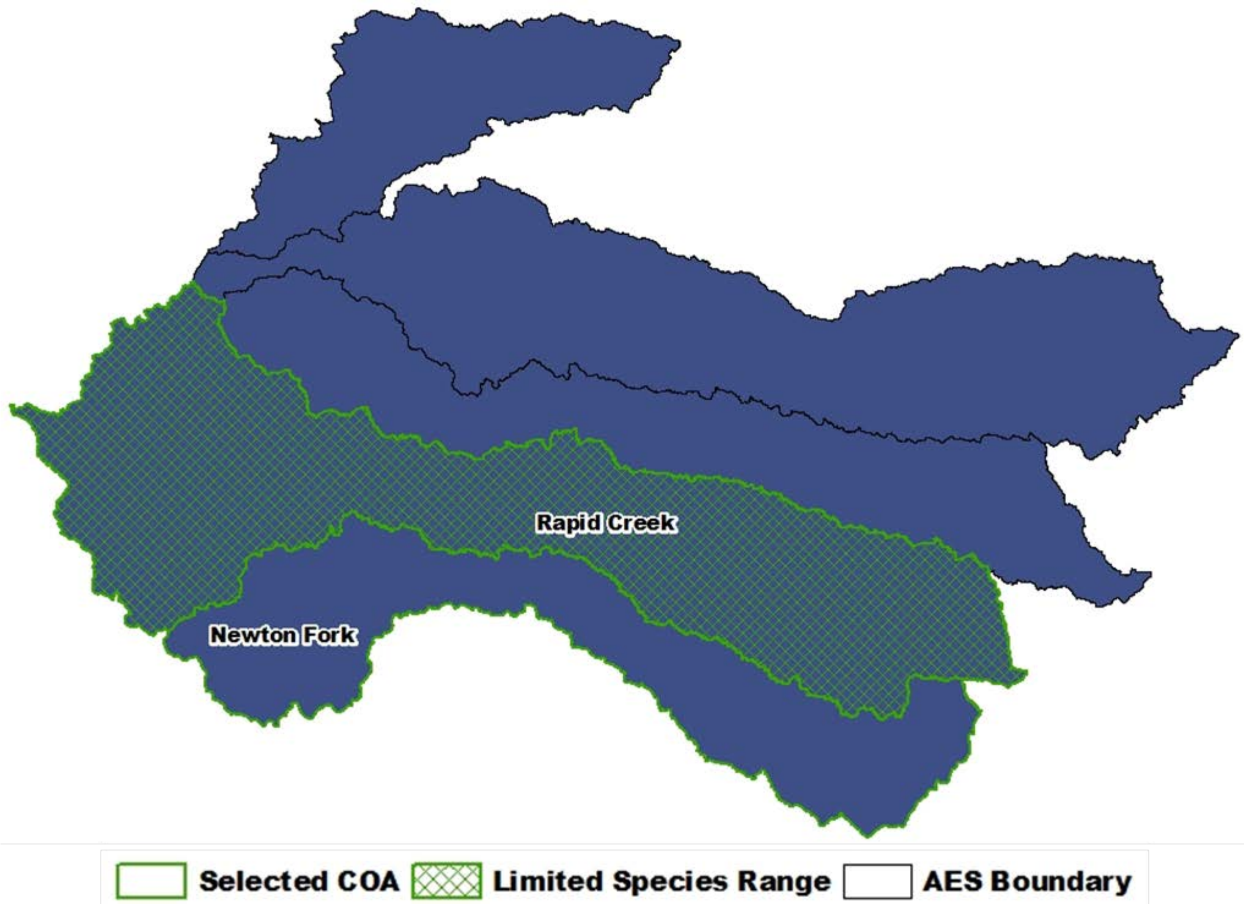


Figure 6-9. Map of two conservation opportunity areas within Clarks Fork Yellowstone River Aquatic Ecological System-Type, Cheyenne Ecological Drainage Unit that were selected to meet all elements of the conservation strategy and assessment process in South Dakota.

The James EDU was the only EDU within South Dakota that was composed of a single AES-Type (Figure 6-10).

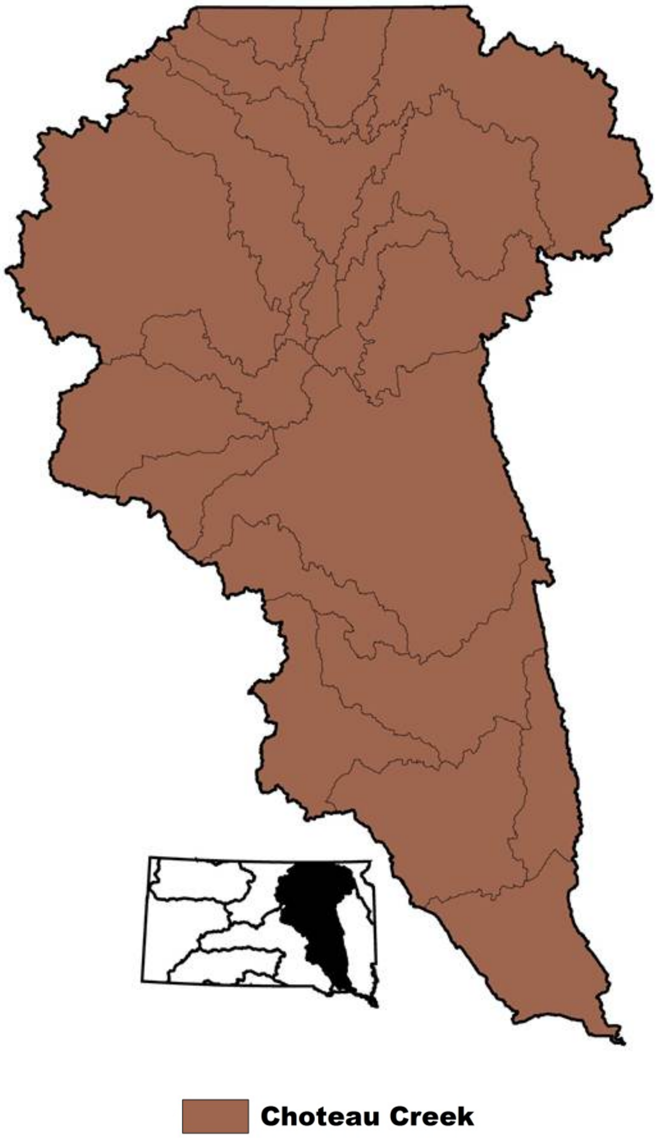


Figure 6-10. Map showing the James Ecological Drainage Unit (EDU), the only EDU in South Dakota which contains a single Aquatic Ecological System (AES)-Type (Choteau Creek AES-Type).

In the case of an EDU containing only a single AES-Type, the conservation strategy identified COAs for separate stream classes at the individual AES level. Stream classes were divided into three categories:

- Upper: includes headwater, creek and small river stream classes.
- Middle: includes headwater, creek, and medium or large river stream classes.
- Lower: includes headwater, creek, and great river stream classes.

The James EDU was broken into two different stream classification categories (Upper and Middle) following the conservation strategy (Figure 6-11). Based on this, at a minimum the James EDU would select two separate COAs, one from each stream classification. COAs were then selected following the assessment criteria. When necessary, additional COAs were selected to capture underrepresented SGCN with limited ranges (contained within one or two individual AESs across the entire state).

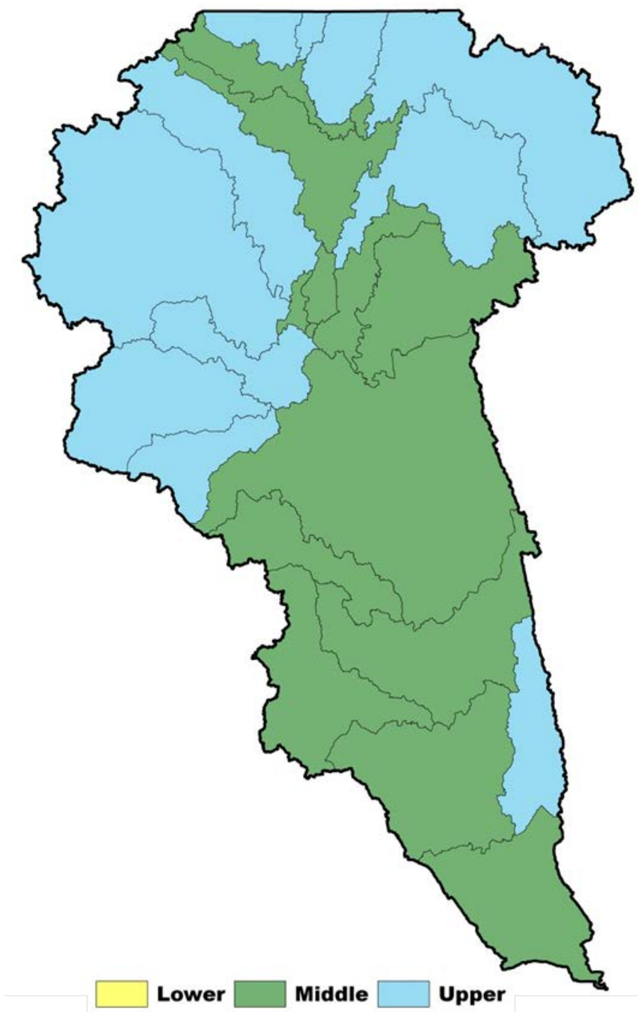


Figure 6-11. Map showing the James Ecological Drainage Unit broken down by stream classification type: lower, middle, upper.

Discussion

Conservation opportunity areas (COAs) have been identified and named for the largest tributary stream for all 12 EDUs in South Dakota (Appendix T, COA description). Statewide, 49 COAs were identified through the conservation strategy and assessment process (Figure 6-12). Figure 6-12 does not depict the current situation, but rather shows priority areas to better maximize limited resources, while representing the full extent of distinct aquatic ecosystems and habitats across South Dakota. These COAs represent the broad diversity of stream ecosystems and riverine assemblages within South Dakota and cover a relatively small percentage of the landscape. Specifically, the COAs encompass approximately 3.1% of the total stream miles in the state. In terms of land area, the COAs cover 14.9 million acres, or approximately 30% of the entire state. All 36 aquatic SGCN are contained and represented by at least one COA within the state (Appendix U). To conserve the overall ecological integrity of South Dakota, efforts cannot be limited to the land area and streams contained within the selected COAs. However, the selected methodology provided an efficient and effective strategy for the long-term conservation of relatively high quality examples of the various ecosystem and community types that exist across the state.

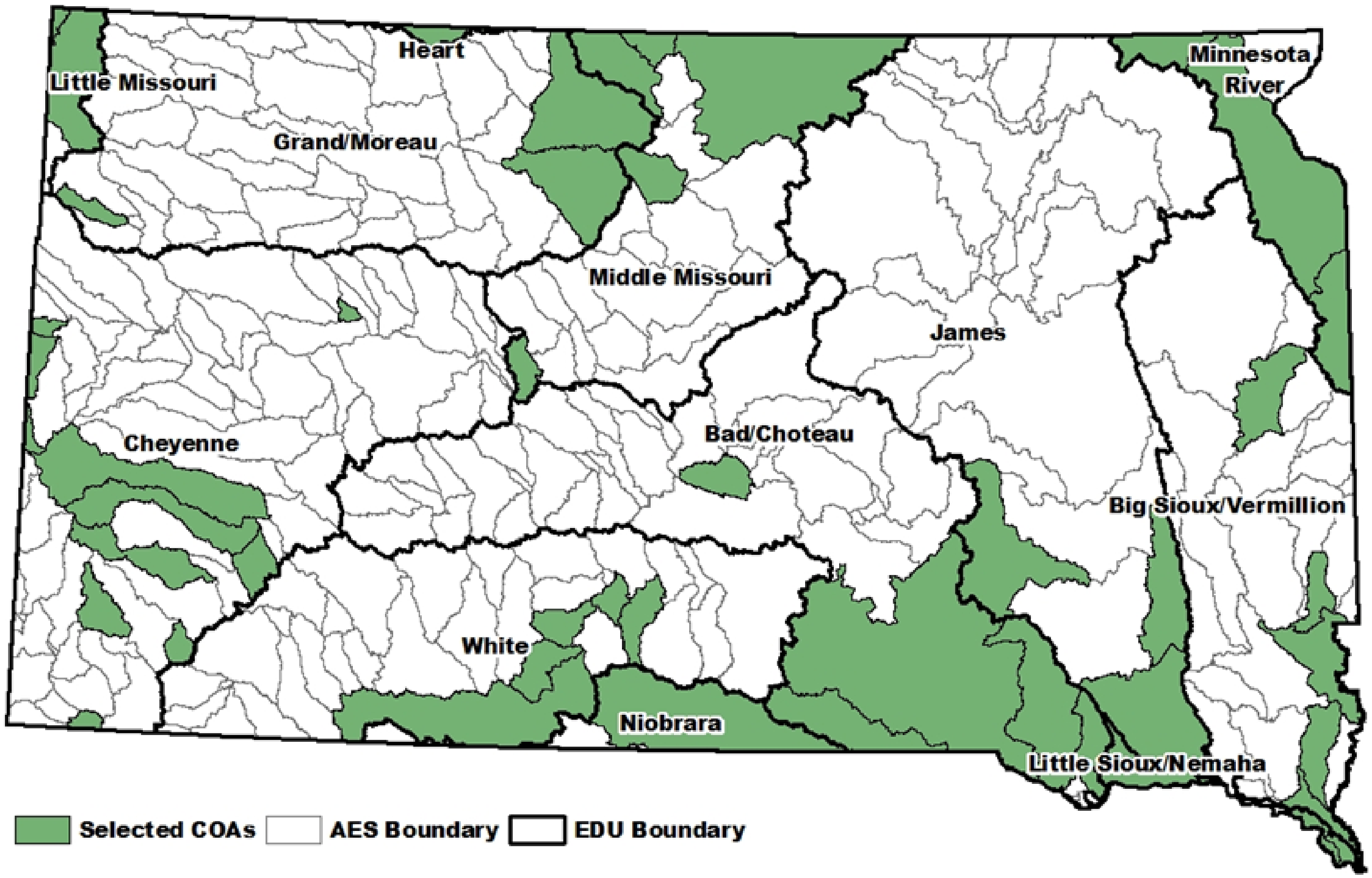


Figure 6-12. Map of 49 aquatic conservation opportunity areas selected to meet all elements of the aquatic conservation strategy and assessment process across South Dakota.

The selected COAs provide the framework to identify areas with the greatest potential to maintain or restore large areas to desired conditions to maintain South Dakota's aquatic biodiversity. In addition to conserving South Dakota's aquatic biodiversity, COAs provide spatial data and other necessary information for natural resource professionals, NGOs, state and federal agencies, and landowners to make informed decisions on the prioritization of research and monitoring needs to fill information gaps and to expand incentive programs in specific areas with the greatest potential to maintain and restore native conditions.

The coarse and fine filter strategies for identifying COAs provide the framework to maintaining and conserving aquatic biodiversity in South Dakota. However, the amount of land required to maintain and restore native ecosystem diversity still remains a large question. This is largely due to our relatively poor understanding of the ecological relationships, habitat requirements, and limiting factors for aquatic SGCN. At a minimum, the strategy used focuses on providing COAs across all unique drainages (i.e., ecological drainage units (EDUs) and aquatic ecological system-types (AES-types)), while representing the full array of aquatic SGCN.

Because more than 80% of the state is in private ownership, conservation of the state's biodiversity depends on support and participation by private landowners. Conservation actions should be evaluated considering costs and benefits for meeting conservation goals, and the partnership and perspective of landowners should be treated as invaluable resources.

Implementation of the conservation actions on a statewide level will help ensure that a significant number of opportunities for conservation of biological diversity in South Dakota are acted upon. The following actions are recommended to help further achieve the goals identified for maintaining and conserving biodiversity.

6.6 Conservation Actions Summary: Terrestrial and Aquatic Systems

Conservation challenges will continue to alter South Dakota's landscapes and ecological processes that sustain ecosystem diversity. Historically, natural disturbances such as drought, flooding events, fire, and natural grazing regimes shaped the patterns of ecosystem diversity on South Dakota's landscape. Today, the suppression of natural disturbances, human-influenced changes to hydrology, the introduction of exotic and invasive species, habitat fragmentation, pollution, and climate change have all directly and indirectly impacted species and degraded the habitats that sustain them. Future actions should promote the maintenance and restoration of natural ecosystems and address species-level challenges that are not accommodated through ecosystem maintenance and related disturbance regimes. The following conservation actions are recommended to help further achieve the representation goals identified for native ecosystem diversity at both the terrestrial and aquatic system levels.

Coordination

1. Develop and expand partnerships with agencies, organizations, and landowner groups to meet the conservation goals for ecosystem diversity identified for each of South Dakota's ecoregions.

2. Identify applicable federal, state, local, and non-governmental programs that can be used to achieve the representation goals identified, and develop coordination among these programs. For example, meet with NRCS to explore these options in existing and future landowner programs.
3. Increase collaboration and communication to share responsibilities, reduce duplication, increase data exchange, and maximize limited resources on conservation priorities. Identify the lead and supportive roles for partners.
4. Continue efforts to identify funding sources to help meet representation goals. State Wildlife Grant funds are a small and unreliable funding source to meet nearly unlimited needs. The Wildlife Action Plan's success will depend on the ability to leverage government dollars and resources with other sources of match.

Management

1. Conduct assessments of existing ecosystem conditions using the coarse filter framework to determine the amount of historical ecosystem conditions present today that can contribute to target goals for ecosystem diversity.
2. Identify site management tools and techniques to maintain or restore desired ecosystem conditions.
3. Apply existing or develop new incentive programs that make it possible for landowners to participate in partnerships to meet conservation goals for ecosystem diversity.
4. Evaluate South Dakota public lands for opportunities to contribute toward ecosystem diversity goals.
5. Identify and map unique natural communities/habitat features that are not addressed through ecosystem diversity objectives that are also important for conservation of biological diversity in South Dakota (e.g., caves, cliffs, etc.).
6. Continue to promote enforcement of road right-of-way mowing restrictions and investigate wildlife value of this habitat type.
7. Continue or expand efforts to control exotic and invasive species across South Dakota.
8. Develop one-stop shopping programs for landowners interested in ecosystem restoration to ensure easy and timely access to funds and professional assistance.
9. Identify locations (example: COAs as described in this Plan) where concerted efforts can be coordinated to produce habitat blocks of sufficient size to address habitat fragmentation concerns.
10. Continue to search for data sources to help identify more discrete COAs in western South Dakota.

11. Identify resources to allow wildlife interests to better compete with agricultural land values to further the goal of ecosystem representation in eastern South Dakota.
12. Address connectivity concerns to allow sufficient movement and genetic exchange to support populations of SGCN.
13. Restoration projects should focus on creating habitat corridors and stream connectivity that connect disjunct habitats.
14. Explore options to develop captive breeding, stocking, and trap and transfer programs for extirpated and declining populations of aquatic SGCN for future reintroductions.

Research

1. Continue to explore data sources for better information on pre-settlement vegetation conditions and the historical range of variability across all South Dakota ecoregions and ecosystem types.
2. Develop a better understanding of the effects of natural disturbance regimes on plant species compositions, structures, and functions of ecosystems.
3. Develop a better understanding of landscape patterns of heterogeneity resulting from natural disturbance regimes.
4. Develop prescribed burning methods and programs that better simulate natural disturbance regimes and their effects on South Dakota's ecosystem diversity.
5. Define ecosystem friendly grazing/haying practices (i.e. reduced stocking rates, rotational grazing, staggered timing of haying, and height of cutting) and develop recommendations for applying this management tool.
6. Define management practices that reduce nutrient, agricultural runoff, and sedimentation to enhance water quality and aquatic ecosystems.
7. Develop and refine landscape models to quantify historical range of variability in South Dakota.
8. Identify the levels of risk associated with selected levels of representation.
9. Develop a better understanding of exotic and invasive plant species distributions and spread relative to priorities for ecosystem diversity.
10. Research and monitor the establishment, spread, control measures and impacts of aquatic invasive species on native ecosystems.

Education

1. Develop educational materials for landowners that describe desired ecosystem conditions, management actions to achieve these conditions, and the potential economic and social benefits of their actions.

2. Develop and use best practices in conservation education to teach about the importance of ecosystem diversity and species conservation. These practices include both active efforts (e.g., school programs, teacher trainings, etc.) and passive efforts (e.g., posters, brochures, signage, etc.). Such programs will be conducted by SDGFP personnel and contractors, in partnership with other individuals, organizations, and agencies.
3. Increase the amount of information available to the public via the South Dakota Wildlife Diversity/Natural Heritage Program website regarding ecosystem diversity.
4. Promote outreach efforts that emphasize exotic and invasive plant prevention/control, prevention of the spread of aquatic invasive species and associated impacts on ecosystem diversity.

In addition to these coarse filter-targeted actions, species-specific conservation actions may be found in SGCN profiles (Appendix C) and Appendices G-K.

CHAPTER 7 AGENCY COORDINATION, COOPERATOR INTERACTIONS, AND PUBLIC INVOLVEMENT

7.1 Public Involvement and Partnership Process

SDGFP used the agency's website as an important communication tool during the Plan revision. In addition to the website's traditional uses, such as sharing agency news and events, SDGFP Commission activities, and hunting and fishing season details, SDGFP is now actively involved in social media. This transition will help maintain the website's future relevance to the public and agency partners. This tool was supplemented with targeted messages and meetings with internal staff, other agencies and tribes, species and taxonomic experts, and the general public. The roles and expected input for each group are described below:

SDGFP Staff and their roles:

- Science Team: Members are listed in the Acknowledgements Section. This Team provided overall direction and continuity in the development of the planning process, contract oversight, and plan completion. Members also completed a variety of input-gathering and public involvement tasks and drafted certain plan sections and appendices.
- Internal Resource Staff: SDGFP GIS staff members were critical participants in the Plan revision, assisting with the conservation opportunity area process, in developing formats for making State Wildlife Grant-funded project information more readily accessible to the public, and in overall planning direction. The SDGFP Wildlife Division is composed of 4 administrative regions. Each region has managers responsible for wildlife, fisheries, and land management within regional boundaries. These regional staff and other species experts within the agency were asked for input and assistance at various stages of the planning process.
- Other Internal Staff: General information about the planning effort was shared at various times with Wildlife Division staff to help provide an overall understanding of the process and purpose for the planning effort.
- Outreach Team: Assisted with the public involvement process and conducted public attitude surveys, which are described later in this chapter.
- SDGFP Commission: Information about the planning effort was shared at various times with the SDGFP Commission to help provide an overall understanding of the process and relevance of this planning effort to the agency. The draft Plan was shared with the Commission prior to it being available for public comment. A final briefing on the Plan was presented at the June 5-6, 2014 Commission meeting, at which time the SDGFP Commission endorsed the South Dakota Wildlife Action Plan Revision.

Agencies and Native American Tribes

A list was assembled of 55 local, state, and federal agencies with responsibility for land or natural resource management, Native American tribes, universities with wildlife or biology departments, and a few quasi-governmental entities, such as joint ventures (Appendix V).

Periodic contacts were made with these entities to update them on planning progress and to solicit input on specific information needs. Examples include multiple contacts regarding the draft species of greatest conservation need list and requests for input on monitoring programs conducted by respective entities. All comments on the SGCN list were considered, and monitoring suggestions were added to the monitoring programs list (Appendix E) to make it more comprehensive and reflective of entities besides SDGFP. As described in Section 6.4, input was also specifically sought on existing conservation initiatives and potential methods of identifying conservation opportunity areas. Several species experts, as described below, were affiliated with state or federal agencies. A lack of input from these conservation partners did not necessarily indicate a lack of engagement in the process, as some entities responded to requests that they had no comments or no specific feedback to offer on particular topics.

Species and Taxonomic Experts

A list of 56 individuals was assembled of state and regional experts on rare species or species groups to request their assistance at various planning stages. This group included both internal staff and experts from other agencies and private conservation organizations. Individuals were asked to categorize their expertise by one or more of the following categories: aquatic invertebrates, fishes, terrestrial invertebrates, herptiles, birds, or mammals. Of those who expressed a willingness to assist in reviewing and modifying the species of greatest conservation need list, 18 were from state, tribal, or regional colleges or universities, 5 were private contractor biologists or associated with an NGO, and 9 were from state or federal land or resource agencies. Many of these experts also assisted in identifying research and survey needs described in Appendices G – K.

External public

The general public was informed about the planning process and offered various input opportunities. The general public was also surveyed in a follow-up attitude survey conducted during the Plan revision process to better understand specific attitudes and to assist the agency in communication strategies.

7.2 Coordination with Other Agencies and Tribes

Agencies, universities, and Native American tribes (Appendix V) were contacted at intervals throughout the planning process. Specific contacts were as follows:

1. May 10, 2012 memo to introduce the revision process; inform them of the Plan website, which included background information and a draft species of greatest conservation need list; to invite comments on the draft species of greatest conservation need list; and to offer them the opportunity to meet with the Science Team upon request. Several responses were received, particularly sharing respective agency rare species lists. These comments were considered by the Science Team. In most cases, the species did not qualify for the species of greatest conservation need list because they did not fit the established criteria.

2. November 30, 2012 memo to inform them of upcoming Open Houses, to share the final species of greatest conservation need list, to request input on relevant conservation initiatives that should be considered during Plan preparation, and to remind them of the use of the agency's website as the primary communication tool during the revision process.
3. December 6, 2012 email invitation to state and federal resource agencies and tribes with responsibilities in western South Dakota to invite them to a meeting held prior to the Rapid City Open House.
4. February 3, 2013 memo to present an update on the planning process, to share the specific content of the website, and to again share the species of greatest conservation need list.
5. March 6, 2013 memo to update them on recent planning progress, to outline a draft approach to defining terrestrial conservation opportunity areas, to share the proposed approach to defining aquatic conservation opportunity areas, and to request suggested conservation opportunity areas for inclusion in the Plan. Several comments were received regarding the definition of conservation opportunity areas, and these comments were considered by the Science Team.
6. August 6, 2013 memo to circulate and request feedback on a draft listing of research and survey needs related to species, habitats, species groups, and habitat- or species-specific restoration needs. Comments received were used to update this information.
7. September 5, 2013 memo to circulate and request feedback on a draft listing of current wildlife monitoring programs. Comments received were used to update this listing.
8. May 8, 2014 memo to inform them of the Plan's comment period, which lasted from May 7 through June 6, 2014.

Agencies and tribes in western South Dakota were invited to a meeting that preceded the Rapid City Open House on December 12, 2012. Invitees included 13 representatives from the U.S. Forest Service, 4 from the National Park Service, 2 from the Bureau of Land Management, 2 from the U.S. Fish and Wildlife Service, 1 from the U.S. Geological Survey, 4 from Native American tribes, 4 from state wildlife agencies in South Dakota and Wyoming, and 1 from the South Dakota State University Extension Service. A webinar was organized by USFWS refuge staff in eastern South Dakota. Six USFWS staff participated in the webinar to learn more about the planning process and provide input on planning priorities. An additional meeting was held with USFWS Private Lands Staff in Brookings, South Dakota, prior to the Sioux Falls Open House on December 13, 2012. The purpose of this meeting was similar to that of the USFWS refuge staff webinar.

7.3 Public Participation Opportunities

The SDGFP website has provided updates on State Wildlife Grant-funded projects since this funding source became available, in addition to information about the original Wildlife Action Plan (http://gfp.sd.gov/wildlife/management/plans/wildlife-action-plan.aspx). The website was enhanced for use as a primary communication tool for sharing information about the planning process with the general public. Statewide news releases were used to publicize specific input opportunities.

1. The Plan revision website was established in May 2012. Text included background information explaining the function of the Plan and reasons for its revision, Plan requirements, a proposed

schedule and planning process overview, questions and answers for likely questions, a description of changes intended for the revised document compared to the original plan, and an introduction to upcoming public attitude surveys.

2. A statewide news release was circulated in August 2012 informing the public of the planning process and offering the opportunity to comment on the draft species of greatest conservation need. Two comments were received and considered.
3. The website was updated in August 2012 with a comment form for input on the species of greatest conservation need list.
4. A statewide news release was circulated in early December 2012 informing the public of upcoming Open Houses to be held in Rapid City and Sioux Falls.
5. Open Houses were held on December 12 and 13, 2012 at SDGFP Outdoor Campuses in the state's largest cities, Rapid City and Sioux Falls. The Open Houses included introductory remarks, a PowerPoint presentation on the planning framework and process, and map displays showing components being considered for conservation opportunity areas. Specific comment forms were available for use to be handed in or mailed at a later time. Presenters at the Open Houses included SDGFP staff and contractors at both events. Attendees at the Outdoor Campus West Open House included a SDGFP Commissioner and 2 members of the public. No members of the public chose to attend the event at the Outdoor Campus East.
6. A statewide news release was shared with the public on May 7, 2014, informing them of the opportunity to provide feedback on the full Plan through June 6, 2014.

7.4 Review of Draft South Dakota Wildlife Action Plan

In addition to the opportunity to provide input on the species of greatest conservation need list and to share questions and concerns during the Open Houses, the public was offered the opportunity to comment on the draft Plan during a five-week comment period from May 7 through June 6, 2014.

Six entities submitted comments. Following conclusion of the comment opportunity for the public, agencies, and tribes, members of the Wildlife Action Plan Science Team and Outreach Team met to discuss all comments received and determine how to respond to each of the points raised. The comment letters/emails and specific resolutions are found in Appendix W. Not every point raised by commenters was specifically addressed in Appendix W. Some points were suggested policies for SDGFP apart from the Plan preparation or were suggestions for species of greatest conservation need. The latter suggestions were considered during previous public and agency comment periods, because of the necessity to finalize this list earlier in the planning process.

The Plan was submitted to the U.S. Fish and Wildlife Service for their review and approval, a review process that included the participation of the Nebraska Game and Parks Commission. SDGFP subsequently received and reviewed a listing of minor corrections needed and additional points for consideration. The final Plan was then submitted to the U.S. Fish and Wildlife Service.

7.5 Understanding South Dakota Citizens – Wildlife Values

SDGFP has a long history of surveying its citizens and resource users to track attitudes and trends and to identify areas that may need additional public involvement or better communication between the agency and its constituents. As part of the Plan revision, SDGFP coordinated with the South Dakota Cooperative Fish and Wildlife Research Unit at South Dakota State University to conduct an attitude survey of South Dakotans. The survey repeated some questions asked during a survey conducted during the original Plan's preparation in addition to new questions reflecting new wildlife or environmental issues.

The complete reports from this survey can be found on the SDGFP website

(http://gfp.sd.gov/wildlife/management/plans/docs/WildlifeValueOrientationsReport.pdf). The report citations are included in the References Cited portion of this document.

Executive Summary

Prepared by Larry Gigliotti, Ph.D., U.S. Geological Survey, South Dakota Cooperative Fish and Wildlife Research Unit, South Dakota State University, Department of Natural Resource Management, Brookings, SD, 57007

Wildlife and Environmental Attitudes of South Dakota Citizens – 2012

This survey of South Dakota citizens' wildlife and environmental attitudes was conducted in 2012 in conjunction with South Dakota Game, Fish and Parks' (SDGFP) revision of the South Dakota Wildlife Action Plan (WAP). The WAP was first approved in 2006 and SDGFP made a commitment to review and revise the plan five years following its approval. This survey, in part, addresses the eighth essential element in the WAP, each state's provisions to provide public participation in the development, revisions, and implementation of its strategy. The purpose of the survey was to identify trends as well as mapping current environmental attitudes, providing a better understanding of South Dakota citizens.

The mail survey questionnaire (11 by 8½ booklets) was developed with input from SDGFP staff and survey results were analyzed by South Dakota State University. Two versions of the questionnaire were developed to maximize the number of questions asked while minimizing the overall length of the survey. Initial sample size was 2,400 randomly selected South Dakota citizens (94 addresses were undeliverable) and 1,138 usable questionnaires (49%) were returned. A total of 45 questions measured an array of wildlife and environmental attitudes and 12 items measured people's Wildlife Value Orientations, plus questions measured peoples' participation in hunting, fishing, and wildlife viewing and a few demographic variables.

Results

In general, most South Dakota residents have positive attitudes towards wildlife and are supportive of efforts to maintain quality habitat for wildlife. The importance of wildlife is best summarized by the results showing that 80% of South Dakota residents reported fish and wildlife contributes to a high "quality of life" and only about 1% reporting that fish and wildlife detracts from their "quality of life" in South Dakota. However, there can be some controversy when it comes to issues involving specific wildlife species. For example, this survey measured a greater level of disagreement regarding issues involving specific wildlife species, such as, prairie dogs, mountain lions, rattlesnakes, bats, river otters, and ospreys.

Controversy surrounding some species of wildlife generally stems from different opinions on how wildlife should be viewed/treated/managed. These differences are best summarized by the Wildlife Value Orientation (WVO) scale, which measures a general core value people have towards wildlife. The WVO scale measures peoples' wildlife values along a continuum of utilitarian values at one end and mutualist values at the other end and classifies people into four groups (Utilitarian, Mutualist, Pluralist, and Distanced) (Table 7-1). Pluralists can hold both value orientations and their attitude towards a specific issue is dependent upon the given situation, while people with a distanced orientation do not hold either orientation. Utilitarians value wildlife primarily for their use or benefit to humans while mutualists view all wildlife as deserving of rights and caring. Such contrasting viewpoints can create controversial issues involving a range of wildlife species and management actions. The potential for conflict is also supported by the split in peoples' attitudes regarding the degree to which wildlife management decisions should favor game animals/fish or rare wildlife species. In general, most South Dakota residents (54%) favored a "balanced approach" on wildlife management decisions regarding game animals/fish versus rare wildlife species with the remaining residents about evenly split between favoring game/fish and rare wildlife species.

The value of the WVO scale lies in its potential to predict how people may respond to various wildlife issues. Utilitarians will generally be supportive of actions that allow use of wildlife classified as game and control of species deemed as harmful to humans, their property, or valued game species. Mutualists will generally be opposed to any management actions that are harmful to any wildlife species. Thus, the WVO of South Dakota residents measured in this survey can be used to estimate attitudes towards wildlife issues not measured by this survey. South Dakotan' WVO have not change much since last measured in 2004 (Figure 7-1Figure6_1) and most of the wildlife and environmental attitudes also have remained relatively stable over the past decade.

Fishing, Hunting and Wildlife Viewing. Most South Dakotans have fished (87%) or hunted (60%) at least sometime in their lives, and almost half (49%) reported they have taken trips sometime in their lifetime for which fish and wildlife viewing was the primary purpose of the trip. Overall, 91% of South Dakota residents have participated in some combination of these activities (Figure 7-2Figure6_2). Participation in one or more of these activities increased peoples' appreciation for wildlife and also increased the likelihood of holding stronger opinions on various wildlife management issues.

Table 7-1. Descriptions of the four wildlife value orientations (measured in 2012 for South Dakota residents).

UTILITARIAN (53.6%). Believe that wildlife should be used and managed primarily for human benefit. Individuals with a strong utilitarian orientation are more likely to prioritize human well-being over wildlife in their attitudes and behaviors. They are also more likely to find justification for treatment of wildlife in utilitarian terms and to rate actions that result in death or harm to wildlife as being acceptable.

MUTUALIST (15.3%). View wildlife as capable of living in relationships of trust with humans, as if part of an extended family, and deserving of rights and caring. Those with a strong mutualism orientation are less likely to support actions resulting in death or harm to wildlife, more likely to engage in welfare-enhancing behaviors for individual wildlife (e.g., feeding), and more likely to view wildlife in human terms (e.g., Bambi).

PLURALIST (20.9%). Hold both a mutualism and a utilitarian value orientation toward wildlife. Which of the orientations plays a role is dependent upon the given situation. For certain issues, Pluralists are likely to respond in a manner similar to that of Utilitarians, whereas for other issues they may behave more like Mutualists.

DISTANCED (10.2%). Do not hold either a utilitarian or a mutualism orientation. As their label suggests, they tend to be less interested in wildlife and wildlife related issues. The Distanced type is also more likely than the other value types to express fear, or concern for safety, while in the outdoors due to the possibility of negative encounters with wildlife (e.g., risk of being attacked or contracting a disease).

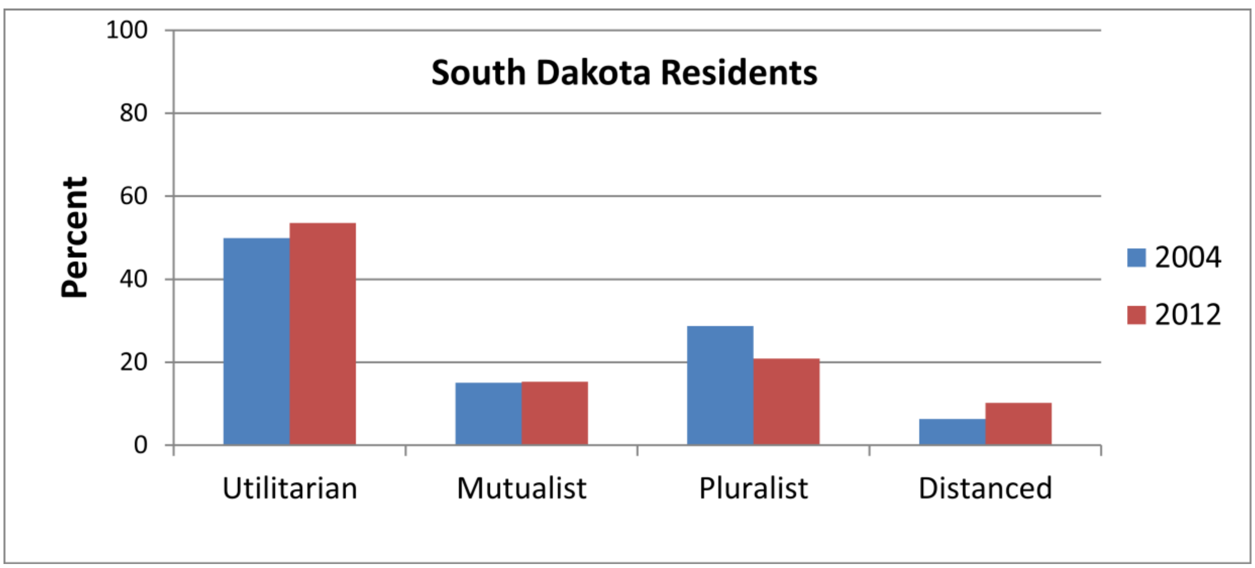


Figure 7-1. South Dakota residents' wildlife value orientations measured in 2004 and 2012.

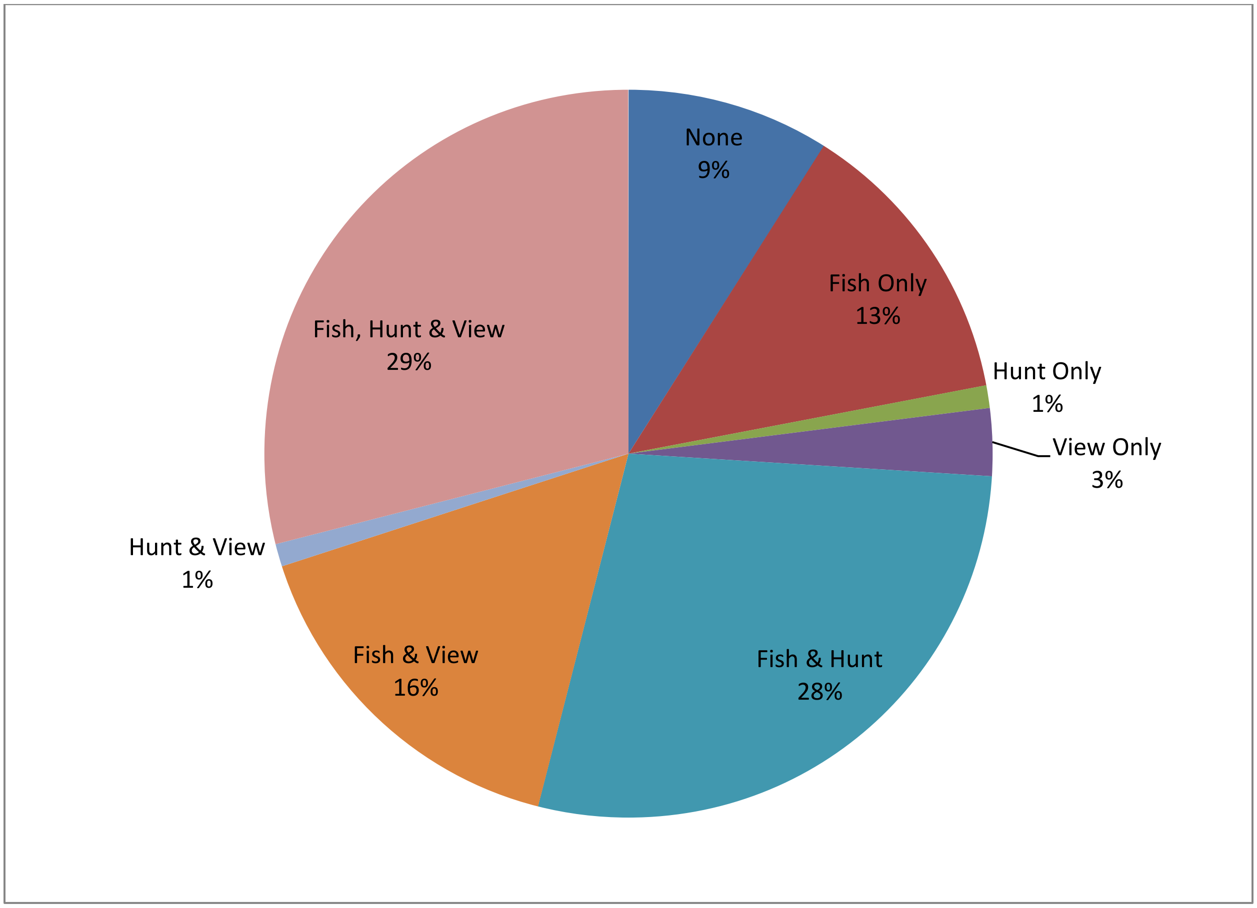


Figure 7-2. Participation in fishing, hunting and/or wildlife viewing trips by South Dakotans sometime during their lifetime (measured in 2012).

Chapter 8 Monitoring and Inventory, Research, and Adaptive Management

Monitoring and inventory are different but related activities. The purpose of monitoring is to check on the status of specific resources and progress toward stated goals or objectives. Inventory has a more basic purpose of determining the occurrence or abundance of specific resources, not necessarily regarding stated goals or objectives. Monitoring is a key component of the SDWAP as it is the process for checking on progress towards the goals and objectives of the plan, as well as the basis for setting up adaptive management programs. Inventory can be a stated objective of the plan, primarily to determine more information on species that lack good information on their status or distribution.

For terrestrial systems, the SDWAP emphasizes maintaining or restoring native ecosystem diversity as the primary means to address habitat needs for the State's biodiversity, with a secondary focus on non-habitat concerns of SGCN. The proposed monitoring follows this same approach. Monitoring of native ecosystem diversity addresses objectives at both ecoregion and community levels of biological organization. The aquatic approach in the SDWAP is to accommodate the needs of SGCN through identification of conservation opportunity areas that consider a variety of stressors to both aquatic ecosystems and related landuses. Monitoring at the species level is primarily directed at addressing more specific conservation actions for a particular species. Inventory can be incorporated at any level to address more basic information needs.

8.1 Monitoring and Research Needs for Terrestrial Native Ecosystem Diversity

As discussed previously, the goal of the coarse filter developed for the SDWAP is to maintain or increase levels of representation of native ecosystems that occurred in South Dakota based on an historical reference. Monitoring of this objective should occur at both the ecoregion or landscape level as well as the ecosystem or community level (Haufler et al. 2002).

Ecoregion or Landscape Level Monitoring and Research

Monitoring ecosystem diversity at the ecoregion level involves tracking the amount of existing acres of each specific ecosystem that can contribute to representation goals identified in Section 6.1. That section identified a framework for setting goals and priorities for desired conditions in terms of amounts of each ecosystem. For monitoring, the relevant measures are the amounts, sizes, and distributions of representative areas for each ecosystem. For the purpose of the SDWAP, a level of 10% of historical amounts was used for determining desired levels of representation, but this amount could be too low for a specific ecosystem when considering other variables such as the sizes and distribution of the ecosystems, etc. For forest and riparian-wetland ecosystems, historical references are limited or entirely lacking and this is an important research goal for the implementation of the SDWAP across the full range of ecosystems within the state. Additional efforts at quantifying amounts of each identified ecosystem occurring under natural disturbance regimes (i.e. historical range of variability) are also needed.

Information for tracking representation levels of ecosystems can come from a variety of sources, and better cooperation and information sharing may result once these needs are identified. Potential cooperators who deal directly with land protection or enhancement include both private and public entities. Where public lands are being managed, such as state or national wildlife lands, grasslands or parks, information on amounts of each ecosystem type that meets representation criteria may be directly available and the acres of representation tallied. For Game Production Areas, South Dakota continues to evaluate native habitat occurrence and condition. These data can be interpreted relative to the ecosystem diversity framework, and amounts and sizes of each ecosystem present on these areas documented. Similarly, where Farm Bill or other conservation programs can provide direct incentives to private landowners to maintain or produce specific desired ecosystem conditions, acres qualifying for these programs can be directly tracked. Other acres occurring on lands not currently involved in either of the above may be more difficult to track for purposes of ecosystem representation. Remote sensing provides some capabilities for tracking the status of many ecosystems, particularly for forested and some riparian ecosystems. Determining the disturbance state and the appropriate compositions and structures of grass and shrub ecosystems is currently less effective using remote sensing information, but this could change as these technologies advance.

The goal of ecoregion monitoring is to track the amounts of each identified ecosystem from the ecosystem diversity descriptions that are present today relative to historical amounts and the stated representation goals. Current monitoring capabilities will be conservative in their estimates of representation for some ecosystems because of the challenges identified with remote sensing, but a consistent tracking of amounts, sizes, and known distributions will indicate trends as well as a minimum level of representation that is known to be present.

Monitoring and research to support the ecosystem diversity component of the SDWAP at the landscape level represent a new evaluation framework and process for SDGFP. Developing the specifics of these programs will be an important operational component for implementing the goals of the Plan. To facilitate this need, one or more workshops should be provided as needed to develop a coordinated and consistent understanding of the conservation strategy used in the SDWAP and the implications for existing and future monitoring and research programs in the state. The workshop will be made available to SDGFP employees as well as land management and research partners to help ensure consistency of monitoring and research methods to support implementation of the SDWAP. Table 8-1 presents the recommended monitoring and research priorities to support implementation of the ecosystem diversity component of the SDWAP at the landscape level.

Table 8-1. Priority monitoring and research needs identified for the landscape level of the ecosystem diversity component of the South Dakota Wildlife Action Plan.

<table>
<tr><th>MONITORING</th><th>RESEARCH</th></tr>
<tr><td colspan="2">• Present a workshop to facilitate a consistent understanding of the SDWAP conservation strategy by SDGFP and partners to ensure monitoring and research efforts at the landscape level support implementation of the SDWAP.</td></tr>
<tr><td>• Quantify the amount of each ecosystem by ecoregion using the ecosystem diversity framework, beginning with state lands.
• Work with federal partners to quantify ecosystem diversity on federal lands.
• Work with state, federal, and NGOs to quantify ecosystem diversity on private lands where conservation program participation provides an opportunity.</td><td>• Work with research partners to develop better tools and methodologies to use remotely sensed data or other data sources to map disturbance states identified in the ecosystem diversity framework.
• Work with research partners to develop tools and methodologies to quantify historical range of variability using the ecosystem diversity framework, by ecoregion.</td></tr>
</table>

Ecosystem or Community Level Monitoring and Research

As discussed in the previous section, achieving the representation goals identified in the SDWAP requires monitoring the amounts, sizes, and distributions of ecosystems within an ecoregion. First, however, a determination of whether a specific site meets the requirements for representation will need to be made at the ecosystem level. A specific site will need to meet specific criteria for ecosystem composition, structure, function, and processes sufficiently similar to those that occurred historically to be considered representative of those conditions. For example, a particular site may have historically supported a plant community dominated by western wheatgrass and needle-and-thread grass. If that site still contains western wheatgrass and needle-and-thread grass but is also currently composed of 50% smooth brome, it would not be reasonable to consider it representative of historical plant community composition.

Monitoring of sites at the ecosystem level will track progress in addressing specific problems such as species composition, structures, functions, or processes. Typically, the plant composition of the ecosystem will be the primary monitoring criterion. However, structural characteristics may also be important criteria for some sites. Ecosystem functions such as nutrient cycling, while a critical characteristic of ecosystems and their dynamics, would not be commonly used as a monitoring measure, but could be important in some instances. A range of compositions, structures or functions may be acceptable for a site to be considered representative, but sideboards on acceptable levels, particularly for compositions and structures, should be identified. Processes are typically drivers of a site's composition and structure, but may also be used as criteria for appropriate representation. For example, fire return intervals for most areas that historically occurred on a particular ecological site may have averaged 7 years, and areas within the ecological site may be considered within an acceptable range of fire return for fire-dependent conditions if they have had a fire within the last 15 years. If an area within the ecological site has not burned within the last 15 years, the site might be classified as being representative of a long-term fire return interval, if it had an acceptable composition of species for that specific ecosystem. However, such an area would be considered representative of a long-interval fire return condition, not the short-fire return interval that may have occurred across a majority of areas historically.

Research is needed at the ecosystem level to identify and describe the historical disturbance states for forest and riparian-wetland ecosystems relative to the ecosystem diversity framework of the SDWAP. Restoration programs will be conducted at the ecosystem level and will require new and better tools and methodologies to re-establish sustainable plant communities to meet the objectives of the SDWAP, while also evaluating their effectiveness and cost relative to budgets and personnel.

As with the landscape level, monitoring and research to support the ecosystem diversity component of the SDWAP at the ecosystem or community level represent a new evaluation framework and process for SDGFP. Developing the specifics of these programs will be an important operational component for implementing the goals of the Plan. To facilitate this need, one or more workshops should be provided as needed to develop a coordinated and consistent understanding of the conservation strategy used in the SDWAP and the implications for existing and future monitoring and research programs in the state. The workshop should be made available to SDGFP employees as well as land management and research partners to ensure consistency of monitoring and research methods to support implementation of the SDWAP at the ecosystem level. Table 8-2 presents the recommended monitoring and research priorities to support implementation of the ecosystem diversity component of the SDWAP at the ecosystem level.

Table 8-2. Priority monitoring and research needs identified for the ecosystem level of the ecosystem diversity component of the South Dakota Wildlife Action Plan.

<table>
<tr><th>MONITORING</th><th>RESEARCH</th></tr>
<tr><td colspan="2">• Present a workshop to facilitate a consistent understanding of the SDWAP conservation strategy by SDGFP and partners to ensure monitoring and research efforts at the ecosystem level support implementation of the SDWAP.</td></tr>
<tr><td>• Work with partners to develop the monitoring criteria for determining whether conditions at a site meet the requirements for native ecosystem conditions to qualify toward representation goals.
• Work with partners to develop monitoring methods to help prioritize restoration opportunities relative to Conservation Opportunity Areas.</td><td>• Work with research partners to describe historical disturbance states for forest and riparian-wetland ecological sites.
• Work with research partners to improve existing and develop new tools and methodologies to restore native ecosystem diversity on all ecological sites.
• Work with research partners to evaluate restoration effectiveness and identify opportunities for improvement.</td></tr>
</table>

Additional examples of landscape- and ecosystem-level needs are presented in Table 8-3.

Table 8-3. Landscape- and ecosystem-level needs identified during the South Dakota Wildlife Action Plan revision.

Identified Need	Related Projects
Landscape Level	
• Monitor sagebrush habitats	• Wright, P. and D. Wegner. 2007. Mapping sagebrush for sage grouse habitat in Butte and Harding Counties, South Dakota. Bureau of Reclamation Technical Service Center Remote Sensing and GIS Group Technical Memorandum No. 86-68260-08-01. 35 pp.
• Survey remaining native prairie on a recurring basis	• Higgins, K. F., V. J. Smith, J. A. Jenks, J. J. Higgins, and G. A. Wolbrink. 2000. A provisional inventory of relict tallgrass prairie tracts remaining in eastern South Dakota. SD Agricultural Experiment Station Extension Circular EC912. South Dakota State University, Brookings.
Ecosystem Level	
• Map sagebrush habitat on private lands • Map sagebrush habitat in Fall River County • Determine quality of sagebrush • Monitor sagebrush habitats	• Wright, P. and D. Wegner. 2007. Mapping sagebrush for sage grouse habitat in Butte and Harding Counties, South Dakota. Bureau of Reclamation Technical Service Center Remote Sensing and GIS Group Technical Memorandum No. 86-68260-08-01. 35 pp. • Mergen, D. E., C. J. Corley, and S. Deisch. 2013. Past and recent vegetation conditions of sagebrush habitat and habitat of the greater sage-grouse (*Centrocercus urophasianus*) in western South Dakota. Final report to South Dakota Game, Fish and Parks. 110 pp.
• Update National Wetlands Inventory maps • Determine locations of springs • Map lakes and streams	• Lakes and streams mapped for SDWAP Revision
• Map riparian corridor habitats • Monitor riparian hardwood habitats • Survey woody habitat layer, including tree type, density, and average tree height • Outline and survey pine-juniper-mahogany habitat in the southern Black Hills • Survey Black Hills meadows, aspens, and conifers for associated wildlife species	• Swanson, D. L., J. S. Palmer, E. T. Liknes, and K. L. Dean. 2000. A breeding population of Virginia's Warblers in the southwestern Black Hills of South Dakota. Southwestern Naturalist 45:39-44. • Ervin, A. E. 2011. Habitat selection, nesting success and genetic structure of the American Three-toed Woodpecker in the Black Hills of South Dakota. Ph.D. dissertation, Univ. of South Dakota, Vermillion. 156 pp. • Rota, C. T., M. A. Rumble, J. J. Millspaugh, C. P. Lehman, and D. C. Kesler. 2014. Space-use and habitat associations of Black-backed Woodpeckers (*Picoides arcticus*) occupying recently disturbed forests in the Black Hills, South Dakota. Forest Ecology and Management 313:161-168. • South Dakota Department of Game, Fish and Parks. 2008. Private Lands Habitat & Access Programs Strategic Plan. South Dakota Department of Game, Fish and Parks, Wildlife Division – Habitat Section, Pierre. • Ley, M. J. 2012. Riparian forest vegetation patterns and historic channel dynamics of the Big Sioux River, South Dakota. M. S. Thesis, University of South Dakota, Vermillion. 185 pp. • Classification and mapping of riparian forest along the White River in South Dakota. SD State Wildlife Grant project T-50-R-1 (in progress).

Table 8-3 (continued). Landscape- and ecosystem-level needs identified during the South Dakota Wildlife Action Plan revision.

Ecosystem Level (continued)	
• Assess grassland habitats throughout the state during grassland bird migration and breeding seasons • Determine quality of untilled prairie • Determine minimum size of a "large" intact grassland habitat block for wildlife species in South Dakota	• Higgins, K. F., V. J. Smith, J. A. Jenks, J. J. Higgins, and G. A. Wolbrink. 2000. A provisional inventory of relict tallgrass prairie tracts remaining in eastern South Dakota. SD Agricultural Experiment Station Extension Circular EC912. South Dakota State University, Brookings. • Ryba, A. 2013. Catalog of map and spatial data products available from the Habitat and Population Evaluation Team (HAPET) Office to support conservation planning and management in the Northern Great Plains Joint Venture. U.S. Fish and Wildlife Service, HAPET, Bismarck, ND. • Mehl, C. A., J. B. Haufler, and S. Yeats. 2009. Native ecosystem diversity of the South Dakota Missouri Coteau. Ecosystem Management Research Institute, Seeley Lake, MT. • Stephens, S. E., J. A. Walker, A. J. Smith, and D. R. Blunck. 2007. Prioritizing grassland conservation on the Missouri Coteau of South Dakota. Final report to the South Dakota Department of Game, Fish and Parks. Ducks Unlimited, Bismarck, ND. • Marriott, H. 2012. Survey and mapping of Black Hills montane grasslands. Prepared for the South Dakota Department of Game, Fish and Parks. State Wildlife Grant T-45-R-1, CFDA #15-634. • Mapping and characterization of native grassland habitats in South Dakota's Prairie Coteau. SD State Wildlife Grant Project T-54-R-1 (in progress).

Adaptive Management

Adaptive management is a structured decision-making tool. Figure 8-1 illustrates the overall process. Figure 8-2 shows the iterative nature of adaptive management (Williams et al. 2009).

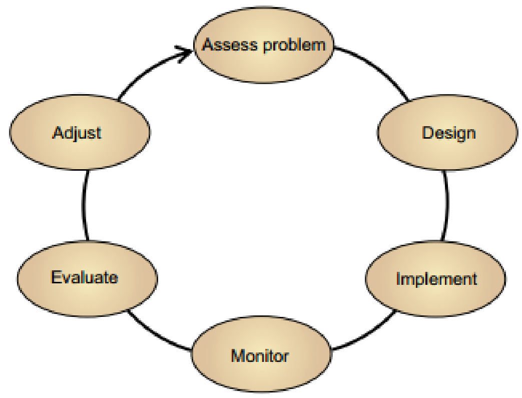


Figure 8-1. Adaptive management process (Williams et al. 2009).

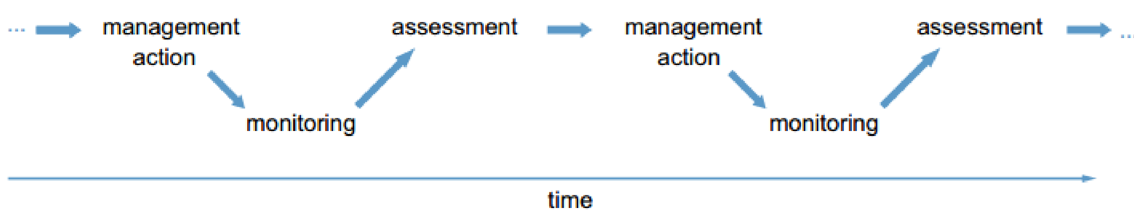


Figure 8-2. Iterative cycle of adaptive management process (Williams et al. 2009).

In short, adaptive management is not simply learning by doing or using trial and error. This tool incorporates stakeholder involvement, careful and specific objective setting, and testing models or hypotheses in a framework of learning and adapting. Key to the successful use of adaptive management is a commitment and capacity to implement the process through its possibly multiple cycles of taking a management action, monitoring the correct variables, reassessing the situation, and starting again with the next management action. This tool also depends on an agency's or institution's ability to deal with uncertainty and to cede some measure of control to the appropriate stakeholders. Not all natural resource issues lend themselves to this decision support tool. However, the development and imminent use of the Wildlife Tracking and Reporting Actions for the Conservation of Species (TRACS) system by the USFWS' Division of Wildlife and Sport Fish Program will elevate this issue within state fish and wildlife agencies. To date, the majority of South Dakota's State Wildlife Grant-funded projects have addressed information gaps at the species level, with limited numbers of projects that implemented and tested specific management actions. It is anticipated that future projects will more closely follow a more formal adaptive management framework.

Adaptive Management for Native Ecosystem Diversity

Because the dynamics of many ecosystems are not well understood, ecosystem level monitoring should be established in an adaptive management framework. Where possible, management actions selected to maintain or restore desired ecosystem conditions should be implemented in a planned, replicated design. For example, to obtain desired grassland community compositions and structures, treatments such as prescribed burning, seeding of native species, control of exotic species, and use of various grazing regimes might be utilized. If these can be applied in a replicated manner across different ecological sites, they can be monitored to determine if desired ecosystem conditions are achieved. Treatment combinations that are most effective can then be identified and prioritized for increased use in future treatments. State Game Production Areas and federal Waterfowl Production Areas are potential study sites for these treatment evaluations. Adaptive management helps address uncertainties by continually checking and evaluating the results of actions relative to the goals of the SDWAP and making the appropriate adjustments.

8.2 Monitoring and Research Needs for Aquatic Ecosystems

During the development of the Aquatic portion of the SDWAP, a lack of resources did not allow the development of a detailed monitoring, inventory, and research needs plan at the aquatic ecosystem level. Listed below are some future needs and a general framework for developing such a plan for future implementation. Due to limitations of both human and financial resources, there is a need for long-term monitoring systems that are strategically designed to evaluate responses of individual species as well as habitats and natural communities in response to impacts of conservation challenges (i.e. climate change and land conversion). As the framework described in this Plan is shared with and adopted by conservation partners and additional needed funding becomes available, these long-term monitoring needs at the aquatic ecosystem level can begin to be addressed.

High quality habitat is essential for healthy and productive fisheries and aquatic ecosystems. Degraded aquatic habitats, with associated problems such as low dissolved oxygen levels, extreme temperature fluctuations, high turbidity, undesirable substrate, and a lack of desirable aquatic vegetation negatively impact native species diversity and jeopardize the ability to provide quality fisheries.

Monitoring landscapes and natural communities occurs at two main levels: monitoring trends in distribution, abundance, status, and condition of individual communities and monitoring the response of communities to conservation actions (i.e. restoration and reintroduction efforts).

Monitoring trends within and among different habitat types can be used to detect impacts of landuse changes and help direct conservation actions within areas that show the largest declines and are in need of restoration, as well as areas that are most intact and in need of preservation.

The Great Plains Fish Habitat Partnership (GPFHP) began in 2007 as a coalition of interests concerned with the future of the rivers and streams of the northcentral United States and the species that rely on those habitats. This partnership addresses the loss of aquatic habitats and focuses on the conservation, restoration, and enhancement of quality and degraded habitats. SDGFP is a member of the GPFHP and plans to build on this partnership with future conservation, restoration, and enhancement needs to assimilate the best management practices to benefit various fish habitats and communities.

Ecoregion or Landscape Level Monitoring and Research

Monitoring ecosystem diversity at the landscape level involves tracking the amount of existing acres of high quality natural communities. There is a need to inventory priority landscapes and quality check COAs for quality examples of habitats for SGCN and natural communities. Identifying other occurrences of high quality habitats at the COA level (i.e. Aquatic Ecological System (AES-Level) and among existing COA sites will increase the efficiency of the efforts of the aquatic conservation strategy.

Ecosystem or Community Level Monitoring and Research

Monitoring documented occurrences of ecosystem diversity at the community level is currently incomplete. Future monitoring, inventory, and research efforts within aquatic ecosystems should:

- Develop partnerships with other governmental entities, NGOs and private citizens in future monitoring, inventory, and research efforts to maximize limited resources.
- Develop a classification system for identifying high-quality examples of various ecosystem diversity types (i.e. lakes, rivers, and streams).
- Work with partners to increase the understanding of ecological processes (i.e. grazing regimes, prescribed burning, and hydrology) and the ways best management practices on the landscape impact aquatic communities.
- Work with partners to identify ecosystem function thresholds and the ways impairment affects aquatic communities.
- Work with partners to develop habitat restoration strategies for communities and habitats for which there is the greatest need for restoration.

8.3. Monitoring, Inventory, and Research Programs and Needs for Wildlife

All potential wildlife habitats for the State of South Dakota have been mapped using the ecosystem diversity framework developed for the SDWAP. To meet the objectives of the SDWAP conservation strategy, future monitoring and research efforts related to individual wildlife species or groups conducted in the State should be reviewed for potential links to the ecosystem diversity framework identified. This includes studies to determine the habitat needs of any species. Specifically, this means identifying the ecological sites and disturbance states most likely to provide the beneficial habitat conditions for a targeted species. Developing this important link between ecosystem diversity and species diversity will be critical to determining whether the ecosystem diversity framework is adequate to ensure the needs of the vast majority of species in South Dakota as well as evaluating the adequacy of the representation goals identified. As with the landscape and ecosystem level, monitoring and research to link the ecosystem and species components of the SDWAP represent a new evaluation framework and process for SDGFP. Developing the specifics of these programs will be an important operational component for implementing the goals of the Plan. To facilitate this need, one or more workshops should be provided as needed to develop a coordinated and consistent understanding of the conservation strategy used in the SDWAP and the implications for existing and future monitoring and research programs in the State. The workshop should be made available to SDGFP employees as well as land management and research partners to ensure consistency of monitoring and research methods to support implementation of the SDWAP at the species level.

Various monitoring programs currently exist and will continue to be tracked for the information they provide on the status and population trends of species. For example, the annual North American Breeding Bird Survey provides standardized, long-term trend information for many species of birds. Other efforts are conducted at periodic intervals. A summary of current primarily species-level monitoring programs and additional pertinent monitoring efforts reported by cooperators is listed in Appendix E. Continuing to communicate and share results of these various monitoring and inventory efforts will enhance the understanding and documentation of the distribution and status of many of South Dakota's SGCN.

SWG funding has allowed SDGFP and its cooperators to conduct many needed studies and inventories on species, species groups, and wildlife habitats. SWG projects conducted or in progress to date are listed in Appendix F. Pertinent research and monitoring projects are listed in individual SGCN species profiles. Because of the unpredictable nature of SWG matching funds, these priorities will be evaluated regularly to prioritize future needs.

Many of the species included on the list of SGCN are also species monitored by the South Dakota Natural Heritage Program, which maintains a Natural Heritage Database as part of an international network coordinated by NatureServe. The database is a dynamic system of data and maps that is regularly revised and improved. South Dakota Natural Heritage Program staff periodically review the state heritage statuses of the plant and animal species monitored by the Natural Heritage Program. Such reviews provide additional priorities for future monitoring of SGCN.

A related task is the periodic review of the statuses of state threatened and endangered species, all of which are listed as SGCN. These related tasks, in addition to the conservation actions identified in the SDWAP's species accounts, will allow SDGFP to evaluate which specific inventory, monitoring, or conservation action items have been attempted. Since the majority of projects are likely to be conducted under the auspices of Federal Assistance (Wildlife and Sport Fish Restoration Programs and State Wildlife Grant Program) accountability will be directly related to whether project objectives have been met. SDGFP will regularly assess progress toward meeting the high-priority inventory needs and conservation actions lists at the species level.

A variety of research and monitoring needs identified at the species level are described in Appendices G-K. Common themes from the species-level needs assessments are listed below:

Inventories and Monitoring:

- Monitor species and ecosystems for exposure to exotic diseases and contaminants.

- Collect baseline data on aquatic and terrestrial species, associated habitat needs, and ecosystem diversity variables.
- Determine and implement survey protocols at various monitoring levels (ecosystem, habitat type and terrestrial or aquatic species group).
- Monitor typical land-use practices to determine impacts on plant composition, structure, and quality.
- Implement long-term monitoring at various levels, where possible, rather than more typical short-term efforts.
- Determine ways to address the lack of species or taxonomic experts for many invertebrate groups and understudied vertebrate groups.

Research:

- Determine limiting habitats for rare or isolated populations.
- Determine impacts of new land uses, such as wind energy facilities and associated infrastructure.
- Monitor impacts of habitat loss or encroachment due to conversion for various uses.
- Determine habitats needed for migrating birds.
- Define high-quality habitat types for species with similar requirements.
- For the rarest species, determine the season with the most limiting conditions that may affect expansion or recovery.
- Genetic variation studies on a variety of rare or marginal species.

Coordination:

- Raise public awareness about specific conservation challenges to take advantage of residents' demonstrated support for the importance of wildlife and habitat diversity to quality of life.
- Need for better coordination among agencies, tribes, NGOs, and individuals for work on shared priorities.
- Use captive propagation and release of terrestrial and aquatic species when and where appropriate.
- Periodic public opinion surveys needed to gauge support or concerns about emerging topics or long-standing conservation issues.
- Need for informational materials on nongame species to inform and educate cooperators and the general public.

Policy:

- Need for protection for nongame species that currently lack protection from unlimited exploitation.

Adaptive Management for Species Diversity

Management actions directed towards species, where feasible, should continue to be designed using an adaptive management framework. For many species, information on responses to many management actions remains largely unknown. How species respond to many practices designed to maintain or restore ecosystem diversity are often poorly documented. Monitoring, included as a component of overall conservation actions, will provide documentation of these responses. When treatments are designed with adaptive management in mind, new knowledge will be gained in a credible, scientific manner.

Adaptive Management for Wildlife Action Plan Revision

Since the initial sets of state and territorial Wildlife Action Plans were produced, several entities, particularly the Association of Fish and Wildlife Agencies, have attempted to provide guidance for making revisions as useful and consistent as possible. One such effort was mentioned earlier in this document (AFWA 2012). Appendix B describes how this Plan incorporated the voluntary guidance described in that publication.

A related effort by AFWA provided guidance to help evaluate the effectiveness of State Wildlife Grants in general, including Wildlife Action Plans (Figure 8-3; AFWA 2011). Although specific effectiveness measurements are still in development for this evaluation, the following summary touches on key Wildlife Action Plan elements.

- Wildlife Action Plan updated: South Dakota Wildlife Action Plan was updated during 2012 – 2014 with clearer priorities and more specific lists of habitat and species research and monitoring needs identified than in the original plan.
- Increased funding: All State Wildlife Grant funds allocated to South Dakota have been spent, with a large percentage of the nonfederal match provided by SDGFP Wildlife Division. This represents a significant amount of increased funding available for conservation in South Dakota.
- Direct agency action is more strategic. SDGFP Wildlife Diversity/Natural Heritage Program staff priorities are closely tied to Wildlife Action Plan implementation, particularly related to SGCN priorities.
- Improved federal and state policy environment for wildlife: There is improved leadership buy-in for wildlife diversity issues within SDGFP. Policy changes are more difficult to measure, although the SDGFP Commission has been more engaged with the SDWAP Revision than with the original plan.
- Other federal, state and private actions coordinated with wildlife needs: There is better recognition of the role of SGCN in state priorities and overall knowledge of the existence and purpose of the South Dakota Wildlife Action Plan.
- Development of more effective coalitions: South Dakota has experienced continued growth of the state Teaming with Wildlife Coalition and increased NGO interactions because of the availability of State Wildlife Grant funding to implement the state Wildlife Action Plan.
- Improved conservation capacity: The majority of South Dakota's State Wildlife Grant allocation has helped address threat reduction, restoration needs, and wildlife conservation. Less attention has been paid to habitat conservation and restoration to this point, although partnerships with universities and other agencies have increased and improved because of the availability of State Wildlife Grant funds and the opportunity to involve partners who

can provide the nonfederal match. We anticipate that these partnerships will continue to improve with implementation of the revised plan.

SDGFP will continue to monitor the development of effectiveness measurement tools related to specific State Wildlife Grant projects and the overall planning effort represented by the Wildlife Action Plan.

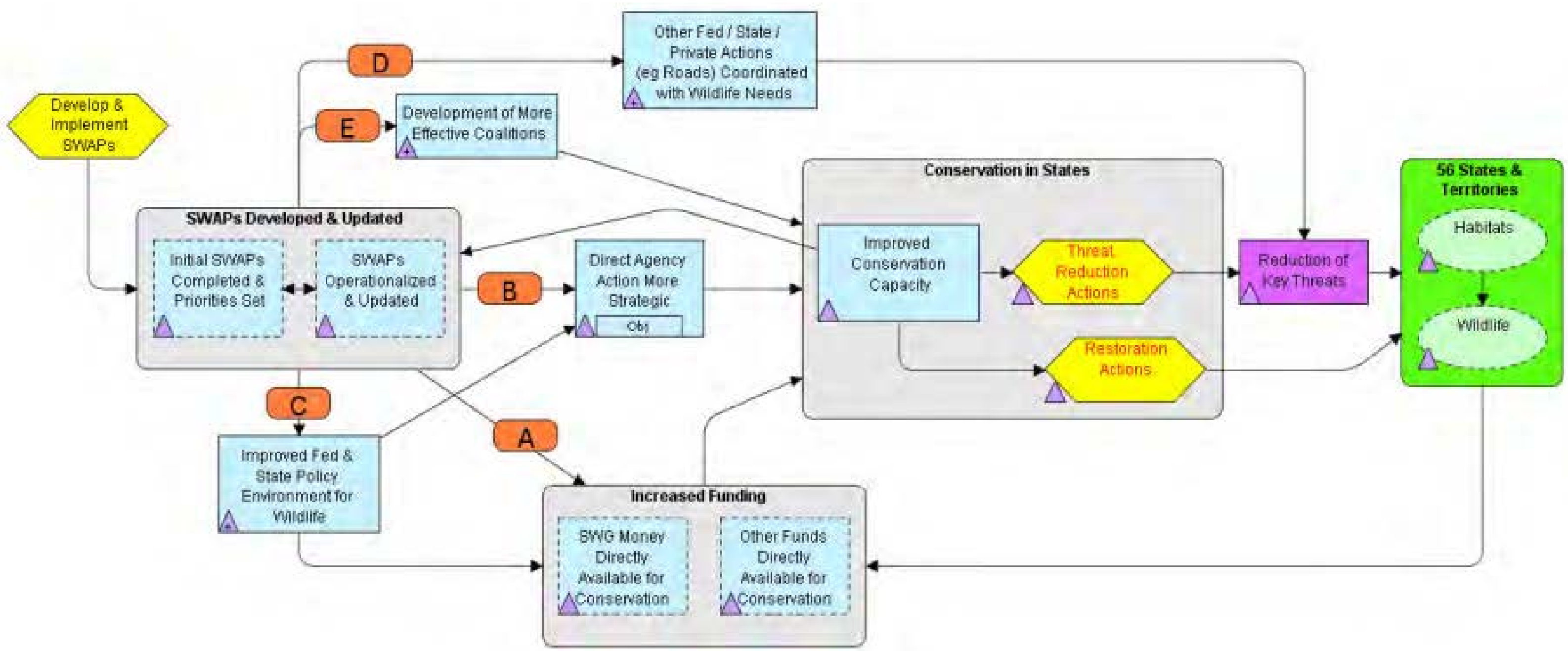


Figure 8-3. Overall results chain and indicators for State Wildlife Action Plan effectiveness (AFWA 2011).

CHAPTER 9 REVIEW SCHEDULE AND GENERAL FRAMEWORK

Because the majority of SWG projects are multi-year efforts, SDGFP will conduct a biennial review of progress in completing projects and summarize the results of this review. These results will be shared with cooperators, with regular opportunities to provide input on additional project priorities.

SDGFP will review and revise the SDWAP at 10-year intervals, with specific attention to whether the highest Plan priorities have been addressed, and if they have not been addressed, will attempt to determine the reasons they have not. In the case of emerging issues, SDGFP will coordinate with the USFWS Region 6 Office to determine the best course of action regarding this Plan.

SDGFP will follow the overall public involvement model used during the 2014 Plan preparation for soliciting agency, tribal, and public input. Prior to beginning the next revision, SDGFP will explore additional methods to engage tribes and other natural resource agencies. SDGFP will solicit specific suggestions from agency, tribal, and NGO partners for their preferred methods of involvement in the Plan revision. SDGFP will also evaluate the applicability of public involvement strategies that have been effective tools for specific issues, such as Aquatic Invasive Species. SDGFP will conduct periodic public attitude surveys to continue monitoring the public's awareness and level of support for rare species and ecosystem values. SDGFP will continue to use its website as a communication tool in explaining the Plan's purpose, related activities such as SWG projects and Teaming with Wildlife, and refining the web-based tools developed for the 2014 Plan.

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Appendix A. South Dakota Game, Fish and Parks letter of intent to revise South Dakota Wildlife Action Plan and U.S. Fish and Wildlife Service response letter.

SOUTH DAKOTA Game, Fish & Parks

DEPARTMENT OF GAME, FISH, AND PARKS
Foss Building
523 East Capitol
Pierre, South Dakota 57501-3182

August 11, 2010

David MacGillivray
U.S. Fish and Wildlife Service
Chief, Wildlife and Sport Fish Restoration Program
Denver Federal Center
PO Box 25486
Denver, CO 80225-0486

Dear Mr. MacGillivray,

I am writing to inform you that our agency intends to begin the process of revising the South Dakota Wildlife Action Plan during the fall of 2010. We are currently finalizing the proposal to be submitted as a planning grant for State Wildlife Grants matching funds at a 75% federal cost share.

Since we intend to review and potentially revise our list of species of greatest conservation need, we consider this to be a major revision. We are familiar with and following the "Guidance for Wildlife Action Plan Review and Revisions" prepared by the Service and the Association of Fish and Wildlife Agencies.

We look forward to working with the Service on this important conservation planning instrument.

Sincerely,

Jeffrey R. Vonk,
Department Secretary
SD Department of Game, Fish, and Parks

cc: Scott Larson, USFWS, Pierre, SD; Nora Kohlenberg, SDGFP, Pierre, SD; Tony Leif, SDGFP, Pierre, SD

Office of Secretary: 605.773.3718 Wildlife Division: 605.223.7660 Parks/Recreation Division: 605.773.3391 FAX: 605.773.6245
TTY: 605.223.7684

Appendix A (continued). South Dakota Game, Fish and Parks letter of intent to revise South Dakota Wildlife Action Plan and U.S. Fish and Wildlife Service response letter.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mountain-Prairie Region

IN REPLY REFER TO:
WSFR/FWS/R6

MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225-0486

STREET LOCATION:
134 Union Blvd.
Lakewood, Colorado 80228-1807

AUG 19 2010

AUG 2010
RECEIVED
Dept. of Game, Fish & Parks
Pierre, SD 57501

Jeffrey R. Vonk, Department Secretary
South Dakota Department of Game, Fish, and Parks
Foss Building
523 East Capitol
Pierre, South Dakota 57501-3182

Dear Mr. Vonk:

Thank you for your letter of August 11, 2010, alerting us to your intention to complete a major revision to your State Wildlife Action Plan (SWAP). Evaluation and update of the lists of Species of Greatest Conservation Need should strengthen the SWAP and define the focus of cooperative efforts to conserve and manage all of South Dakota's wildlife.

As a reminder, the July 12, 2007, "Guidance for Wildlife Action Plan Review and Revision" (Guidance), copy enclosed, requires that a state implementing a major revision prior to the planned review/revision date must submit a modified SWAP which includes:

- Summary of all significant revisions;
- Documentation describing how the revision meets the required Eight Elements, including an up-to-date public review process specified in Elements 7 and 8; and
- A "road map" to locate revisions in the SWAP.

The Guidance also encourages posting an electronic version of the SWAP on the Web with the summary of significant changes and a "road map."

Appendix A (continued). South Dakota Game, Fish and Parks letter of intent to revise South Dakota Wildlife Action Plan and U.S. Fish and Wildlife Service response letter.

Jeffrey R. Vonk, Department Secretary

Please periodically keep us apprised of your progress and all meeting and workshops. We look forward to receiving the revised draft SWAP in the fall of 2010. At that time the U. S. Fish and Wildlife Service (Service) Regional Review Team (RRT) will review the SWAP with input from our office. The RRT will determine whether the revision is approvable and provide a letter to the State Director with documentation of the decision. If it is determined that the revision is not approvable, the letter will include a description of any required actions. State Directors can appeal to the Service Regional Director

We appreciate your continuing attention to South Dakota's natural resources and look forward to working with you on the revision to your SWAP. If you have any questions, please feel free to contact me at (303) 236-4411 or Connie Young-Dubovsky at (303) 236-8179.

Sincerely,

David McGillivary
Chief, Division of Wildlife and Sport Fish Restoration

Enclosure

Appendix B. Summary of suggestions from Association of Fish and Wildlife Agencies (AFWA 2012) incorporated into the South Dakota Wildlife Action Plan Revision.

Chapter 1 – Prioritization

- recommendation to use NatureServe methodology to assess extinction risk
- include geographically-isolated subspecies
- update species of greatest conservation need list early in the revision process
- establish clear conservation goals
- group species by habitat
- emphasize coarse-scale biodiversity
- consider the proportion of the species' range that occurs within the state

Chapter 2 – Species and Habitats

- identify conservation opportunity areas
- incorporate information other conservation planning efforts with compatible goals
- clearly describe the purpose and intended uses of maps
- use ecological boundaries
- use models to describe future changes, rather than only describing the current situation
- use point data in addition to species distribution prediction tools, such as GAP models
- use classification systems that facilitate regional and national integration
- maintain flexibility in modeling methodology
- use accepted vegetation classification standards for terrestrial and aquatic habitats
- use accepted or official taxonomic standards for species

Chapter 3 – Threats and Conservation Actions

- conduct a climate change vulnerability assessment
- link climate change to priority actions
- work with regional partners to use climate assessment information

These suggestions should be considered for future plan revisions:

- include climate change impacts as criteria for selecting and prioritizing species of greatest conservation need
- use a classification system to describe conservation projects and to prioritize and categorize conservation actions
- define metrics to measure the effectiveness of conservation actions

Appendix B (continued). Summary of suggestion in AFWA 2012 incorporated into South Dakota Wildlife Action Plan revision

Chapter 4 – Monitoring

- use scientifically sound monitoring protocols
- assess population, habitats and effectiveness at multiple scales; collaborate in established, long-term monitoring efforts
- participate in alliances such as LCCs and regional wildlife agency associations
- use TRACS auxiliary tools, once they are available

These suggestions should be considered for future plan revisions:

- develop new citizen science programs to augment monitoring
- specify assessable objectives for each conservation action

Chapter 5 – Review and Revision

- use internet as a tool to allow review of drafts and viewing completed WAP
- scale level of partner participation to the type of revision
- use partner newsletters to feature revision updates
- include “how to use this document” section, organized by user type
- use web links for entire document plus segmented version with documents and tools that are easily updated
- provide GIS portal for accessing and downloading data (in development)
- provide hard copies to state libraries (in development)
- create short, condensed version (in development)

Chapter 6 – Partnerships and Public Participation

- identify overlapping priorities
- cultivate partnerships with NRCS and LCCs
- work with neighboring states with common species of greatest conservation need
- coordinate across jurisdictional boundaries; work with international conservation organizations
- interact with state Teaming with Wildlife Coalition
- develop a communications plan
- use a team approach to develop models and maps
- define objectives for public involvement process and relate them to the plan’s methodology
- follow the state’s public notification and comment process
- notify the public of the intent to revise the WAP early in the process
- provide 30-60 days to comment on the WAP
- develop public involvement strategies, such as events, electronic media and public opinion data collection
- document processes used and consideration of comments received
- file and archive all comments received
- emphasize the voluntary nature of the WAP

This suggestion should be considered for future plan revisions:

- follow Collaborative Conservation Model

Appendix C. Species profiles for species of greatest conservation need.

Terrestrial Species of Greatest Conservation Need

Information on each species can be found in the order listed.

Birds

American Dipper
American Three-toed Woodpecker
American White Pelican
Baird's Sparrow
Bald Eagle
Black Tern
Black-backed Woodpecker
Burrowing Owl
Chestnut-collared Longspur
Ferruginous Hawk
Greater Prairie-Chicken
Greater Sage-Grouse
Interior Least Tern
Lark Bunting
Le Conte's Sparrow
Lewis's Woodpecker
Long-billed Curlew
Marbled Godwit
Northern Goshawk
Osprey
Peregrine Falcon
Piping Plover
Ruffed Grouse
Sprague's Pipit
Trumpeter Swan
White-winged Junco
Whooping Crane
Willet
Wilson's Phalarope

Mammals

Black-footed Ferret
Black Hills Red Squirrel
Franklin's Ground Squirrel
Fringe-tailed Myotis
Northern Flying Squirrel
Northern Myotis

Mammals continued

Northern River Otter
Richardson's Ground Squirrel
Silver-haired Bat
Swift Fox
Townsend's Big-eared Bat

Reptiles and Amphibians

Black Hills Redbelly Snake
Blanchard's Cricket Frog
Cope's Gray Treefrog
Eastern Hognose Snake
False Map Turtle
Lesser Earless Lizard
Lined Snake
Many-lined Skink
Sagebrush Lizard
Short-horned Lizard
Smooth Softshell
Western (Ornate) Box Turtle

Terrestrial Insects

American Burying Beetle
Dakota Skipper
Great Plains Tiger Beetle
Indian Creek Tiger Beetle
Iowa Skipper
Little White Tiger Beetle
Northern Sandy Tiger Beetle
Ottoe Skipper
Pahasapa Fritillary
Poweshiek Skipperling
Regal Fritillary

Gastropods

Dakota Vertigo
Frigid Ambersnail
Mystery Vertigo

Aquatic Species of Greatest Conservation Need

Information on each species can be found in the order listed.

Fishes

Banded Killifish
Blacknose Shiner
Blackside Darter
Blue Sucker
Carmine Shiner
Central Mudminnow
Finescale Dace
Hornyhead Chub
Lake Chub
Logperch
Longnose Sucker
Mountain Sucker
Northern Pearl Dace
Northern Redbelly Dace
Pallid Sturgeon
Shovelnose Sturgeon
Sicklefin Chub
Southern Redbelly Dace
Sturgeon Chub
Topeka Shiner
Trout-Perch

Freshwater Mussels

Creek Heelsplitter
Elktoe
Hickorynut

Higgins Eye
Mapleleaf
Pimpleback
Rock Pocketbook
Scaleshell
Yellow Sandshell

Aquatic Insects

Analetris eximia (A Mayfly)
Dakota Stonefly
Dot-winged Baskettail
Elusive Clubtail

Map legend (for more information, see Figure 2-1)

Summer

Migration

Winter

Year Round

Aquatic SGCN

Confirmed

Probable

Historic

Current

American Dipper | AMDI | *Cinclus mexicanus*

Description:

Small, stocky, dark grey bird and exhibits a characteristic bobbing motion when it moves.

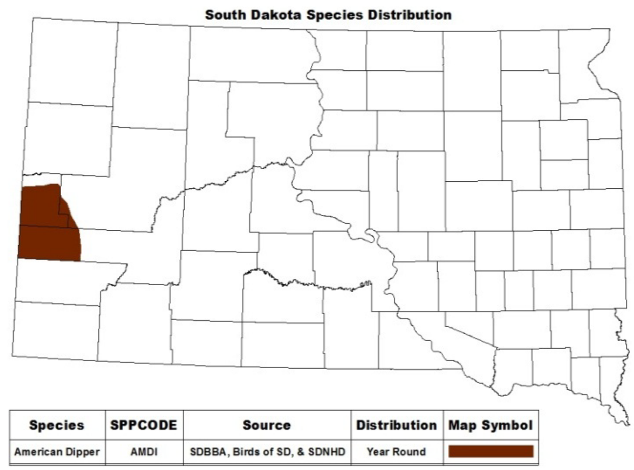
Protection Status:

Federal: None

State: Threatened

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout MLRA 62 but today its distribution is limited to the northern portion of its former range - see distribution map on right.



Key Habitat:

Prefers clean, cold, fast flowing mountain streams with abundant aquatic insects.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: Water quality impacts from road building, logging steep slopes adjacent to streams, and pollution from mining, septic tanks, and other sources; reduced release of water from large dams can cause stream to freeze over in winter, resulting in no open water for foraging; reduced stream flows from diversion for irrigation, community water, groundwater wells, or other human-uses; nest-site disturbance due to trail development and other recreational activities adjacent to streams

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: Work with agencies and landowners to protect riparian areas from erratic water levels, erosion, and chemical pollution; develop programs and materials to protect nest sites from disturbance; and investigate genetic diversity of the population

Current Monitoring & Inventory (Appendix E):

Periodic population monitoring

SWG Accomplishments (Appendix F):

Monitoring American dippers in the Black Hills (T-17C)

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Continue to document sightings of color-marked birds

Identify critical wintering areas

Monitor breeding success

Existing Recovery Plans/Conservation Strategies:

Backlund, D. 2005. The American Dipper, *Cinclus mexicanus*, in the Black Hills of South Dakota: Past and Present. South Dakota Dept. of Game, Fish, and Parks.

American Three-toed Woodpecker | ATTW | *Picoides tridactylus*

Description:

Medium-sized woodpecker with a mostly black back and white throat, breast and belly.

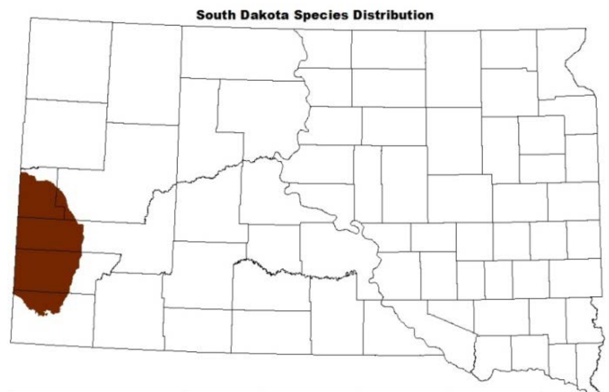
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout MLRAs 61 and 62. See map on right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
American Three-toed Woodpecker	ATTW	SDBBA & SDNHD	Year Round	

Key Habitat:

Prefers spruce forests particularly where dead timber remains after fires; nests in cavities of large dead trees.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: none identified

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-Habitat: Develop programs and educational materials about the role of natural disturbance regimes in maintaining habitat for this species

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

Integrated Monitoring in Bird Conservation Regions

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Biology of American three-toed woodpeckers in the Black Hills (T-18)

Priority Research & Monitoring (Appendices G-K):

Habitat surveys of Black Hills meadows, aspen and conifers

Develop and implement appropriate monitoring techniques

Response to mountain pine beetle infestations

Genetic research on population isolation potential

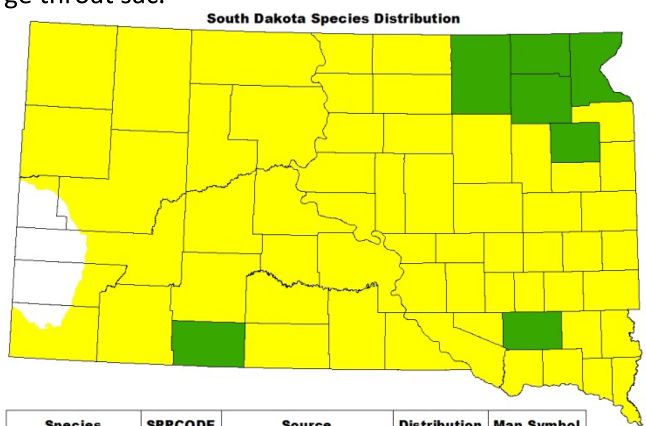
Existing Recovery Plans/Conservation Strategies:

Wiggins, D. (2004, July 1). American Three-toed Woodpecker (*Picoides dorsalis*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available online: http://www.fs.fed.us/r2/projects/scp/assessments/americanthreetoedwoodpecker.pdf

American White Pelican — AWPE — *Pelecanus erythrorhynchos*

Description:

Large, white bird with long flat bill and large throat sac.



Species	SPPCODE	Source	Distribution	Map Symbol
American White Pelican	AWPE	SDBBA, Birds of SD, & SDNHD	Summer	
			Migration	

Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat associated with the Missouri River system before impoundment as well as a few other large, shallow water bodies in the state. See map at right for current distribution.

Key Habitat:

Preferred foraging habitat includes open, shallow lakes with abundant fish and amphibian populations and adjacent loafing sites; nesting and loafing sites are flat, barren, earthen islands in lakes, occasionally in rivers, protected from mammalian predators.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: Diseases; low number of colonies in state; dams/impoundments on rivers and lakes have changed natural water levels eliminating water barriers to predation and flooding nest sites; nest site disturbance from recreational use; pesticides; and illegal shooting

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels near habitat; develop programs and materials to educate the public on appropriate activities near nesting sites or in some instances, protect nesting sites using fencing, postings, etc.; develop programs and materials to reduce illegal shooting; monitor the incidence of disease in nesting colonies; monitor water quality near nesting colonies; conduct research on foraging habitats and impacts on local fisheries; investigate seasonal abandonment of nesting colonies in the northern Great Plains; and investigate the impacts of West Nile Virus

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

SWG Accomplishments (Appendix F):

Exploration of factors that influence productivity of American white pelicans at Bitter Lake in northeastern South Dakota (T-27)

Statewide colonial and semi-colonial waterbird inventory (T-16)

Colonial and semi-colonial waterbird monitoring (T-52)

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Determine factors that may contribute to poor survival; analyze chick mortalities for contaminants

Establish monitoring program for large colonies, in association with fish contaminant monitoring and pelican disease monitoring

Baird's Sparrow | BAIS | *Ammodramus bairdii*

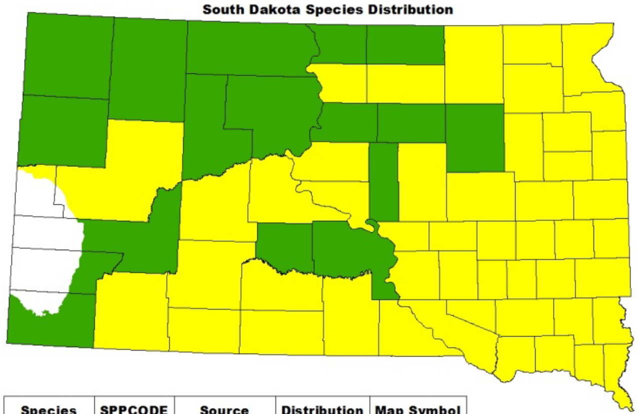
Description:
Small, brown bird with a tan face and prominent dark spot on the upper rear of the ear coverts.

Protection Status:

Federal: None
State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout South Dakota with the exception of MLRAs 61 and 62. See the map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Bairds Sparrow	BAIS	SDBBA & SDNHD	Summer	
		Birds of SD	Migration	

Key Habitat:

Prefers lightly grazed native grass ecosystems and wetland meadows with low shrub cover and little woody vegetation.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: draining of wet meadows; nest parasitism by Brown-headed Cowbirds

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-Habitat: Develop programs and educational materials about the role of natural disturbance regimes in maintaining habitat for this species

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Map and assess quality of native prairie on a recurring basis

Map Grassland Bird Conservation Areas in western South Dakota

Assess grassland habitat during migration and breeding season

Existing Recovery Plans/Conservation Strategies:

Wiggins, D.A. (2006, June 9). Baird's Sparrow (*Ammodramus bairdii*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/bairdssparrow.pdf

Bald Eagle | BAEA | *Haliaeetus leucocephalus*

Description:

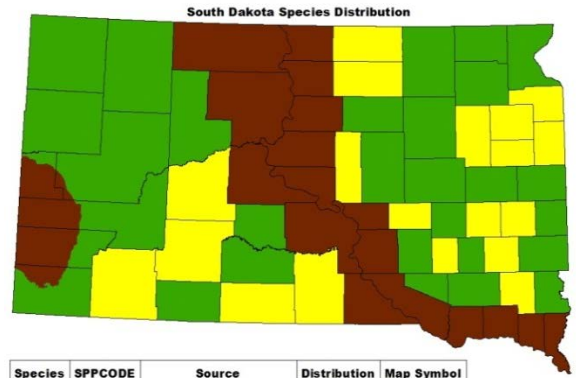
Very large bird of prey with a dark back and undersides. Adults also have a characteristic white head and tail.

Protection Status:

Federal: None

State: Threatened

Distribution:



Species	SPPCODE	Source	Distribution	Map Symbol
Bald Eagle	BAEA	SDGFP, SDNHD, Expert Opinion	Summer	
			Migration	
			Year Round	

Key Habitat:

Usually found near (within 4 km) water – rivers, lakes, reservoirs; large cottonwood trees used for nesting and roosting; requires large area of clear surface water for feeding.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: Removal of nesting and roosting trees near water bodies; decreasing food supply due to over-harvesting of fish and waterfowl by humans; water quality impacts, and/or food chain disruption by exotic species; chronic disturbance by humans or pets, particularly near nest-sites and communal roosts; biocide contamination of food supply; and illegal shooting

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels near habitat; develop programs and materials to educate the public on appropriate activities near nesting sites; and develop programs and materials to reduce illegal shooting

Current Monitoring & Inventory Programs (Appendix E):

Bald eagle midwinter survey

Bald eagle nest surveys

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Document causes of mortality

Map and monitor riparian corridor habitats

Existing Recovery Plans/Conservation Strategies:

1) South Dakota Game, Fish and Parks. 2005. South Dakota Bald Eagle (*Haliaeetus leucocephalus*) Management Plan. Available online: http://gfp.sd.gov/wildlife/docs/bald-eagle-plan.pdf; 2) U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines. 23 pp.

Black Tern | BLTE | *Chlidonias niger*

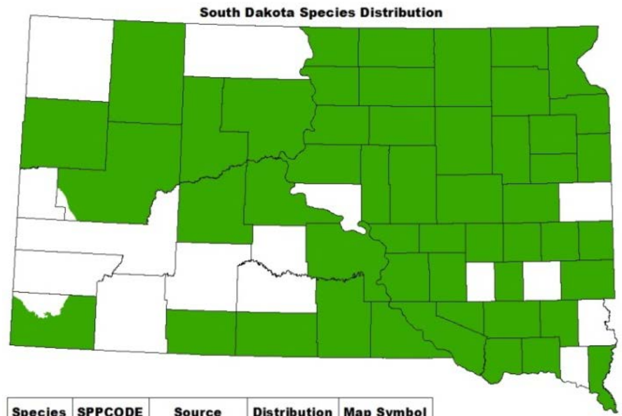
Description:
Small tern with a dark, sooty gray body.

Protection Status:

Federal: None

State: None

Distribution:



Species	SPPCODE	Source	Distribution	Map Symbol
Black Tern	BLTE	SDBBA & SDNHD	Summer	

Key Habitat:

Prefers marshes, sloughs, rivers, lakeshores, wet meadows with a mixture of emergent vegetation and open water; nests on floating plant matter.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: water level manipulations that flood nests or make them vulnerable to predation; nest depredation; pesticides/herbicides

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and industry to maintain water quality by reducing soil erosion and reducing chemical use near habitat; maintain stable water levels in nesting colonies during nesting season; develop educational programs and post signs to protect nesting sites from disturbance.

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Statewide colonial and semi-colonial waterbird inventory (T-16)

Colonial and semi-colonial waterbird monitoring (T-52)

Priority Research & Monitoring Needs (Appendices G-K):

Periodically monitor colonial waterbird populations

Monitor impacts of tile drainage

Investigate impact of narrowleaf cattail and hybrid species

Existing Recovery Plans/Conservation Strategies:

1) Shuford, W.D. 1999. Status assessment and conservation plan for the black tern (*Chlidonias niger surinamensis*) in North America. US Dept. of Interior, Fish and Wildlife Service, Denver, Co.; 2) Naugle, D.E. 2004. Black Tern (*Chlidonias niger surinamensis*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/blacktern.pdf.

Black-backed Woodpecker BBWO *Picoides arcticus*

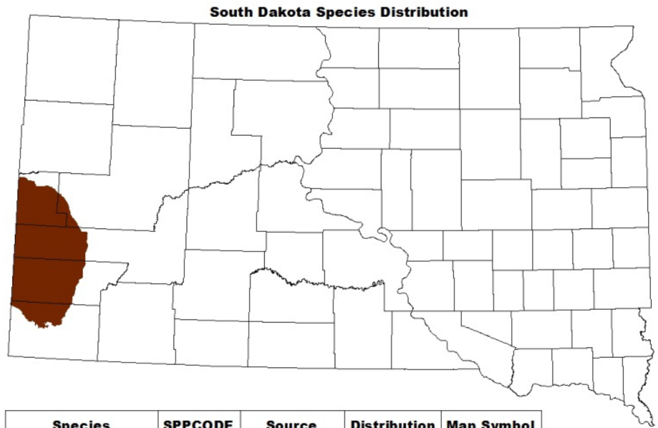
Description:

Medium-sized woodpecker with a solid black back and barred sides. Males also have yellow cap.

Protection Status:

Federal: None

State: None



Species	SPPCODE	Source	Distribution	Map Symbol
Black-backed Woodpecker	BBWO	SDBBA & SDNHD	Year Round	

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 61 and 62. See the map at right for current distribution.

Key Habitat:

Prefers post-burn forests with high densities of small trees for feeding; nests in excavated cavity of dead, medium to large-sized tree, or live tree with dead heartwood.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: none

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-Habitat: Develop programs and educational materials about the role of natural disturbance, including historical fire regimes, in maintaining habitat for this species

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

Integrated Monitoring in Bird Conservation Regions

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Black-backed and Lewis's woodpeckers responses to fire; can post-burn use be predicted using pre-burn forest structure variables? (T-3)

Importance of mountain pine beetle infestations and fire as black-backed woodpecker habitat in the Black Hills, South Dakota (T-39)

Priority Research & Monitoring Needs (Appendices G-K):

Continue investigation of mountain pine beetle infestations to black-backed woodpecker home range configurations, foraging patterns and mortality

Habitat surveys of Black Hills meadows, aspen and conifers

Determine relationship between summer prescribed fire, timing of wildfires and black-backed woodpecker habitat

Burrowing Owl | BUOW | *Athene cunicularia*

Description:
Small, ground dwelling owl with long legs, white chin stripe, round head, and stubby tail.

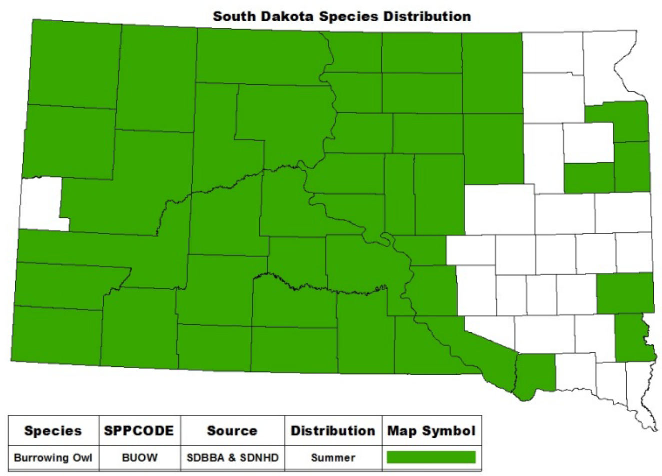
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout South Dakota where prairie dogs and ground squirrels occurred. See map at right for current distribution.



Key Habitat:

Live in colonies using burrows excavated by black-tailed prairie dogs or ground squirrels for cover; prefer burrows in heavily grazed grass ecosystems that provide good horizontal visibility; forage in grass ecosystems with low to moderate grass cover to aid in prey detection.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: elevated structures such as fence posts and utility poles may provide a hunting advantage to avian predators; nest depredation; vehicle collisions

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and landowners to reduce the use of pesticides and poisons to control burrowing mammals in Burrowing Owl habitat

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

Black-tailed prairie dog surveys

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Does prairie dog colony size matter? Implications for conservation of grassland biota in SD (T-23)

Burrowing owl distribution in western South Dakota (T-2-5)

Priority Research & Monitoring Needs (Appendices G-K):

Continue to determine habitat requirements and habitat trends

Existing Recovery Plans/Conservation Strategies:

Klute, D.S., L.W. Ayers, M.T. Green, W.H. Howe, S.L. Jones, J.A. Shaffer, S.R. Sheffield, and T.S. Zimmerman. 2003. Protection Status Assessment and Conservation Plan for the Western Burrowing Owl in the United States. U.S. Department of the Interior; Fish and Wildlife Service, Biological Technical Publication FWS/BTP-R6001-2003, Washington, D.C.

Chestnut-collared Longspur   CCLO   *Calcarius ornatus*

Description:

Sparrow-sized bird with black underparts and white on face and wings.

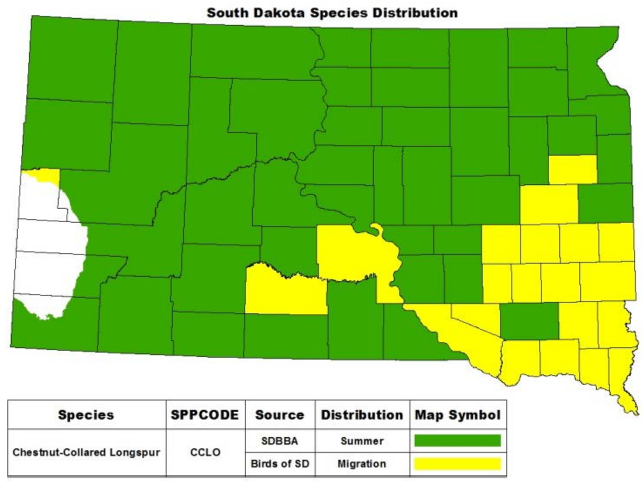
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout South Dakota with the exception of MLRAs 61 and 62. See map at right for current distribution.



Key Habitat:

Prefers heterogeneous grazed cover of short and mid-statured grasses, particularly bunchgrasses; avoids shrubby areas; avoids areas with dense litter accumulation.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5; woody plant encroachment; habitat fragmentation

Non-habitat: nest depredation; pesticides/herbicides

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and landowners to reduce the use of pesticides and herbicides in habitat; develop programs and educational materials about the role of natural disturbance regimes in maintaining habitat for this species

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Assess grassland habitat during migration and breeding season

Map Grassland Bird Conservation Areas in western South Dakota

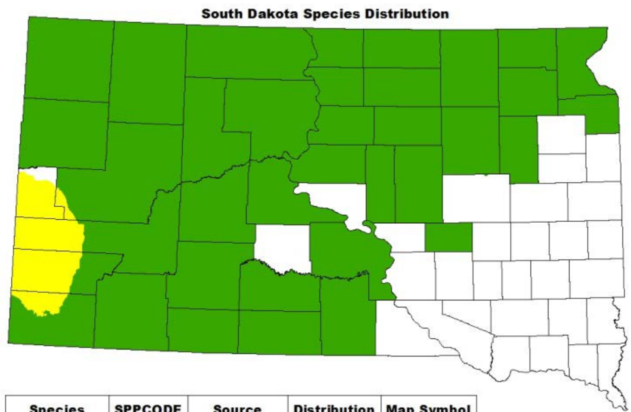
Compare nest success between native and "tame" grasslands

Identify core areas with highest population densities

Continue participation in Saltillo Grasslands, Mexico habitat protection program through Southern Wings partnership

Ferruginous Hawk FEHA *Buteo regalis*

Description:
Medium-large bird of prey; rusty brown on the upper parts and pale on the head, neck, and underparts with rust on the legs; upper wings are grey.



Species	SPPCODE	Source	Distribution	Map Symbol
Ferruginous Hawk	FEHA	SDBBA & SDNHD	Summer	
			Migration	

Protection Status:

Federal: None

State: None

Distribution:

Information on the historical distribution of this species is currently lacking but is believed to have primarily occurred as breeding populations in all but MLRAs 61, 62, 102B and 102C. May have also been migratory throughout the state. See map at right for current distribution.

Key Habitat:

Prefers a diversity of grass/shrub ecosystem structures supporting a diversity and abundance of prey such as ground squirrels, jackrabbits and prairie dogs; forages in open, short-statured grass/shrub ecosystems; nests within a short distance of abundant prey sources; prefers to nest in trees but will also nest in shrubs and in tall, clumpy grasses on the ground.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: human disturbance near nest sites; illegal shooting; poisoning of prey base

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and the public to minimize disturbance in key nesting habitat; reduce illegal shooting; work with agencies and landowners to reduce the use of poisons to control prey species

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

Various inventories of nesting and wintering raptors

Video camera surveys to document prey selection

SWG Accomplishments (Appendix F):

Breeding ecology of ferruginous hawks and golden eagles in northcentral and western SD (T-58)

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Map Grassland Bird Conservation Areas in western South Dakota

Identify critical habitats and prey preferences

Research the effects of lead and other contaminants in the ecosystem to raptor populations

Continue participation in Saltillo Grasslands, Mexico habitat protection program through Southern Wings partnership

Greater Prairie-Chicken GRPC *Tympanuchus cupido*

Description:

Medium sized grouse with a short dark rounded tail and feathered toes.

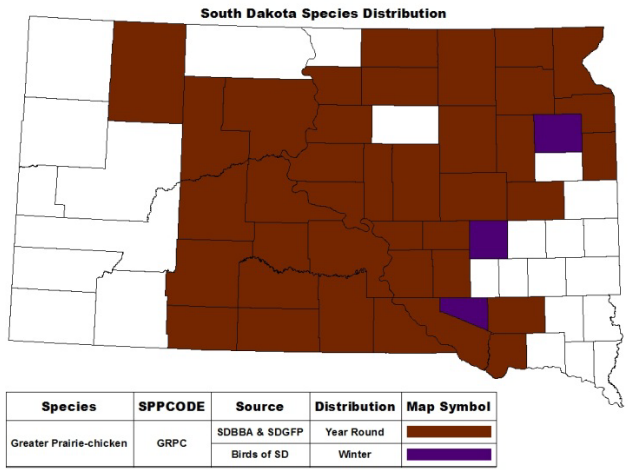
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout South Dakota with the possible exception of MLRA 62. See map at right for current distribution.



Key Habitat:

Requires a diversity of grass ecosystem structural conditions depending on breeding, foraging, or nesting activities; leks require open short-statured grass conditions, nest sites require mid-to tall stature grass ecosystems, and foraging habitat appears to be characterized by a diversity of grass structural stages that maximize insect production including wet meadows.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: insecticide use may decrease the availability of insects to young birds; introduced diseases such as West Nile Virus

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and landowners to reduce pesticide/herbicide use in habitat

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

Spring lek survey

Harvest survey; wing collection to estimate hatching dates

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Distribution and lek locations of Greater Prairie-Chickens and Sharp-tailed Grouse outside of their traditional range in South Dakota (T-2-7)

Priority Research & Monitoring Needs (Appendices G-K)

Determine minimum size of habitat block needed

Map Grassland Bird Conservation Areas in western South Dakota

Compare nest success between native and "tame" grasslands

Existing Recovery Plans/Conservation Strategies:

1) Robb, L.A. and M.A. Schroeder. (2005, April 15). Greater Prairie-Chicken (*Tympanuchus cupido*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/greaterprairiechicken.pdf; 2) SD Game, Fish and Parks. 2011. Prairie Grouse Management Plan for South Dakota 2011-2015. 26 pp; 3) Vodehnal, W. L., and J. B. Haufler, Compilers. 2007. A grassland conservation plan for prairie grouse. North American Grouse Partnership. Fruita, CO.

Greater Sage-Grouse | SAGR | *Centrocercus urophasianus*

Description:

Largest of the North American grouse species; gray with a blackish belly.

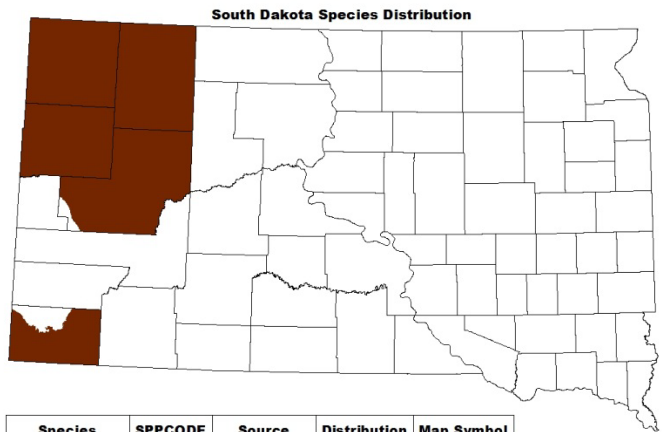
Protection Status:

Federal: Candidate

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 58D, 60A, and 61, and possibly the very western portions of 54, 63A, and 64. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Greater Sage-Grouse	SAGR	SDBBA & SDGFP	Year Round	

Key Habitat:

Prefers a diversity of sagebrush-grass ecosystem structural conditions depending on breeding, foraging, or nesting activities; leks require open short-statured grass conditions, nest sites require mid-to tall stature sagebrush-grass ecosystems, and foraging habitat appears to be characterized by a diversity of grass structural stages that maximize insect production including wet meadows.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: collision with fences and powerlines; introduced diseases such as West Nile Virus; presence of elevated structures such as power poles that provide birds of prey with a hunting advantage

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop strategies to reduce the risk of collisions with utility lines and fences; work with agencies and landowners to reduce the presence of elevated structures that provide birds of prey with a hunting advantage

Current Monitoring & Inventory (Appendix E):

Lek surveys and inventories

Hunter harvest survey

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Mapping big sagebrush vegetation in western South Dakota (T-29)

Past and current vegetation conditions of core sagebrush habitat and leks of greater sage-grouse (*Centrocercus urophasianus*) at the easternmost extent of its range in western SD (T-51)

Priority Research & Monitoring Needs (Appendices G-K):

Map, characterize and monitor sagebrush habitat

Identify and monitor sites in Fall River County with suitable lek, nesting, brood-rearing, and winter habitat

Identify sites for sagebrush restoration

Determine effects of livestock grazing on sagebrush habitat

Existing Recovery Plans/Conservation Strategies:

1) U.S. Fish and Wildlife Service. 2013. Greater Sage-Grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report. U.S. Fish and Wildlife Service, Denver, CO.; 2) Stiver, S.J., A.D. Apa, J.R. Bohne, S.D. Bunnell, P.A. Deibert, S.C. Gardner, M.A. Hilliard, C.W. McCarthy, and M.A. Schroeder. 2006. Greater Sage-grouse Comprehensive Conservation Strategy. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, Wyoming; 3) Greater Sage-Grouse Management Plan, South Dakota, 2008-2017. South Dakota Dept. of Game, Fish and Parks (http://gfp.sd.gov/wildlife/docs/sage-grouse-management-plan.pdf).

Interior Least Tern LETE *Sternula antillarum athalassos*

Description:

Smallest North American tern

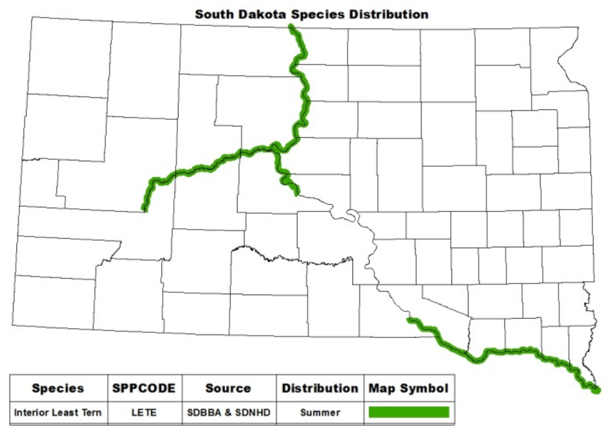
Protection Status:

Federal: Endangered

State: Endangered

Distribution:

This species is believed to have historically occurred in appropriate habitat found in the Missouri River system. See map at right for current distribution.



Key Habitat:

Prefers open areas for feeding and nesting; feeding occurs in the shallow water of lakes, ponds, and rivers located close to nesting areas with an abundance of small fish; nesting habitat is bare or sparsely vegetated sand, shell, and/or gravel beaches, sandbars, islands, and salt flats associated with rivers or lakes.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: human disturbance of nest sites; water pollution caused by pesticides and industrial discharge; predation

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels near habitat; perform predator control when necessary; fence off nesting areas to reduce disturbance to nests

Current Monitoring & Inventory Programs (Appendix E):

Nesting surveys along Missouri River; periodic surveys along Cheyenne River

Priority Research & Monitoring Needs (Appendices G-K):

Continued evaluation of nesting requirements and responses to annual available habitat

Existing Recovery Plans/Conservation Strategies:

1) U. S. Fish and Wildlife Service. 1990. Recovery plan for the interior population of the least tern (*Sterna antillarum*). U. S. Fish and Wildlife Service, Twin Cities, Minnesota. 90 pp.; 2) South Dakota Game, Fish and Parks. 2005. Interior Least Tern (*Sterna antillarum athalassos*) and Piping Plover (*Charadrius melodus*) Management Plan. Wildlife Division Report 2005-02. Pierre, SD; 3) U. S. Fish and Wildlife Service. 2013. Interior Least Tern (*Sternula antillarum*) 5-Year Review, Summary and Evaluation. USFWS, Jackson, MS. 75 pp. Available online: http://www.fws.gov/southeast/5yearReviews/5yearreviews/interiorLeastTern5yrReivew102413.pdf

Lark Bunting | LARB | *Calamospiza melanocorys*

Description:
Small bird; males are black with white wing patches, tail coverts and outer tail feathers; female is gray brown above and white below with dusky streaks.

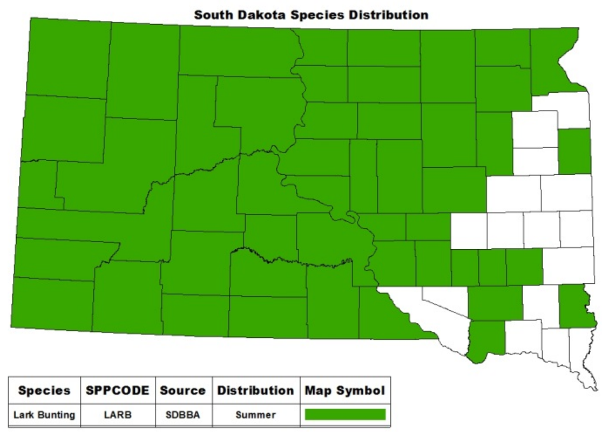
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout South Dakota. See map at right for current distribution.



Key Habitat:

Prefers native grass ecosystems of low to moderate stature with relatively high ground cover; an overstory of shrubs may be present; may nest in colonies with birds roughly distributed every 100 feet.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: mowing during the nesting season; pesticides/herbicides; parasitism by Brown-headed Cowbirds

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and landowners to reduce pesticide use to control grasshoppers in habitat

Current Monitoring & Inventory (Appendix E):

North American Breeding Bird Survey

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Assess grassland habitats during migration and breeding season

Map Grassland Bird Conservation Areas in western South Dakota

Compare nest success between native and "tame" grasslands

Le Conte's Sparrow | LCSP | *Ammodramus leconteii*

Description:
Small bird with a mottled brown back, white belly and crown stripe, and orange-yellow eye stripe and collar.

Species	SPPCODE	Source	Distribution	Map Symbol
Le Contes Sparrow	LCSP	SDBBA & SDNHD	Summer	
		Birds of SD	Migration	

Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 53B, 53C, 55B, 55C, 63A, 63B, 102A, 102B, and 102C. See map at right for current distribution.

Key Habitat:

Prefers wet meadows and marshy areas; springs/fens; nests in drier parts; also appears to prefer burned sites 2 years post-burn.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: mowing or grazing during the breeding/nesting season; nest parasitism by Brown-headed Cowbirds; drought

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and materials to educate the public about the role natural disturbance regimes played in maintaining habitat

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Assess grassland habitat during migration and breeding season

Monitor impacts of tile drainage

Lewis's Woodpecker | LEWO | *Melanerpes lewis*

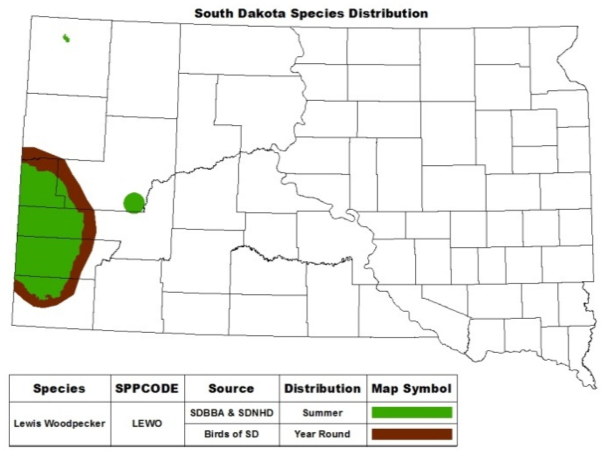
Description:

Large woodpecker with a black back and rose red belly.

Protection Status:

Federal: None

State: None



Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 61 and 62, and possibly 58D and 60A. See map at right for current distribution.

Key Habitat:

Prefers fire maintained old-growth ponderosa pine; large snags are used for nest cavities; often found in burned stands.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: European Starlings may outcompete for nest cavities

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and materials to educate the public about the role natural disturbance regimes play in maintaining habitat

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

Integrated Monitoring in Bird Conservation Regions

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Black-backed and Lewis's woodpeckers responses to fire; can post-burn use be predicted using pre-burn forest structure variables? (T-3)

Priority Research & Monitoring Needs (Appendices G-K):

Monitor long-term population trends

Response to mountain pine beetle infestations

Existing Recovery Plans/Conservation Strategies:

Abele, S.C., V.A. Saab, and E.O. Garton. (2004, June 29). Lewis's Woodpecker (*Melanerpes lewis*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available online : http://www.fs.fed.us/r2/projects/scp/assessments/lewisswoodpecker.pdf

Long-billed Curlew | LBCU | *Numenius americanus*

Description:

Largest North-American shorebird with a distinctive long, curved bill.

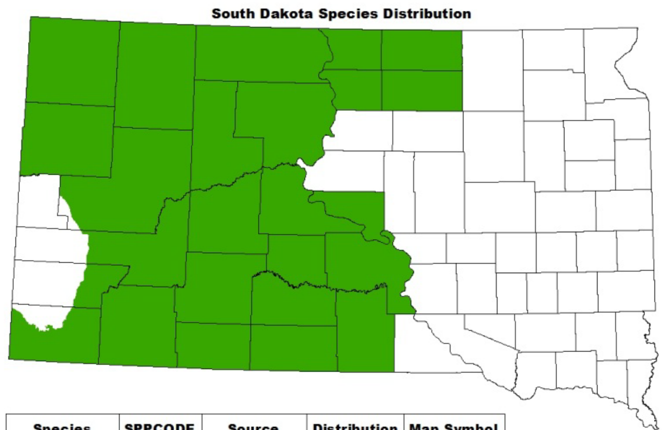
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout South Dakota with the exception of MLRAs 61 and 62. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Long-Billed Curlew	LBCU	SDBBA & SDNHD	Summer	

Key Habitat:

Prefers short grasses (<12 in); may use prairie dog colonies for foraging.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: nest site disturbance due to agricultural practices; human activities; possible spread of mammalian predators into areas they did not occur historically; pesticide/herbicide impacts

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels near habitat

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

SWG Accomplishments (Appendix F):

Nesting success, brood survival, and movements of long-billed curlews (*Numenius americanus*) in grazed landscapes of western South Dakota (T-13)

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Compare nest success between native and "tame" grasslands

Identify core areas for conservation efforts

Determine minimum size of habitat needed

Existing Recovery Plans/Conservation Strategies:

Fellows, S. D., and S. L. Jones. 2009. Status assessment and conservation action plan for the Long-billed Curlew (*Numenius americanus*). U.S. Department of Interior, Fish and Wildlife Service, Biological Technical Publication, FWS/BTP-R6012-2009, Washington, D.C.

Marbled Godwit MAGO *Limosa fedoa*

Description:
Large shorebird with dark brown plumage and black markings, light brown belly, and long bill.

Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout South Dakota with the exception of MLRAs 61 and 62. See map at right for current distribution.

Species	SPPCODE	Source	Distribution	Map Symbol
Marbled Godwit	MAGO	SDBBA	Summer	
		Birds of SD	Migration	

Key Habitat:

Prefers short, sparse to moderately grazed upland prairie intermixed with wet prairie systems; prefers relatively large contiguous blocks (>250 ac); also attracted to burned areas 2 years post-burn.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: loss of grasslands near nest site; human/pet/livestock disturbance of nest

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and materials to protect nesting sites from human disturbance; work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels near habitat

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Monitor impacts of tile drainage

Identify high-quality stopover habitat

Compare nest success between native and "tame" grasslands

Existing Recovery Plans/Conservation Strategies:

Melcher, C.P., A. Farmer, and G. Fernández. 2010. Version 1.2. Conservation Plan for the Marbled Godwit (*Limosa fedoa*). Manomet Center for Conservation Science, Manomet, Massachusetts; 2) Skagen, S.K., and G. Thompson. 2013 (updated). Northern Plains/Prairie Pothole Regional Shorebird Conservation Plan, Version 1.0, in United States Shorebird Conservation Plan.

Northern Goshawk NOGO *Accipiter gentilis*

Description:
Medium large bird of prey with short, broad wings and a long tail; blue-grey above and barred grey or white below.

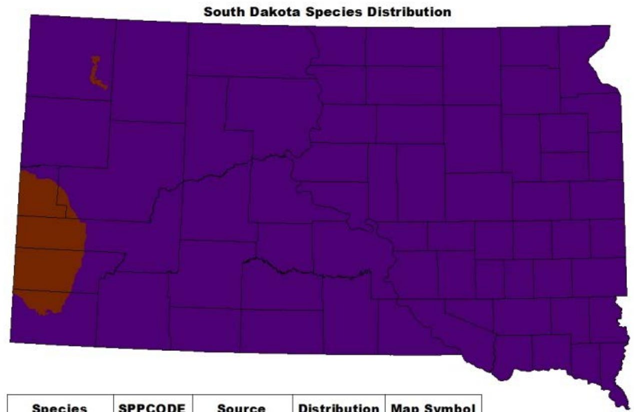
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate breeding habitat found in MLRAs 61 and 62. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Northern Goshawk	NOGO	SDBBA & SDNHD	Year Round	
			Winter	

Key Habitat:

Prefers a wide variety of forest types, age classes and structural conditions in a relatively intact large forest matrix; nest sites are usually associated with old growth trees.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: disturbance near nest sites; loss of trees and stands to pine bark beetles

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and materials to educate the public on limiting disturbance near nesting sites

Current Monitoring & Inventory Programs (Appendix E):

Nesting surveys in Black Hills National Forest

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Evaluate wildlife response to mountain pine bark beetle epidemics

Continue to monitor nest site selection, nesting success, feeding habits and population trends

Surveys of Black Hills meadows, aspens and conifers

Existing Recovery Plans/Conservation Strategies:

Kennedy, P.L. 2003. Northern goshawk (*Accipiter gentilis atricaupillus*): A technical conservation assessment. Prepared for the USDA, Forest Service, Rocky Mountain Region, Species Conservation Project

Osprey | OSPR | *Pandion haliaetus*

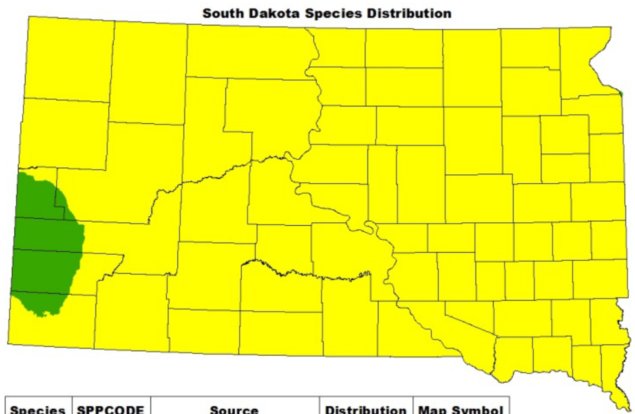
Description:
Nearly eagle-sized bird of prey with white head, dark back and white undersides.

Protection Status:

Federal: None
State: Threatened

Distribution:

This species is believed to have historically occurred in appropriate habitats in South Dakota. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Osprey	OSPR	SDBBA, Birds of SD, & SDNHD	Summer	
			Migration	

Key Habitat:
Always found near water – rivers, lakes, ponds; large open-top trees used for nesting and roosting.

Conservation Challenges:
Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: water quality impacts; chronic disturbance by humans or pets; biocide contamination of food supply; illegal shooting

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide use near habitat; develop programs and materials to educate the public on appropriate activities near nesting sites; reduce illegal shooting; develop reintroduction programs for unoccupied suitable habitat

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

Periodic surveys of nesting ospreys, particularly in the Black Hills

SWG Accomplishments (Appendix F):

Reintroduction of osprey into suitable sites along the Missouri River in South Dakota (T-10)

South Dakota breeding bird atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Continue to solicit sightings of color-banded birds to evaluate success of reintroduction effort

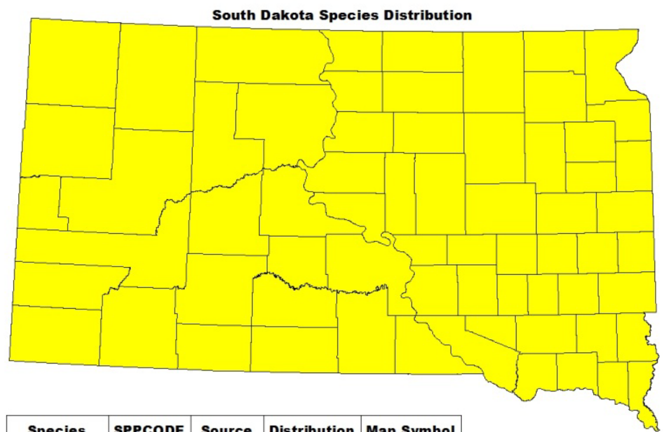
Continue periodic monitoring of Black Hills population, including evaluation of nests that may pose risks to powerlines or other structures

Peregrine Falcon PEFA *Falco peregrinus*

Description:
Medium size bird of prey with pale brown back and creamy white and heavily spotted underside.

Protection Status:

Federal: None
State: Endangered



Species	SPPCODE	Source	Distribution	Map Symbol
Peregrine Falcon	PEFA	Birds of SD	Migration	

Distribution:

This species is believed to have historically occurred in appropriate habitat found throughout South Dakota. See map at right for current distribution.

Key Habitat:

Prefers open grasslands with suitable nesting cliffs and rock outcroppings near a concentrated prey base such as waterfowl or colonial ground squirrels.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: impacts to prey base; pesticides/pollution; human disturbance near nest sites

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide use near habitat; develop programs and materials to educate the public on appropriate activities near nesting sites; develop reintroduction programs for unoccupied suitable habitat

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Peregrine falcon (*Falco peregrinus*) reintroduction in South Dakota (T-10, as amended)

Priority Research & Monitoring Needs (Appendices G-K):

Continue to solicit sightings of color-banded birds to evaluate success of reintroduction efforts

Investigate reports of nesting pairs

Existing Recovery Plans/Conservation Strategies:

U.S. Fish and Wildlife Service. 2003. Monitoring plan for the American peregrine falcon, a species recovered under the Endangered Species Act. U.S. Fish and Wildlife Service, Divisions of Endangered Species and Migratory Birds and State Programs, Pacific Region, Portland, OR. 53 pp.

Piping Plover | PIPL | *Charadrius melodus*

Description:
Small, stocky, sandy-colored plover with yellow-orange legs.

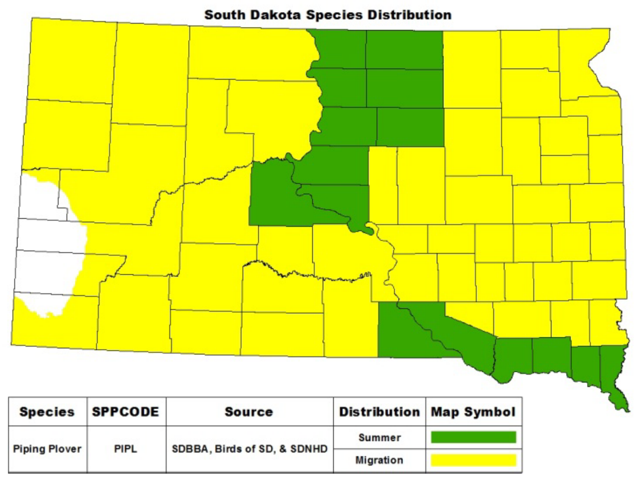
Protection Status:

Federal: Threatened

State: Threatened

Distribution:

This species is believed to have historically occurred in appropriate habitat found primarily in the Missouri River system. See map at right for current distribution.



Key Habitat:

Prefers shorelines around small alkaline lakes, large reservoirs, or river islands and sandbars with wide beaches (65 ft) and highly clumped but sparse (< 25% cover) vegetation.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: water management on rivers and reservoirs may cause flooding of nests; nest depredation; human disturbance of nest sites; possibly pesticides

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide use near habitat; fence off or cage nesting areas to reduce disturbance and predation to nests; perform predator control when necessary

Current Monitoring & Inventory Programs (Appendix E):

Nesting surveys

International Piping Plover Census; conducted at approximately 5-year intervals

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Continue nesting surveys and evaluation of responses to annual available habitat

Update National Wetlands Inventory maps

Identify high-quality stopover habitat

Existing Recovery Plans/Conservation Strategies:

1) United States Fish and Wildlife Service. 2001. Draft environmental assessment: proposal of critical habitat for northern Great Plains breeding population of piping plovers (*Charadrius melodus*). Ecological Services, Pierre, South Dakota, USA; 2) South Dakota Game, Fish and Parks. 2005. Interior Least Tern (*Sterna antillarum athalassos*) and Piping Plover (*Charadrius melodus*) Management Plan. SDGFP, Wildlife Division Report 2005-02, Pierre, SD.

Ruffed Grouse | RUGR | *Bonasa umbellus*

Description:

Brown, reddish brown or gray-brown grouse with barred sides; tail fan-shaped, with black band near tip.

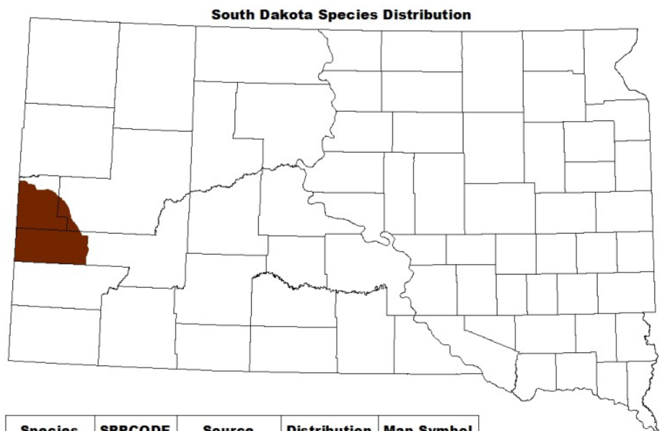
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 61 and 62. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Ruffed Grouse	RUGR	SDBBA & SDGFP	Year Round	

Key Habitat:

Dependent on a mix of multiple age-classes of aspen for food and cover; may also use hardwoods and open pine forests.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: pesticides; overhunting

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and landowners to reduce pesticide/herbicide use in habitat

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

Occasional spring surveys

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Habitat surveys of Black Hills meadows, aspen and conifers

Monitor long-term population trends

Wildlife response to mountain pine beetle infestation

Existing Recovery Plans/Conservation Strategies:

Wiggins, D.A. 2006. Ruffed Grouse (*Bonasa umbellus*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/ruffedgrouse.pdf [06/12/2012].

Sprague's Pipit | SPPI | *Anthus spragueii*

Description:
Pale, slender, sparrow-sized bird with white outer tail feathers, a thin bill, pale legs, and streaked back.

Protection Status:

Federal: Candidate

State: None

Distribution:

This species is believed to have historically had breeding populations in habitat found in MLRAs 53B, 53C, 58D, 54, and northern portions of 60A, 63A, and 63B. Migratory populations may have occurred statewide. See map at right for current distribution.

Species	SPPCODE	Source	Distribution	Map Symbol
Spragues Pipit	SPPI	SDBBA & SDNHD	Summer	
		Birds of SD	Migration	

Key Habitat:

Prefers lightly to moderately grazed short-grass ecosystems with low to moderate levels of litter; also prefers short-grass ecosystems several years post-burn.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5; woody plant encroachment; habitat fragmentation

Non-habitat: reduced productivity due to Brown-headed Cowbird parasitism; human disturbance during the nesting season

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop educational materials to reduce human disturbance in breeding/nesting habitat

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Assess grassland habitats during migration and breeding season

Compare nest success between native and "tame" grasslands

Determine minimum size of habitat block needed

Existing Recovery Plans/Conservation Strategies:

Jones, S. L. 2010. Sprague's Pipit (*Anthus spragueii*) conservation plan. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C.

Trumpeter Swan | TRUS | *Cygnus buccinator*

Description:

Large, white swan.

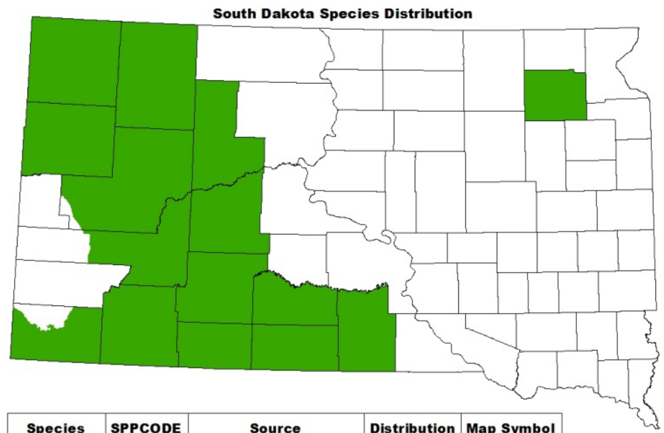
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found throughout South Dakota. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Trumpeter Swan	TRUS	SDBBA, Birds of SD, & SDNHD	Summer	

Key Habitat:

Prefers shallow water ponds, rivers, and lakes with aquatic and emergent vegetation; nests constructed on an island, beaver lodge, or a mat of floating vegetation that consist of cattails, bulrushes, and horsetails.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: overcrowding contributes to disease outbreaks; severe winter weather; widely varying controlled water levels can flood nest sites; nest site disturbance from recreational use; pesticides/pollution; illegal shooting; sensitive to lead poisoning

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and materials to educate the public on appropriate activities near nesting site; work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide use near habitat; develop programs and materials to educate hunters on critical identification features relative to other similar swan species; develop programs and materials to ensure public awareness of non-toxic shot regulations

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

Opportunistic nesting pair monitoring

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Survey winter distribution and limits to that distribution

Research impact of narrowleaf cattail and hybrid species on wetland birds

Existing Recovery Plans/Conservation Strategies:

Slater, G.L. 2006. Trumpeter Swan (*Cygnus buccinator*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/trumpeterswan.pdf.

White-winged Junco | WWJU | *Junco hyemalis aikeni*

Description:

Subspecies of the dark-eyed junco with two white wingbars.

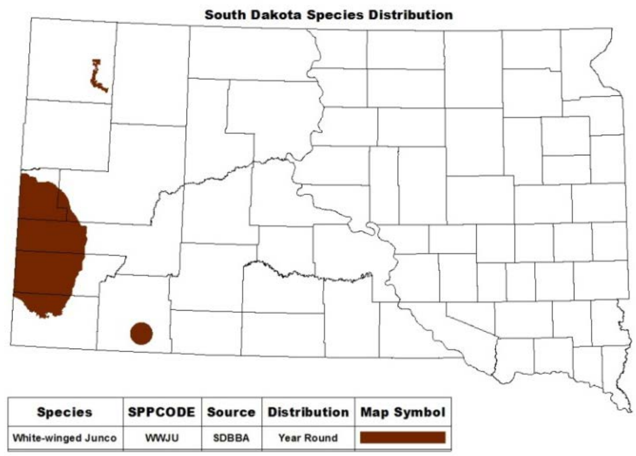
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 60A, 61 and 62. See map at right for current distribution.



Key Habitat:

Prefers coniferous and deciduous forest openings and edges; little information available.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: limited range and a general lack of information regarding this subspecies of junco

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: none

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Monitor general status through existing methods, such as SDBBA2, North American BBS and SDOU reporting

Whooping Crane | WHCR | *Grus americana*

Description:
Very tall white bird with a long neck, long legs, and red facial skin.

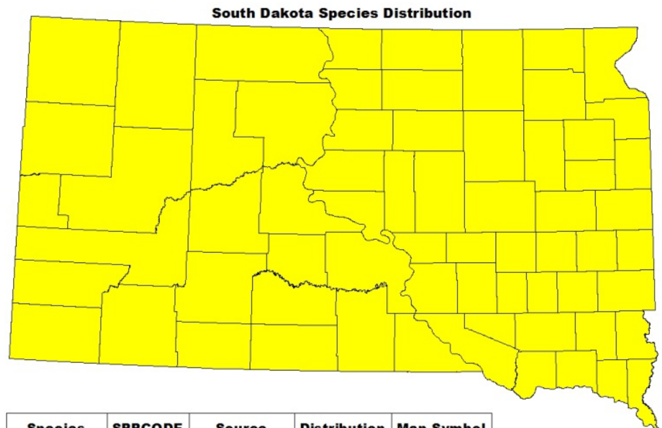
Protection Status:

Federal: Endangered

State: Endangered

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout South Dakota. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Whooping Crane	WHCR	SDBBA & SDNHD	Migration	

Key Habitat:

Migration habitat includes marshes and submerged sandbars in rivers with good horizontal visibility, water depth of 12 in or less, and minimum wetland size of 0.1 ac for roosting.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: collision with power lines; illegal shooting

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop strategies to reduce the risk of collisions with utility lines; work with agencies, landowners, and industry to minimize detrimental activities to habitat; develop programs and materials to reduce illegal shooting; develop programs to protect staging/migrating birds

Current Monitoring & Inventory Programs (Appendix E):

Spring and fall migration monitoring

Priority Research & Monitoring Needs (Appendices G-K):

Update National Wetlands Inventory maps

Continue monitoring movements and associated habitat use of migrating whooping cranes

Monitor impacts of tile drainage

Existing Recovery Plans/Conservation Strategies:

Canadian Wildlife Service and U.S. Fish and Wildlife Service. 2007. International recovery plan for the whooping crane. Ottawa: Recovery of Nationally Endangered Wildlife (RENEW), and U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 162 pp.

Willet | WILL | *Tringa semipalmata*

Description:
Large, long-legged shorebird; gray above, white below and lightly barred on flanks.

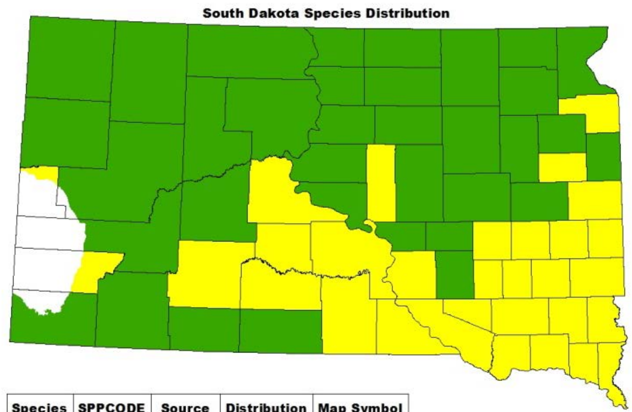
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found throughout South Dakota. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Willet	WILL	SDBBA	Summer	
		Birds of SD	Migration	

Key Habitat:

Prefers shallow-water areas with short, sparse shoreline vegetation; nests on ground in short-grass or bare areas.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: human/pet disturbance of nest sites; nest depredation; loss of grasslands near nest sites

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and materials to educate the public on limiting disturbance near nesting sites; work with agencies, landowners, and industry to reduce pesticide/herbicide use near habitat

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Update National Wetlands Inventory maps

Determine minimum size of habitat block needed

Monitor impacts of tile drainage

Existing Recovery Plans/Conservation Strategies:

Skagen, S.K., and G. Thompson. 2013 (updated). Northern Plains/Prairie Pothole Regional Shorebird Conservation Plan, Version 1.0, in United States Shorebird Conservation Plan.

Wilson's Phalarope | WIPH | *Phalaropus tricolor*

Description:

Shorebird similar to sandpipers but swims readily; white rump and dark wings.

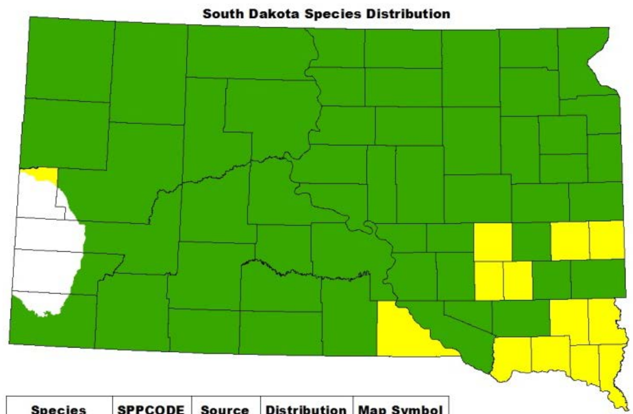
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout South Dakota with the exception of MLRAs 61 and 62. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Wilsons Phalarope	WIPH	SDBBA	Summer	
		Birds of SD	Migration	

Key Habitat:

Prefers shallow marshes and wet meadows adjacent to intact upland grass ecosystems; dense nesting cover.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: nest depredation; loss of grasslands near nest site; human/pet/livestock disturbance of nest

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: control nest and chick predators; develop programs and educational materials to identify appropriate activities near nesting sites; develop strategies to reduce the risk of utility line collisions

Current Monitoring & Inventory Programs (Appendix E):

North American Breeding Bird Survey

SWG Accomplishments (Appendix F):

South Dakota Breeding Bird Atlas 2 (T-41)

Priority Research & Monitoring Needs (Appendices G-K):

Update National Wetlands Inventory maps

Monitor impacts of tile drainage

Identify high-quality stopover habitat

Existing Recovery Plans/Conservation Strategies:

1) Skagen, S.K., and G. Thompson. 2013 (updated). Northern Plains/Prairie Pothole Regional Shorebird Conservation Plan, Version 1.0, in United States Shorebird Conservation Plan; 2) Lesterhuis, A.J., and R.P. Clay. 2010. Conservation Plan for Wilson's Phalarope (*Phalaropus tricolor*) Version 1.1. Western Hemisphere Shorebird Reserve Network. 61 pp.

Black Hills Red Squirrel BHSQ *Tamiasciurus hudsonicus dakotensis*

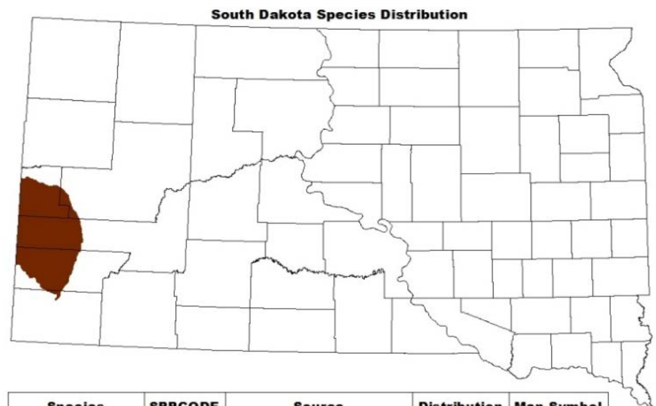
Description:

Reddish-orange in color but with white on the belly and a ring of white fur around the eye.

Protection Status:

Federal: None

State: None



Species	SPPCODE	Source	Distribution	Map Symbol
Black Hills Red Squirrel	BHSQ	Mammals of SD & Expert Opinion	Year Round	

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRA 62. See map at right for current distribution.

Key Habitat:

Prefers evergreen forest with components of late seral conditions; dens in large, old snags.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: timber harvest, mountain pine beetle, genetic diversity

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: none identified

SWG Accomplishments (Appendix F):

Natural history and genetic makeup of the northern flying squirrel population in the Black Hills and northeastern South Dakota (T14) (study of the Black Hills red squirrel was amended to this SWG project at a later date)

Priority Research & Monitoring Needs (Appendices G-K):

Monitor long term population trends

Evaluate effects of timber harvest and mountain pine beetle to population dynamics and movements

Black-footed Ferret BFFE *Mustela nigripes*

Description:

Mink-sized, buff-colored weasel with a short furry tail, oval ears, and black points.

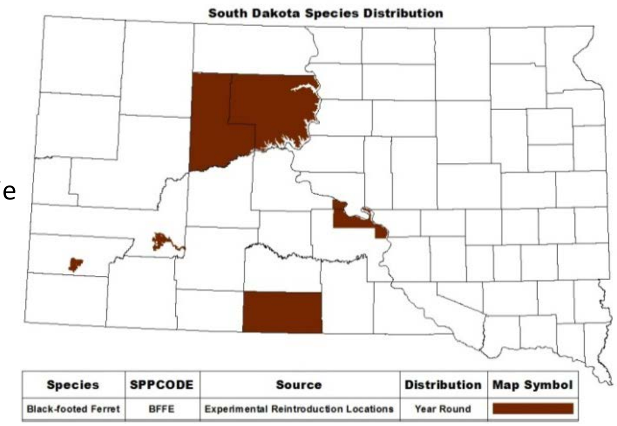
Protection Status:

Federal: Endangered

State: Endangered

Distribution:

This species was historically associated with prairie dog colonies and its distribution was therefore consistent with the distribution of prairie dogs in South Dakota. See map at right for current distribution.



Key Habitat:

Requires black-tailed prairie dog colonies; estimates of 100-150 acres of prairie dog colony are required to support one ferret.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: canine distemper; predation by coyotes and badgers; barriers to dispersal

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: Work with agencies and landowners to reduce the prevalence of canine distemper; develop predator control programs, where appropriate; develop captive breeding and reintroduction programs; and develop incentive programs for landowners who manage for habitat

Current Monitoring & Inventory Programs (Appendix E):

Monitoring success of reintroductions to establish self-sustaining populations (USFS, NPS, USFWS, Cheyenne River, Rosebud and Lower Brule Sioux Tribes)

Monitoring distribution and prevalence of sylvatic plague

SWG Accomplishments (Appendix F):

Understanding the relationship between prairie dog ecology and black-footed ferret resource selection (T-35)

Factors the affect territoriality and productivity of black-footed ferrets (T-38)

Priority Research & Monitoring Needs (Appendices G-K):

Determine the influence of predators and prey on black-footed ferret populations

Further understand the ecology of sylvatic plague

Evaluated and improve reintroduction methods including captive rearing, captive release, and translocation of wild animals

Evaluate and improve sylvatic plague mitigation methods including vaccination and insecticide application

Existing Recovery Plans/Conservation Strategies:

U.S. Fish and Wildlife Service. 2013. Recovery plan for the black-footed ferret (*Mustela nigripes*). U.S. Fish and Wildlife Service, Denver, Colorado. 130 pp. Available online: http://ecos.fws.gov/docs/recovery_plan/Draft%20Revised%20BFF%20Recovery%20Plan_2013%20with%20RD%20signatures_1.pdf

Franklin's Ground Squirrel FGSQ *Poliocitellus franklinii*

Description:

Large, burrowing ground squirrel with brownish gray back and yellowish rump.

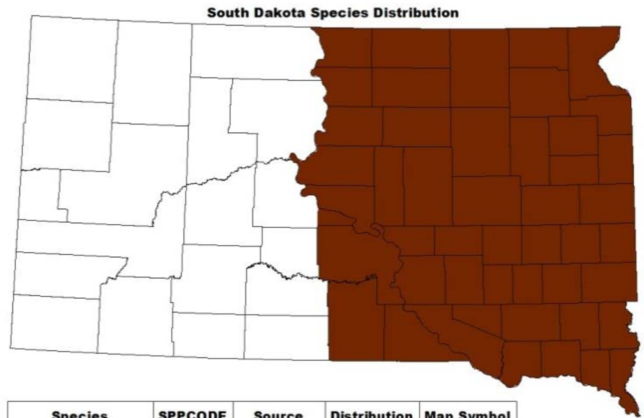
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in all MLRAs east of the Missouri River. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Franklins Ground Squirrel	FGSQ	Mammals of SD	Year Round	

Key Habitat:

Prefers tall- and mixed-grass native ecosystems with relatively dense, tall structure.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: conversion and fragmentation of mixed and tallgrass prairies, possible increased predation rates, poisoning

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and materials to reduce poisoning, shooting, and trapping

SWG Accomplishments (Appendix F):

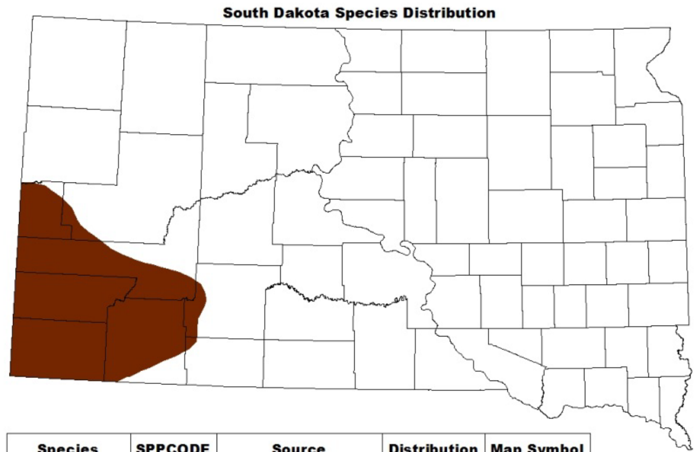
Status and distribution of Franklin's and Richardson's ground squirrels in eastern South Dakota-T-53-R-1

Priority Research & Monitoring Needs (Appendices G-K):

Assess habitat use and requirements

Monitor distribution and abundance to evaluate effects of native grassland alteration

Fringe-tailed Myotis FTMY *Myotis thysanodes pahasapensis*



Species	SPPCODE	Source	Distribution	Map Symbol
Fringe-tailed myotis	FTMY	Mammals of NGP & SDNHD	Year Round	

Description:
Medium sized, insectivorous bat with dark colored fur and long-ears.

Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 61, 62, and 64 and may have also occurred in parts of 60A. See map at right for current distribution.

Key Habitat:

Prefers dry, coniferous forests, ponderosa pine, white spruce, and aspen at moderate elevations; roosts in loose bark on large snags, rock crevices (particularly in badlands), caves, mines, and buildings; forages over grass meadows, standing water and along watercourses.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: closure of abandoned mines and caves; human disturbance and vandalism of roost sites; pesticides to control mosquitoes and other prey items; white nose syndrome

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and materials to reduce human disturbance of roosting sites and hibernacula; work with agencies and landowners to reduce pesticide use to control important prey species; install bat-friendly gates at important cave and abandoned mine sites

Current Monitoring & Inventory Programs (Appendix E):

Monitoring status and trends of Black Hills bats (SDGFP, BatWorks, Wind Cave National Park)

SWG Accomplishments (Appendix F):

Bat habitat protection and evaluation: implementing and assessing management techniques-T15-R

Assessment, monitoring, and protection of bat habitats in western South Dakota-T37-R

Evaluation of artificial bat roost selection and occupancy in South Dakota-T2-8-R-1

Preliminary investigations into migratory movements of bats in South Dakota-T49-R-1

Priority Research & Monitoring Needs (Appendices G-K):

Monitor progression of white-nose syndrome and for evidence at important hibernacula sites

Research hibernacula, maternity and nursery roost requirements and availability

Continue to monitor population status and trends

Existing Recovery Plans/Conservation Strategies:

1) South Dakota Bat Working Group. 2004. South Dakota bat management plan. Wildlife Division Report 2004-08. 89pp. Available online at: http://gfp.sd.gov/wildlife/management/plans/bat-management-plan.aspx 2) Tigner, J. and E.D. Stukel, 2003. Bats of the Black Hills: A Description of Status and Conservation Needs. South Dakota Department of Game, Fish and Parks. Wildlife Division Report 2003-05. Available online at: http://gfp.sd.gov/wildlife/management/diversity/docs/battechreport.pdf

Northern Flying Squirrel NFSQ *Glaucomys sabrinus*

Description:

Small, nocturnal squirrel gray in color with white belly and black rings around eyes

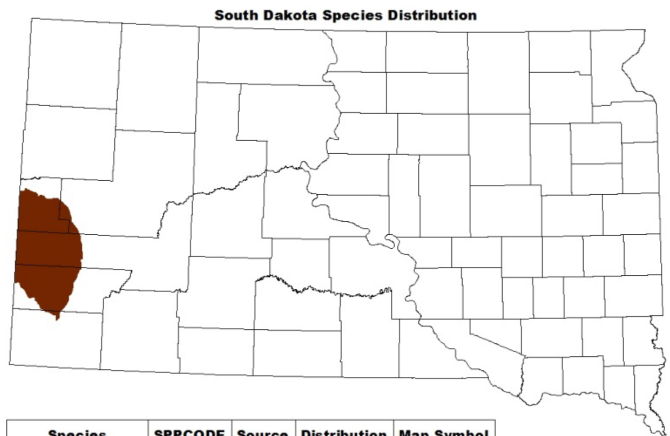
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 61 and 62. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Northern Flying Squirrel	NFSQ	SDNHD	Year Round	

Key Habitat:

Prefers relatively mature, contiguous mixed and coniferous forests of spruce, pine, aspen and other hardwoods; requires large trees or snags for nesting; prefers less dense overstory conditions for easy gliding.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: timber harvest, mountain pine beetle, genetic diversity

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: none identified

Current Monitoring & Inventory Programs (Appendix E):

South Dakota Natural Heritage Database

SWG Accomplishments (Appendix F):

Natural history and genetic makeup of the northern flying squirrel population in the Black Hills and northeastern South Dakota-T-14-R

Priority Research & Monitoring Needs (Appendices G-K):

Monitor long term population trends

Evaluate effects of timber harvest and mountain pine beetles to populations dynamics

Existing Recovery Plans/Conservation Strategies:

Austin, K., et al. No date. Northern flying squirrel draft recovery plan. U.S. Fish and Wildlife Service Region 5. 52 pp.

Northern Myotis NOMY *Myotis septentrionalis*

Description:

Small, insectivorous bat with light to dark brown fur, buffy shoulder patch and long-ears.

Protection Status:

Federal: Threatened

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 60A, 61, 62, and 64. See map at right for current distribution.

Key Habitat:

Typically found near water and dense forest conditions, both coniferous and riparian; roost sites consist of exfoliating bark and tree cavities, open buildings, and caves or mines; winter hibernacula are frequently caves and mines.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: closure of mines and caves; human disturbance of roosting sites and hibernacula; pesticides to control mosquitos and other prey items; white nose syndrome

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and materials to reduce human disturbance of roosting sites and hibernacula; work with agencies and landowners to reduce the use of pesticides to control important prey species; install bat-friendly gates at important cave and abandoned mine sites

Current Monitoring & Inventory Programs (Appendix E):

Monitoring status and trends of Black Hills bats (SDGFP, BatWorks, Wind Cave National Park)

SWG Accomplishments (Appendix F):

Bat habitat protection and evaluation: implementing and assessing management techniques (T-15)

Assessment, monitoring, and protection of bat habitats in western South Dakota (T-37)

Evaluation of artificial bat roost selection and occupancy in South Dakota (T2-8)

Preliminary investigations into migratory movements of bats in South Dakota (T-49)

Priority Research & Monitoring Needs (Appendices G-K):

Research hibernacula, maternity and nursery roost requirements and availability

Monitor progression of white-nose syndrome and for evidence at important hibernacula sites

Continue to monitor population status and trends

Existing Recovery Plans/Conservation Strategies:

1) South Dakota Bat Working Group. 2004. South Dakota bat management plan. Wildlife Division Report 2004-08. 89pp. Available online at: http://gfp.sd.gov/wildlife/management/plans/bat-management-plan.aspx

2) Tigner, J. and E.D. Stukel. 2003. Bats of the Black Hills: A Description of Status and Conservation Needs. South Dakota Department of Game, Fish and Parks. Wildlife Division Report 2003-05. Available online at: http://gfp.sd.gov/wildlife/management/diversity/docs/battechreport.pdf

Northern River Otter NROT *Lontra canadensis*

Description:

Large, dark brown "weasel" with long, slender body; long, thick, tapering tail; webbed feet.

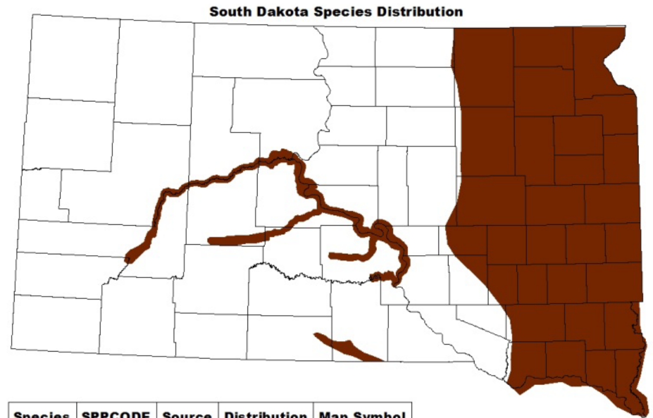
Protection Status:

Federal: None

State: Threatened

Distribution:

This species is believed to have historically occurred in appropriate habitat found throughout South Dakota. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
River Otter	NROT	SDGFP	Year Round	

Key Habitat:

Prefers slow-moving rivers and streams with deep pools, abundant riparian vegetation, and plentiful fish; often associated with beaver activity.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: reduced prey populations; road mortality; diseases such as distemper, rabies, etc.

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop strategies to reduce mortality by lethal beaver traps; work with agencies and landowners to reduce the prevalence of canine distemper and rabies in habitat; develop programs and materials to reduce illegal shooting

Current Monitoring & Inventory Programs (Appendix E):

Monitoring river otter occurrence and distribution (SDGDP, SDSU)

Priority Research and Monitoring Needs (Appendix F):

Update knowledge of river otter distribution in South Dakota

Determine life history characteristics

Determine cause of mortality and reproductive status

SWG Accomplishments (Appendices G-K):

Determination of river otter distribution and evaluation of potential sites for population expansion in South Dakota (T-55)

Existing Recovery Plans/Conservation Strategies:

South Dakota Department of Game, Fish and Parks. 2012. South Dakota River Otter Management Plan. South Dakota Department of Game, Fish and Parks Wildlife Division Report Number 2012-07, Pierre, South Dakota, USA.

Richardson's Ground Squirrel RGSQ *Urocitellus richardsonii*

Description:

Medium-sized ground squirrel of relatively uniform coloration; buffy yellow to grayish in color.

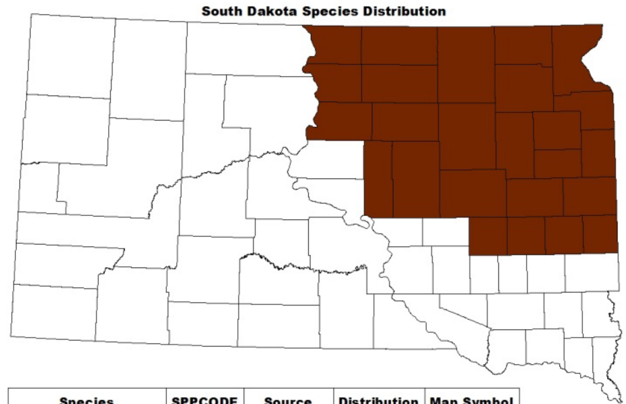
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 53B, 55B, 56, 102A and the northern portions of 53C, 55C, 102B, and 102C. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Richardsons Ground Squirrel	RGSQ	Mammals of SD	Year Round	

Key Habitat:

Prefers relatively flat to gently rolling, short-statured grassland ecosystems .

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: mortality due to poisoning, shooting, or trapping

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and materials to reduce poisoning, shooting, and trapping

SWG Accomplishments (Appendix F):

Status and distribution of Franklin's and Richardson's ground squirrels in eastern South Dakota(T-53)

Priority Research & Monitoring Needs (Appendices G-K):

Monitor distribution and long-term trends in populations

Research factors influencing distributional changes in South Dakota

Silver-haired Bat | SHBA | *Lasionycteris noctivagans*

Description:

Medium sized, densely furred bat; nearly black, with silvery-tipped hairs on back, giving frosted appearance.

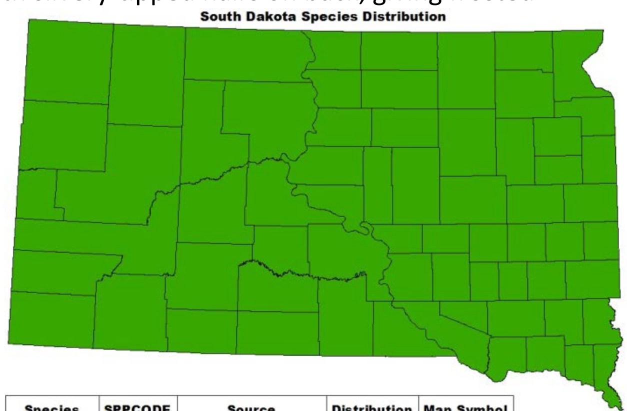
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found throughout South Dakota. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Silver-haired bat	SHBA	Mammals of NGP & SDNHD	Summer	

Key Habitat:

Prefers late successional forest with high concentrations of standing dead trees, some of which have exfoliating bark, cracks in the wood, and cavities excavated by birds.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: white nose syndrome; human disturbance, pesticides to control mosquitoes and other prey items

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and landowners to reduce pesticide use to control important prey species

Current Monitoring & Inventory Programs (Appendix E):

Monitoring status and trends of Black Hills bats (SDGFP, BatWorks, Wind Cave National Park)

SWG Accomplishments (Appendix F):

Bat habitat protection and evaluation: implementing and assessing management techniques (T-15)

Assessment, monitoring, and protection of bat habitats in western South Dakota (T-37)

Evaluation of artificial bat roost selection and occupancy in South Dakota(T2-8)

Preliminary investigations into migratory movements of bats in South Dakota (T-49)

Priority Research & Monitoring Needs (Appendices G-K):

Determine the effects of wind power generation sites on migratory bat populations

Census bats along riparian corridors to understand the value of these habitats for foraging and roosting and as migration routes

Continue to monitor population status and trends

Existing Recovery Plans/Conservation Strategies:

1) Schmidt, C.A. 2003. Conservation assessment for the Silver-Haired Bat in the Black Hills of South Dakota and Wyoming. USDA Forest Service Rocky Mountain Region, Custer, South Dakota. 22 pp.
2) South Dakota Bat Working Group. 2004. South Dakota bat management plan. Wildlife Division Report 2004-08. 89pp. Available online at: http://gfp.sd.gov/wildlife/management/plans/bat-management-plan.aspx 3) Tigner, J. and E.D. Stukel, 2003. Bats of the Black Hills: A Description of Status and Conservation Needs. SDGFP. Wildlife Division Report 2003-05. Available online at: http://gfp.sd.gov/wildlife/management/diversity/docs/battechreport.pdf

Swift Fox SWFO *Vulpes velox*

Description:
Small fox with a black-tipped tail.

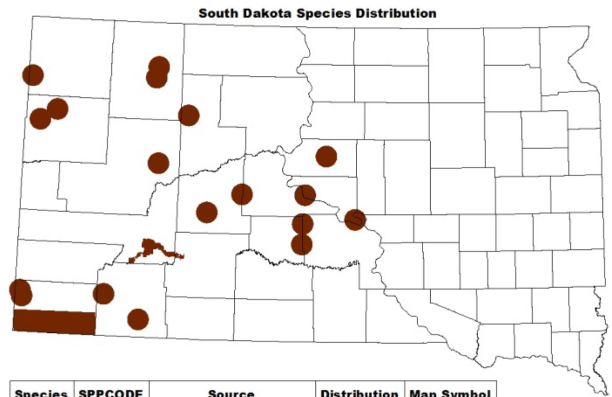
Protection Status:

Federal: None

State: Threatened

Distribution:

This species is believed to have historically occurred in appropriate habitat found throughout South Dakota. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Swift Fox	SWFO	SDGFP, SDNHD, Expert Opinion	Year Round	

Key Habitat:

Prefers heavily grazed shortgrass or mixed-grass prairies with open gently rolling topography for high visibility of surrounding area; usually associated with prairie dogs or ground squirrel colonies.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: predation and interspecific competition with coyotes and red fox; canine distemper; susceptible to shooting, trapping, and poisoning; vehicle collisions

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and educational materials to reduce poisoning, shooting, and trapping; develop strategies to reduce vehicle injury/mortality; vaccinate for canine-distemper when live-trapped and handled; develop reintroduction programs for suitable habitat; control predators (e.g., coyotes)

Current Monitoring & Inventory Programs (Appendix E):

Monitor success of reintroductions to establish self-sustaining populations (Badlands National Park)

SWG Accomplishments (Appendix F):

Restoring swift foxes to the Bad River Ranches and environs in western South Dakota (T-25)

Priority Research & Monitoring Needs (Appendices G-K):

Map remaining native prairie on a recurring basis

Assess quality of untilled prairie

Determine the requirements of intact habitat blocks for swift fox in South Dakota

Existing Recovery Plans/Conservation Strategies:

Dowd Stukel, E., ed. 2011. Conservation assessment and conservation strategy for swift fox in the United States – 2011 Update. South Dakota Department of Game, Fish and Parks, Pierre, South Dakota. U.S.A.

Townsend's Big-eared Bat TBBA *Corynorhinus townsendii*

Description:

Large, insectivorous bat with buff colored fur on back and pale buff on the belly.

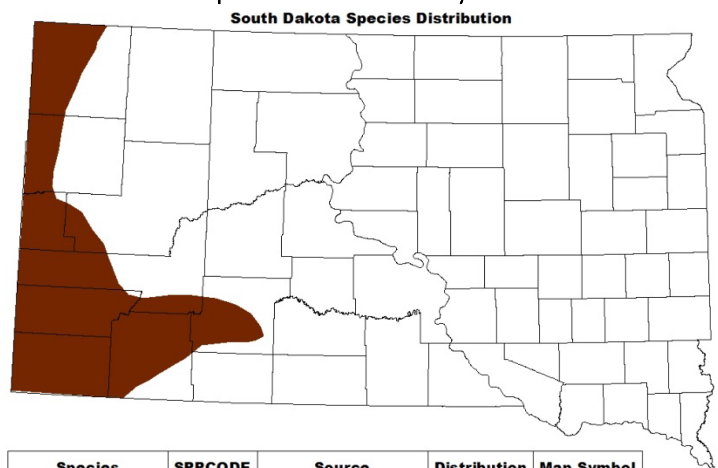
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs west of the Missouri River. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Townsends Big-eared Bat	TBBA	Mammals of NGP & SDNHD	Year Round	

Key Habitat:

Forages over sagebrush-grasslands, riparian areas, and open pine/coniferous forests; caves, mines, rocky outcrops, natural caves, and abandoned mines are preferred for roosting and hibernacula.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: closure of caves and mines; disturbance and vandalism to roost sites and hibernacula; white nose syndrome

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and educational materials to reduce human disturbance of roosting sites and hibernacula; install bat-friendly gates at important cave and abandoned mine sites

Current Monitoring & Inventory Programs (Appendix E):

Monitoring status and trends of Black Hills bats (SDGFP, BatWorks, Wind Cave National Park)

SWG Accomplishments (Appendix F):

Bat habitat protection and evaluation: implementing and assessing management techniques (T-15)

Assessment, monitoring, and protection of bat habitats in western South Dakota (T-37)

Evaluation of artificial bat roost selection and occupancy in South Dakota (T2-8)

Preliminary investigations into migratory movements of bats in South Dakota (T-49)

Priority Research and Monitoring Needs (Appendices G-K):

Identify and protect important maternity roosts, nursery roosts, and hibernacula

Determine the effective size of buffer zones needed around occupied caves and/or mines that serve as hibernacula and maternity roosts

Continue to monitor population status and trends

Existing Recovery Plans/Conservation Strategies:

1) South Dakota Bat Working Group. 2004. South Dakota bat management plan. Wildlife Division Report 2004-08. 89pp. Available online at: http://gfp.sd.gov/wildlife/management/plans/bat-management-plan.aspx

2) Tigner, J. and E.D. Stukel, 2003. Bats of the Black Hills: A Description of Status and Conservation Needs. South Dakota Department of Game, Fish and Parks. Wildlife Division Report 2003-05. Available online at: http://gfp.sd.gov/wildlife/management/diversity/docs/battechreport.pdf

Black Hills Redbelly Snake BHRS *Storeria occipitomaculata pahasapae*

Description:

Small woodland snake that is gray or reddish brown and four narrow dark stripes on its back and one pale stripe down middle.

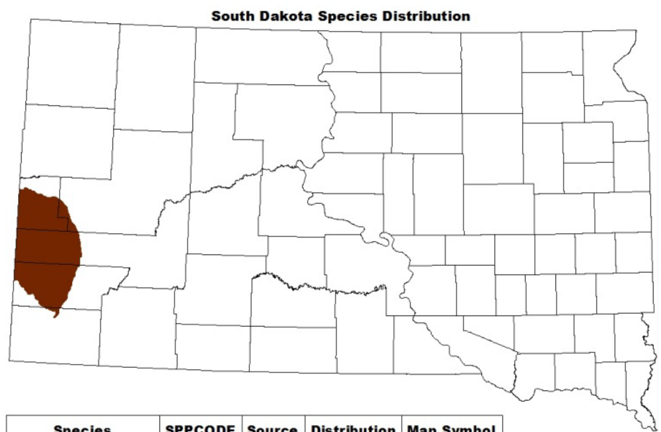
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRA 62 and possibly 61. See the map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Black Hills Redbelly Snake	BHRS	SDNHD	Year Round	

Key Habitat:

Prefers deciduous and mixed woodlands; damp, moist, and cool environments of riparian/wetland ecosystems; hides under bark, logs, rocks, and leaf litter.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: road mortality during migrations to and from their hibernacula

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and educational materials to reduce road mortality during migration periods

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Ecology of the Black Hills redbelly snake (*Storeria occipitomaculata pahasapae*) with emphasis on food habits (T-7)

Herpetology surveys for South Dakota Comprehensive Wildlife Conservation Plan (T-8)

Threats, management, and suggested harvest and collection policy of herpetofauna of SD (T-57)

Priority Research & Monitoring Needs (Appendices G-K):

Characterize habitat features of snake hibernacula via GIS modeling; survey such habitat

Characterize important foraging habitat through niche modeling

Study effects of grazing on mesic meadows at higher elevations in the Black Hills

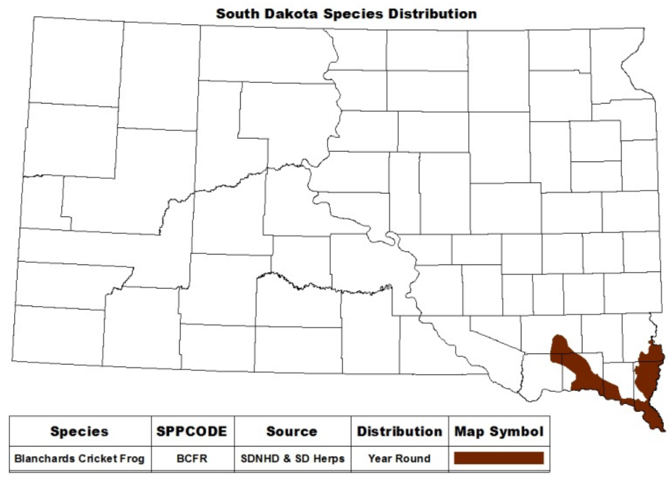
Participate in identification of PARCAs through regional PARC chapters

Existing Recovery Plans/Conservation Strategies:

Smith, B.E. and N.T. Stephens. 2003. Conservation Assessment for the Redbelly Snake in the Black Hills National Forest South Dakota and Wyoming. USDA Forest Service, Rocky Mountain Region. 18 pp.

Blanchard's Cricket Frog | BCFR | *Acris blanchardi*

Description:
Small, semi-aquatic, brown-gray frog with a "warty" appearance and pointed snout.



Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 102B and 102C and portions of 55C, 63A, and 63B. See map at right for current distribution.

Key Habitat:

Prefers margins of permanent marshes, wet meadows, fens, lakes, and slow moving streams and rivers; narrow mud flats and stream banks with abundant, low emergent vegetation preferred.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: predation by non-native species; water pollution caused by pesticides/herbicides and other pollutant; chytrid fungus; overwintering mortality

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and industry to reduce pesticide/herbicide use in habitat; control non-native predators on this species

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Herpetology surveys for South Dakota Comprehensive Wildlife Conservation Plan (T-8)

Threats, management, and suggested harvest and collection policy of herpetofauna of SD (T-57)

Priority Research & Monitoring Needs (Appendices G-K):

Investigate prevalence of ranavirus; establish monitoring program to detect new occurrences

Analyze contaminant loads in wetlands

Monitor to determine long-term status and trends

Participate in identification of PARCAs through regional PARC chapters

Cope's Gray Treefrog	CGTR	*Hyla chrysoscelis*

Description:

Tree frog with yellow inner thigh markings on underside and solid lime green on the back during breeding season.

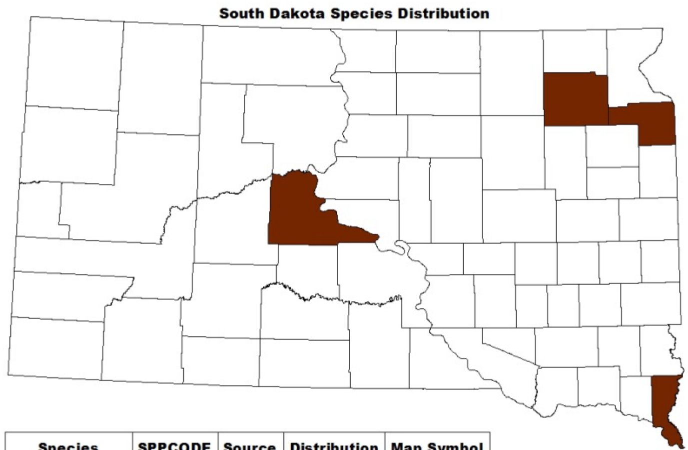
Protection Status:

Federal: None

State: None

Distribution:

This species is on the fringe of its range and is believed to have historically occurred in appropriate habitat found in parts of MLRAs 55C, 63A, 63B, 102A, 102B, and 102C. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Copes Gray Treefrog	CGTR	SDNHD	Year Round	

Key Habitat:

Prefers wooded areas and woodland edges, usually within a few hundred meters of water; recently disturbed areas with abundant shrubs, herbaceous growth, and vines; both arboreal and terrestrial; eggs are laid and larvae develop in temporary or permanent waters of flooded puddles, river sloughs, creeks, and small ponds, where there are woody branches or extensive herbaceous growth along the edges.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: pesticide application; predation by non-native species; introduction of fish into formerly fishless areas

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and landowners to reduce levels of pesticide use in habitat; develop programs to reduce or eliminate the presence of fish in formerly fishless habitat; develop strategies to limit predation by non-native species

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Herpetology surveys for South Dakota Comprehensive Wildlife Conservation Plan (T-8)

Threats, management, and suggested harvest and collection policy of herpetofauna of SD (T-57)

Priority Research & Monitoring Needs (Appendices G-K):

Investigate prevalence of ranavirus; establish monitoring program to detect new occurrences

Analyze contaminant levels in wetlands

Participate in identification of PARCAs through regional PARC chapters

Eastern Hognose Snake EHSN *Heterodon platirhinos*

Description:

Medium-sized, harmless snake with a heavy body and an upturned snout; variable colors include tan, yellow, and brown.

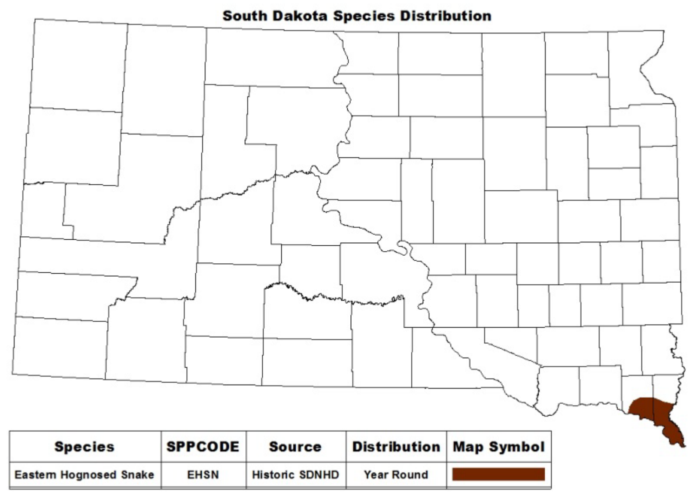
Protection Status:

Federal: None

State: Threatened

Distribution:

This species is on the fringe of its range and is believed to have historically occurred in appropriate habitat found in those portions of MLRAs 55C, 63B, 66, 102B, and 102C associated with the Missouri River. SD is the northwestern fringe of the historical range for this species. See map at right for current distribution.



Key Habitat:

Typically found in sandy floodplains of rivers and streams, sandy shorelines, and sandy upland grasslands; must have an abundant supply of toads and other small amphibians to sustain adults and young

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: destruction/disturbance of sand dune habitat by recreationists; commercial and recreational development; pesticides/herbicides

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and materials to educate the public on appropriate activities near habitat; work with agencies and landowners to reduce pesticide and herbicide use near habitat and to maintain open vegetative cover

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Herpetology surveys for SD Comprehensive Wildlife Conservation Plan (T-8)

Threats, management, and suggested harvest and collection policy of herpetofauna of SD (T-57)

Priority Research & Monitoring Needs (Appendices G-K):

Characterize habitat features of snake hibernacula via GIS modeling; survey such habitat

Collect genetic data to determine genetic variation among South Dakota populations and compared to populations elsewhere

Participate in identification of PARCAs through regional PARC chapters

False Map Turtle | FMTU | *Graptemys pseudogeographica*

Description:

Medium, freshwater turtle; brown carapace with middorsal keel and subtle knobs, light spec/line behind eye.

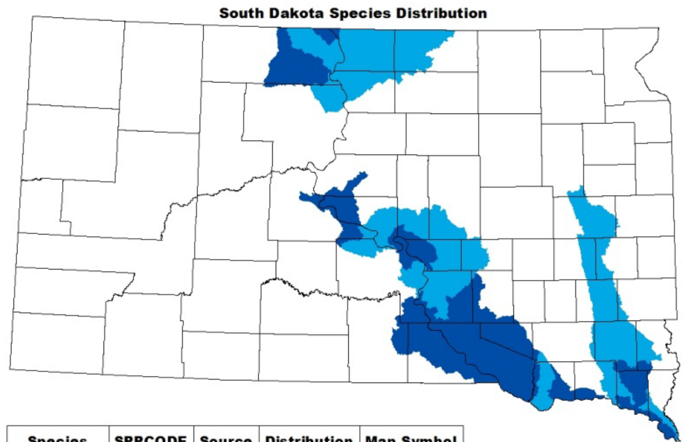
Protection Status:

Federal: None

State: Threatened

Distribution:

This species is believed to have historically occurred in appropriate habitat found in the Missouri River system. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
False Map Turtle	FMTU	SDNHD	Confirmed	
			Probable	

Key Habitat:

Lakes, ponds, reservoirs, sloughs, rivers and their backwaters; areas with abundant aquatic vegetation; deadwood for basking sites surrounded by deep water; lay eggs in nests dug in sandbars, islands, and beaches; may nest up to about 300 ft from water, but usually close to water.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: water pollution; herbicide/pesticide use; removal of basking sites (deadwood); nest disturbance by recreationists; unlawful shooting; nest depredation; bank stabilization

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and industry to maintain water quality by reducing soil erosion and reducing chemical use near habitat; maintain stable water levels in nesting colonies during nesting season; develop educational programs and post signs to protect nesting sites from disturbance.

Current Monitoring & Inventory Programs (Appendix E):

Monitoring in Missouri National Recreational River

SWG Accomplishments (Appendix F):

Population estimates, habitat relationships, and movement patterns of turtles, with an emphasis on the false map turtle and the smooth softshell in southeastern SD (T-30)

Herpetology surveys for SD Comprehensive Wildlife Conservation Plan (T-8)

Threats, management, and suggested harvest and collection policy of herpetofauna of SD (T-57)

Priority Research & Monitoring Needs (Appendices G-K):

Survey Missouri River populations from Pierre to North Dakota border

Examine scope of aquatic turtle mortality as by-catch in fish traps

Identify key nesting beaches along the Missouri River for potential protective measures

Participate in identification of PARCAs through regional PARC chapters

Lesser Earless Lizard | LELI | *Holbrookia maculata*

Description:

Small gray to brownish lizard; lengthwise rows of dark blotches separated by pale stripe down center of back.

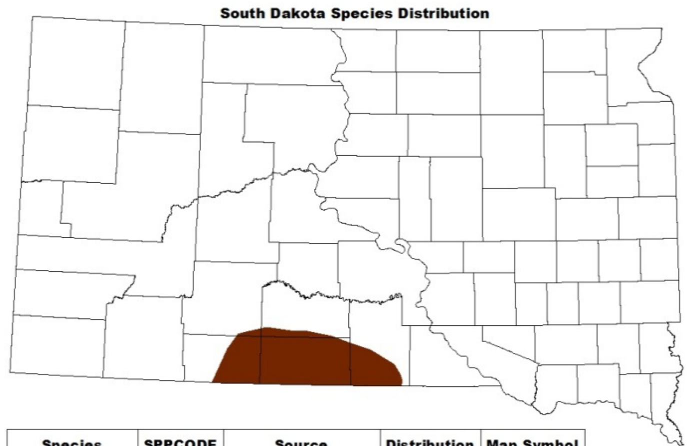
Protection Status:

Federal: None

State: None

Distribution:

This species is on the fringe of its range and is believed to have historically occurred in appropriate habitat found in MLRAs 65, 66, and parts of MLRA 64. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Lesser Earless Lizard	LELI	Historic & Current SDNHD	Year Round	

Key Habitat:

Prefers sandhills; sandy or gravelly areas along streams; sparsely vegetated or short-statured grass ecosystems; prairie dog towns.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: control of prairie dog populations impact this species

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and landowners to reduce the use of pesticides and poisons to control burrowing mammals

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Herpetology surveys for South Dakota Comprehensive Wildlife Conservation Plan (T-8)

Threats, management, and suggested harvest and collection policy of herpetofauna of SD (T-57)

Priority Research & Monitoring Needs (Appendices G-K):

Continue opportunistic data collection through Natural Heritage Program

Establish population monitoring system

Participate in identification of PARCAs through regional PARC chapters

Lined Snake	LISN	*Tropidoclonion lineatum*

Description:

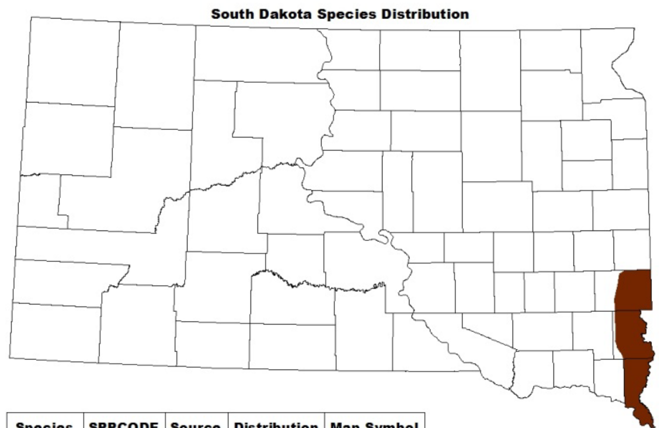
Small snake resembling the garter snake; variable colored with light stripes running down the back and sides.

Protection Status:

Federal: None
State: Endangered

Distribution:

This species is on the fringe of its range and is believed to have historically occurred in appropriate habitat found in portions of MLRAs 102B and 102C. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Lined Snake	LISN	SD Herps	Year Round	

Key Habitat:

Prefers open, grassy prairies with rich soils and sparsely wooded areas; often found on hillsides near rocky areas.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5
Non-habitat: road mortality

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: investigate methods to provide or enhance travel corridors in highly-developed areas; develop programs and materials to educate the public on appropriate activities near habitat

Current Monitoring & Inventory (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Herpetology surveys for South Dakota Comprehensive Wildlife Conservation Plan (T-8)
Threats, management, and suggested harvest and collection policy of herpetofauna of SD (T-57)

Priority Research & Monitoring (Appendices G-K):

Characterize habitat features of snake hibernacula via GIS modeling; survey such habitat
Analyze contaminant loads
Identify areas of high road mortality and design measures to minimize loss
Conduct mark-recapture study to track population densities through time
Participate in identification of PARCAs through regional PARC chapters

Many-lined Skink | MLSK | *Plestiodon multivirgatus*

Description:

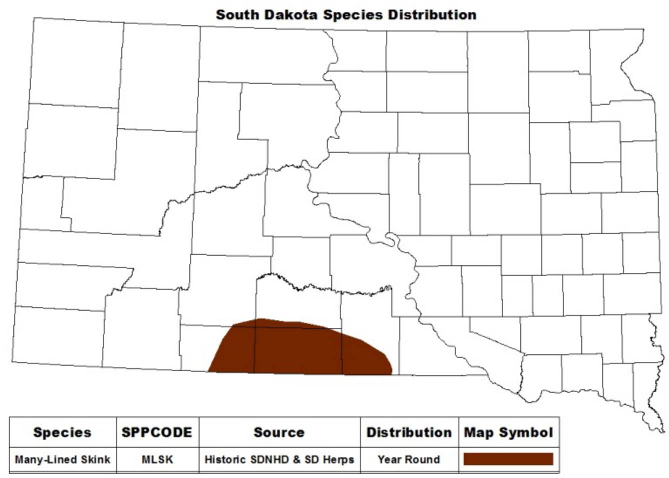
Long-bodied skink, with many alternating light and dark stripes.

Protection Status:

Federal: None
State: None

Distribution:

This species is on the fringe of its range and is believed to have historically occurred in appropriate habitat found in 65 and 66, as well as portions of 64. See map at right for current distribution.



Key Habitat:

Prefers areas of loose sandy soil and prairie dog towns; often found beneath rocks or logs; sandhills and open plains habitats of Great Plains.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5
Non-habitat: control of prairie dog populations impact this species

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and landowners to reduce the use of pesticides and poisons to control burrowing mammals

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Herpetology surveys for South Dakota Comprehensive Wildlife Conservation Plan (T-8)
Threats, management, and suggested harvest and collection policy of herpetofauna of SD (T-57)

Priority Research & Monitoring Needs (Appendices G-K):

Conduct pitfall trap and visual surveys in areas of sandy soils in western and southcentral SD
Collect genetic data to evaluate population distinctiveness
Participate in identification of PARCAs through regional PARC chapters

Sagebrush Lizard SALI *Sceloporus graciosus*

Description:

Small lizard; gray or brown above and black bar on the shoulder; rust color on sides of the neck and body more pronounced in females; blue belly/throat patches more pronounced in males.

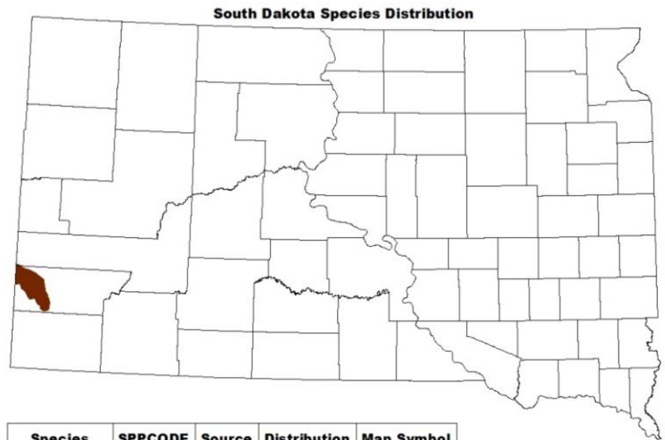
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in only a small portion of MLRAs 60A and 61, near the western state boundary. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Sagebrush Lizard	SALI	SDNHD	Year Round	

Key Habitat:

Prefers sandier sites with relatively sparse vegetation or blowouts and a small percentage of sagebrush or other shrub cover; avoids areas with loamier soils.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: a general lack of information regarding this species

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: None

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Herpetology surveys for South Dakota Comprehensive Wildlife Conservation Plan (T-8)

Threats, management, and suggested harvest and collection policy of herpetofauna of SD (T-57)

Priority Research & Monitoring Needs (Appendices G-K):

Characterize important foraging habitats via niche modeling

Map, characterize and monitor sagebrush habitat

Determine effect of livestock grazing on sagebrush

Collect genetic data to determine risk of low genetic variation

Participate in identification of PARCAs through regional PARC chapters

Short-horned Lizard | SHLI | *Phrynosoma hernandesi*

Description:

Small, flat, broad-bodied, brown to gray lizard with a short tail; spiny back and short spiny horns on the rear of head.

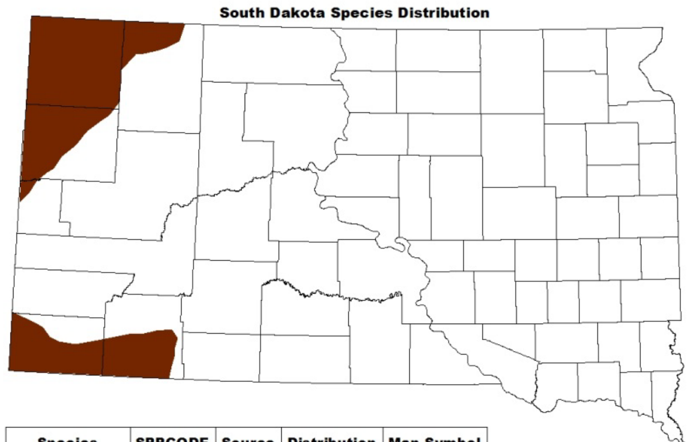
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs west of the Missouri River, except MLRAs 61 and 62. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Short-Horned Lizard	SHLI	SDNHD	Year Round	

Key Habitat:

Prefers short-statured grass ecosystems, sagebrush; sparse vegetation at ground level and easy access to sunlight are among the most important habitat features; prairie dog burrows are used for shelters and foraging.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: off-road recreational vehicle traffic and increased traffic associated with road building to oil and gas developments; use of insecticides could affect the food supply; pet trade

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and the public to reduce recreational use within habitat; develop programs to reduce the use of insecticides to control insects (prey)

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Herpetology surveys for South Dakota Comprehensive Wildlife Conservation Plan (T-8)

Threats, management, and suggested harvest and collection policy of herpetofauna of SD (T-57)

Priority Research & Monitoring Needs (Appendices G-K):

Analyze contaminant loads

Characterize important foraging habitats via niche modeling

Continue surveys using predictive ecological niche modeling to identify appropriate search areas

Collect genetic data to determine risk of low genetic variation

Participate in identification of PARCAs through regional PARC chapters

Smooth Softshell | SMSO | *Apalone mutica*

Description:

Turtle recognized by its long pointed snout and heavily webbed feet.

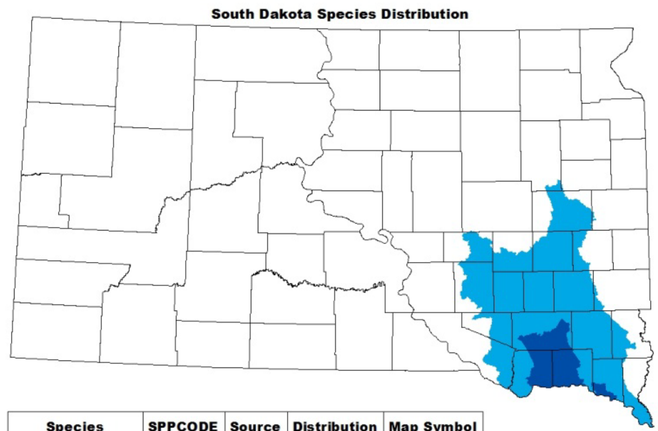
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in habitat found state-wide in South Dakota, except MLRAs 61 and 62. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Smooth Softshell Turtle	SSTU	SDNHD	Confirmed	
			Probable	

Key Habitat:

Prefers rivers and large streams with moderate to fast current, and, lakes with sandy or muddy bottoms and few aquatic plants; lakes are near or part of a large river; sandbars important for basking and egg laying sites.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: removal of basking sites (e.g., deadwood); herbicide and pesticide use; nest disturbance by recreationists; nest depredation; bank stabilization

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and landowners to reduce levels of water pollution in habitat; develop programs to educate the public on recreational impacts to habitat

Current Monitoring & Inventory Programs (Appendix E):

Monitoring along lower Missouri River

SWG Accomplishments (Appendix F):

Population estimates, habitat relationships, and movement patterns of turtles, with an emphasis on the false map turtle and the smooth softshell in southeastern SD (T-30)

Herpetology surveys for South Dakota Comprehensive Wildlife Conservation Plan (T-8)

Threats, management, and suggested harvest and collection policy of herpetofauna of SD (T-57)

Priority Research & Monitoring Needs (Appendices G-K):

Survey rivers in northern and western South Dakota

Identify key nesting beaches along Missouri River for potential protective measures

Examine scope of aquatic turtle mortality as by catch in fish traps

Participate in identification of PARCAs through regional PARC chapters

Western (Ornate) Box Turtle WBTU *Terrapene ornata*

Description:

Turtle with dark brown or black shell and bright yellow lines that radiate to form a star burst pattern.

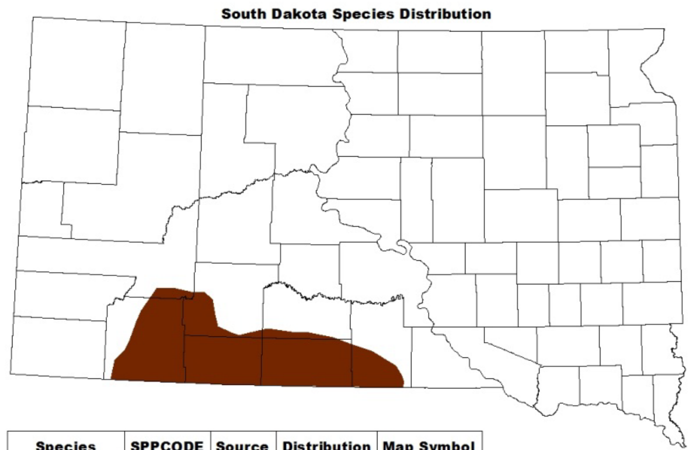
Protection Status:

Federal: None

State: None

Distribution:

This species is on the fringe of its range and is believed to have historically occurred in appropriate habitat found in MLRAs 64, 65, and 66 as well as the southern portions of 63A, 63B, 60A, 102B, and 102C. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Western Box Turtle	WBTU	SDNHD	Year Round	

Key Habitat:

Prefers sandhills and short-statured grass ecosystems; requires deep sandy soil to burrow into for hibernation in the winter; burrows into soil (e.g., under plants such as yucca) or enters burrows made by other species such as prairie dogs.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: road mortality; pet trade; ranavirus

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: develop programs and educational materials to reduce road mortality, e.g., place warning signs in frequently traveled routes and develop culverts to assist road crossing; monitor and assess the risk of pet trading.

Current Monitoring & Inventory Program (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Distribution, abundance, and seasonal habitat use patterns in ornate box turtles in SD (T-44)

Herpetology surveys for South Dakota Comprehensive Wildlife Conservation Plan (T-8)

Threats, management, and suggested harvest and collection policy of herpetofauna of SD (T-57)

Priority Research & Monitoring Needs (Appendices G-K):

Map and assess quality of remaining prairie on a recurring basis

Survey potentially occupied sites identified in Higa et al. 2012 study

Participate in identification of PARCAs through regional PARC chapters

American Burying Beetle | AMBE | *Nicrophorus americanus*

Description:

Large, shiny, black burying beetle with orange patches on wings and head.

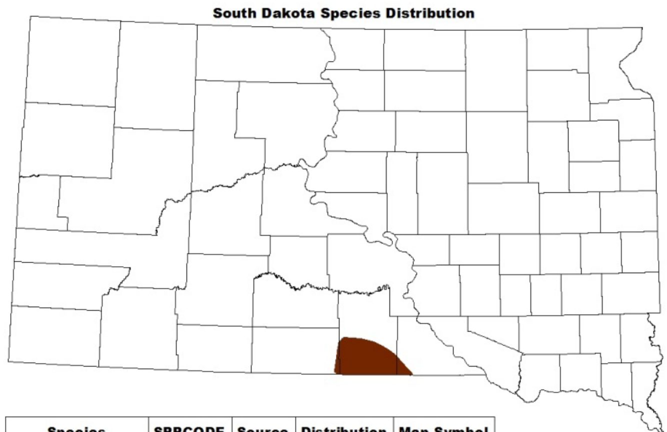
Protection Status:

Federal: Endangered

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout South Dakota with the possible exception of MLRA 62. Today, it is only known to occur in a small portion of its previous range - see current distribution map at right.



Species	SPPCODE	Source	Distribution	Map Symbol
American burying beetle	AMBE	SDNHD	Year Round	

Key Habitat:

Believed to be a habitat generalist as long as there are abundant carrion sources. However, it has been found to be positively correlated with little bluestem mixed prairies, disturbed grasslands, and fine sandy loams that are well-drained and at least moderately permeable. It is typically negatively correlated with forests, bottomland habitat, clays, and silt loams. Habitat areas must be large enough to allow sufficient distance for movements in search of carrion and mates (e.g., may move as a far as 2 miles in 24 hours). A small area of potential habitat is not expected to support a population long term.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: population declines for this species are poorly understood at this time but some suggestions includes carcass reduction/limitations, pesticide use, disease, light pollution, or a combination of these factors

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and industry to reduce pesticide/herbicide use and excessive light pollution in habitat

Current Monitoring & Inventory Programs (Appendix E):

Population surveys

SWG Accomplishments (Appendix F):

Monitoring the American burying beetle in South Dakota (T-17A)

Priority Research & Monitoring Needs (Appendices G-K):

Periodically survey occupied areas to monitor population status and trends

Existing Recovery Plans/Conservation Strategies:

U.S. Fish and Wildlife Service. 1991. American burying beetle (*Nicrophorus americanus*) recovery plan. Newton Corner, MA 80pp.

Dakota Skipper | DASK | *Hesperia dacotae*

Description:

Small butterfly; males are tawny orange above; females are pale grayish brown above.

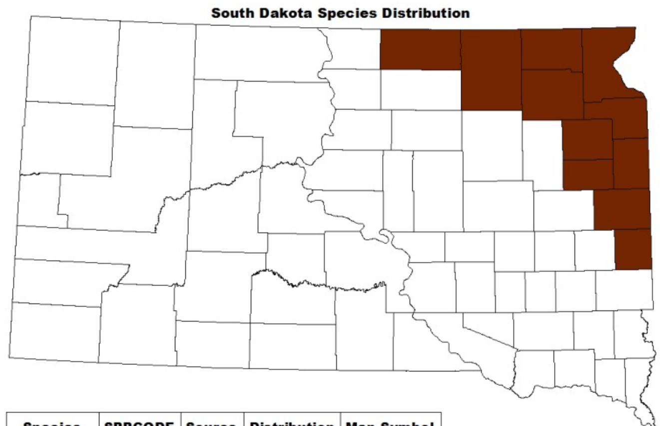
Protection Status:

Federal: Threatened

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRA's east of the Missouri River. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Dakota Skipper	DASK	SDNHD	Year Round	

Key Habitat:

Typically found in gravelly, calcareous, alkaline, dry to moist light to moderately grazed grass ecosystems; larvae feed on little bluestem; alkali grass may be a reliable indicator of habitat

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: poorly timed prescribed fire that results in direct mortality; poorly timed mowing/haying/grazing; and pesticide/herbicides

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and industry to reduce pesticide/herbicide use in habitat

Current Monitoring & Inventory Programs (Appendix E):

Population surveys

SWG Accomplishments (Appendix F):

Monitoring of butterfly species of concern in South Dakota (T-17B)

Mapping and characterization of native grassland habitats on South Dakota's prairie coteau (T-54)

Priority Research & Monitoring Needs (Appendices G-K):

Continue population monitoring

Map and assess quality of remaining prairie on a recurring basis

Continue participation in captive propagation and reintroduction efforts

Existing Recovery Plans/Conservation Strategies:

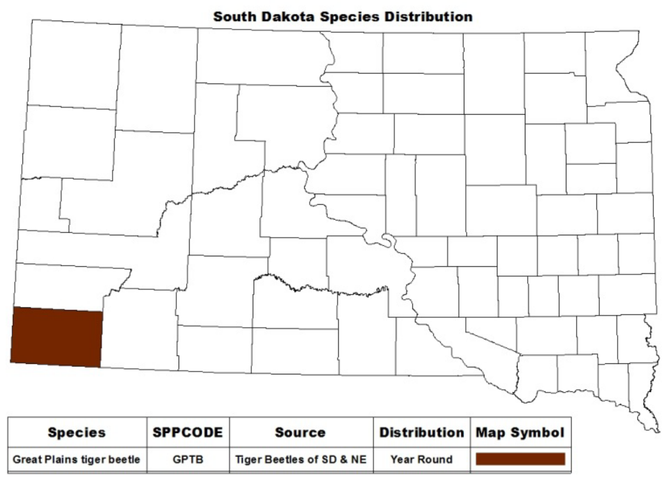
Delphey, P. 2003. Summary of threats and conservation guidelines: Dakota skipper *Hesperia dacotae* (Skinner). U.S. Fish and Wildlife Service, Twin Cities Field Office. 34 pp

Great Plains Tiger Beetle GPTB *Amblycheila cylindriformis*

Description:
Largest North American tiger beetle; dark reddish brown to black in coloration.

Protection Status:

Federal: None
State: None



Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 60A, 61, and portions of MLRA 64. See map at right for current distribution.

Key Habitat:

Eroded gullies, dissected loess, and clay hill banks that are located in sagebrush or short-statured grass ecosystems; in South Dakota, restricted to sand sage prairie.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5
Non-habitat: none identified

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: none identified

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

Priority Research & Monitoring Needs (Appendices G-K):

Population surveys

Indian Creek Tiger Beetle ICTB *Cicindela nevadica makosika*

Description:
Coppery beetle with pronounced white spots; head coppery with greenish reflections especially along edges of eyes.

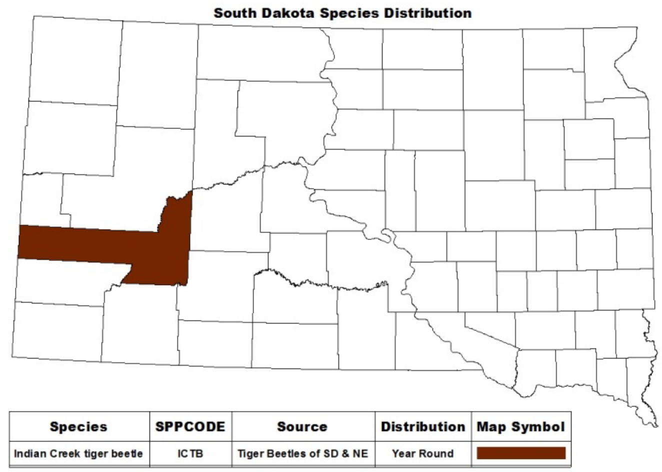
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRA 60A and possibly MLRA 64. See map at right for current distribution.



Key Habitat:

Lower Indian Creek, an intermittent stream with above average salinity, where portions of the streambed consist of a light colored, viscous mud overlying Pierre shale.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: concentrated herds of cattle impact habitat

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with landowners to reduce cattle concentrations in habitat

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

Priority Research & Monitoring Needs (Appendices G-K):

Continued population monitoring; locate larvae and adults

Iowa Skipper | IOSK | *Atrytone arogos iowa*

Description:

Butterfly with yellow-orange upperside and black wing borders.

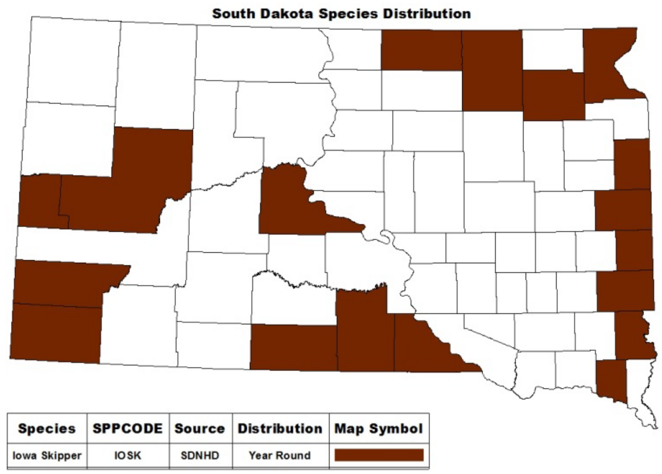
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout South Dakota with the exception of MLRAs 61 and 62. See map at right for current distribution.



Key Habitat:

Prefers a range of short-statured to tall-statured native grass ecosystems; larval host plants include big bluestem, little bluestem, and sideoats grama; adult nectaring sources include yellow prickly pear, milkweeds, coneflowers, and wavy-leaf thistle.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: poorly timed prescribed fire that results in direct mortality; poorly timed mowing/haying/grazing; pesticide/herbicides

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and industry to reduce pesticide/herbicide use in habitat.

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Monitoring butterfly species of concern in South Dakota (T-17B)

Priority Research & Monitoring Needs (Appendices G-K):

Map and assess quality of remaining native prairie on a recurring basis

Population surveys

Existing Recovery Plans/Conservation Strategies:

Moffat, M. and N. McPhillips. 1993. Management for butterflies in the northern Great Plains: a literature review and guidebook for land managers. U.S. Fish and Wildlife Service, Ecological Services, S.D. Field Office, 420 South Garfield Ave., Suite 400, Pierre, SD 57501-5408.

Little White Tiger Beetle | LWTB | *Cicindela lepida*

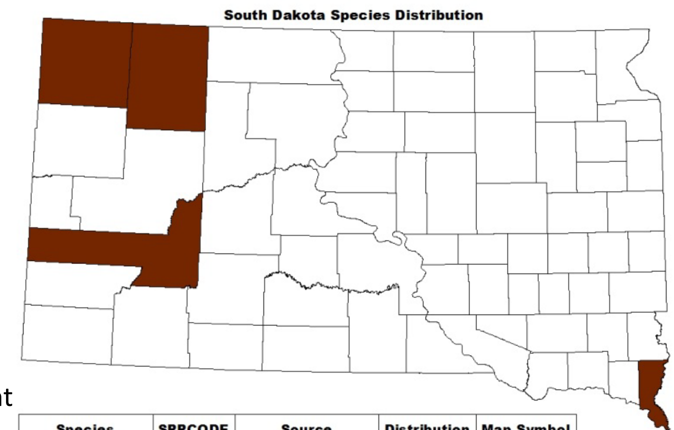
Description:
Small tiger beetle; brown background with white markings that make it appear mostly white.

Protection Status:

Federal: None
State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found throughout South Dakota. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Little White tiger beetle	LWTB	Tiger Beetles of SD & NE	Year Round	

Key Habitat:

Prefers the open, blowing portion of large sand dunes or sand beaches.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5
Non-habitat: stabilization activities to reduce blowing sand

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6
Non-habitat: work with agencies and landowners to reduce stabilization activities near habitat

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

Priority Research & Monitoring Needs (Appendices G-K):

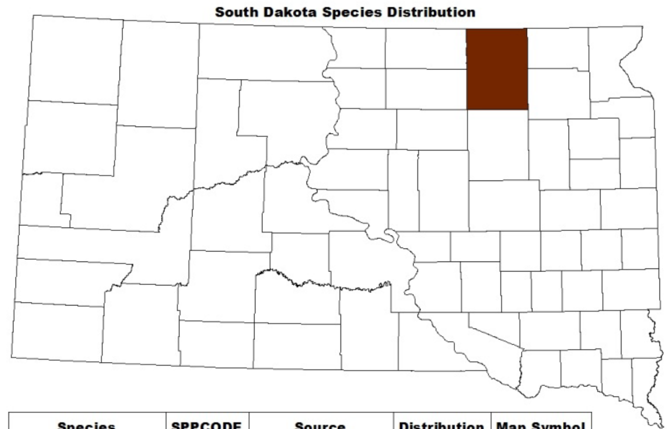
Survey dunes in the Hecla area to see if species is still present
Identify impacts of intensive grazing
Identify undisturbed blowouts inland or along shores of lakes or rivers; potential techniques are blacklighting or use of mercury vapor

Northern Sandy Tiger Beetle | NSTB | *Cicindela limbata nympha*

Description:
Tiger beetle with iridescent green dorsal surface and complete, broad spots covering most of the anterior wings.

Protection Status:
Federal: None
State: None

Distribution:
See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Northern sandy tiger beetle	NSTB	Tiger Beetles of SD & NE	Year Round	

Key Habitat:
Prefers dry, sandy dunes and sandy areas away from water.

Conservation Challenges:
Habitat: see conservation challenges for native ecosystem diversity in Chapter 5
Non-habitat: off-road vehicle use that destroys larval burrows

Conservation Actions:
Habitat: see conservation actions for native ecosystem diversity in Chapter 6
Non-habitat: develop public education materials for off-road vehicle use in habitat

Priority Research & Monitoring Needs (Appendices G-K):
Population surveys

Ottoe Skipper | OTSK | *Hesperia ottoe*

Description:

Butterfly; males are yellowish orange, females are dull brown.

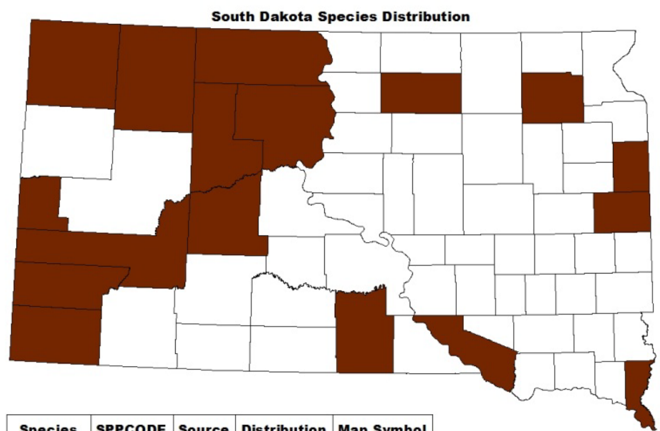
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout South Dakota with the exception of MLRAs 61 and 62. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Ottoe Skipper	OTSK	SDNHD	Year Round	

Key Habitat:

Prefers mid- to tall-statured grass ecosystems.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: poorly timed mowing/grazing/fire that removes nectar sources or vegetation during larval leaf-shelter phase; pesticide/herbicides

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and landowners to reduce pesticide/herbicide use in habitat

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Monitoring butterfly species of concern in South Dakota (T-17B)

Priority Research & Monitoring Needs (Appendices G-K):

Population surveys

Existing Recovery Plans/Conservation Strategies:

Dana, R. P. 1991. Conservation management of the prairie skippers *Hesperia dacotae* and *Hesperia ottoe*. Minnesota Agricultural Experiment Station Bulletin 594-1991. University of Minnesota, St. Paul, MN. 63 pp.

Pahasapa Fritillary | PAFR | *Speyeria atlantis pahasapa*

Description:

Butterfly with orange-brown color above and a complex black pattern of spots, bars, and chevrons.

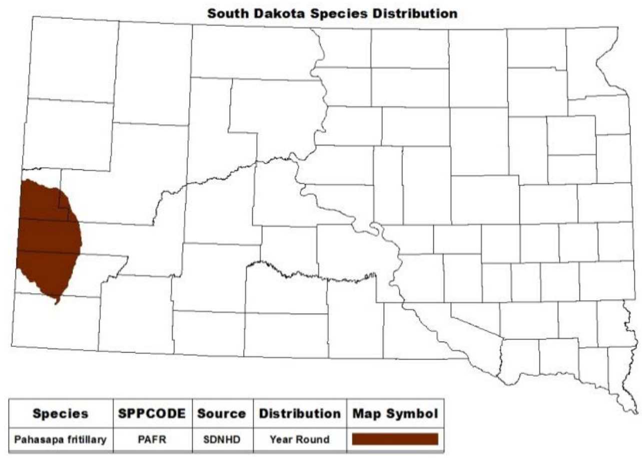
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 61 and 62. See map at right for current distribution.



Key Habitat:

Prefers openings in boreal forest ecosystems; riparian/wetland ecosystems with wet meadows and abundant violets; may be particularly associated with beaver ponds.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: a general lack of information regarding this species

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: none

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Monitoring butterfly species of concern in South Dakota (T-17B)

Priority Research & Monitoring Needs (Appendices G-K):

Map and assess quality of remaining native prairie on a recurring basis

Population surveys

Poweshiek Skipperling | POSK | *Oarisma poweshiek*

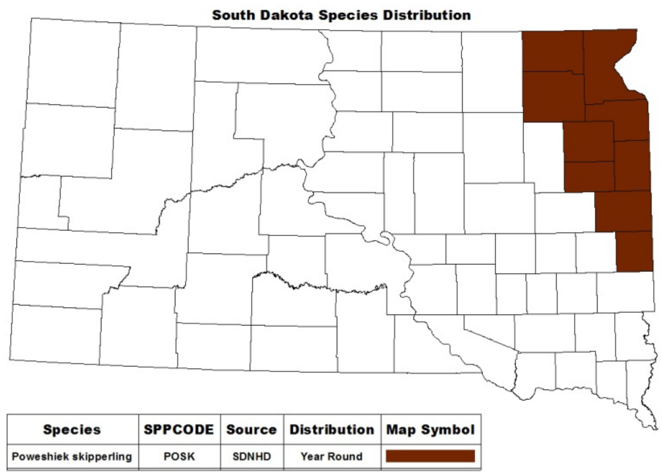
Description:
Butterfly with very dark brown body and upper wings.

Protection Status:

Federal: Endangered
State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 56, 102A, 102B, and 102C. See map at right for current distribution.



Key Habitat:

Prefers lightly grazed tall grass ecosystems with a significant component of plants in the sunflower family; may use the edge of grass/sedge dominated riparian/wetland ecosystems.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: excessive prescribed burning (burn intervals of 3 –5 years or less is detrimental); herbicide/pesticides

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and landowners to reduce pesticide/herbicide use in habitat

Current Monitoring & Inventory Programs (Appendix E):

Population surveys

SWG Accomplishments (Appendix F):

Monitoring butterfly species of concern in South Dakota (T-17B)

Priority Research & Monitoring Needs (Appendices G-K):

Continued monitoring

Existing Recovery Plans/Conservation Strategies:

USFWS. 2011. Candidate Assessment Form. Available online at: http://www.fws.gov/Midwest/endangered/insects/posk/pdf/POSKCandidateAssessmentForm2011.pdf

Regal Fritillary | REFR | *Speyeria idalia*

Description:
Large orange-black butterfly; sometimes confused with the monarch.

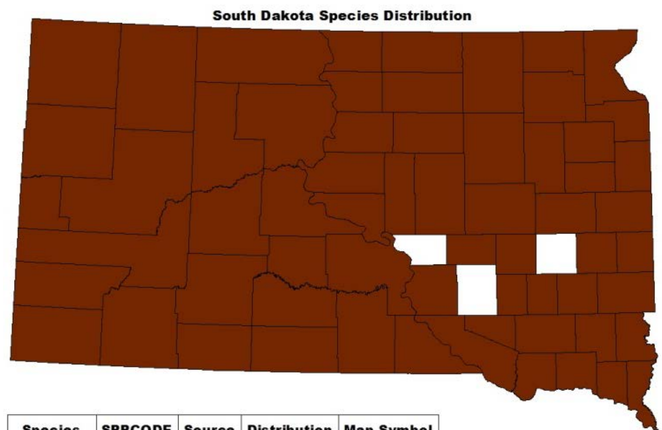
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat throughout South Dakota with the exception of MLRAs 61 and 62. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Regal Fritillary	REFR	SDNHD	Year Round	

Key Habitat:

Prefers tall-statured or lightly grazed grass ecosystems containing violet species and nectar sources.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: poorly timed prescribed fire that results in direct mortality; poorly timed mowing/haying/grazing; pesticide/herbicide application

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and landowners to reduce pesticide/herbicide use in habitat

Current Monitoring & Inventory Programs (Appendix E):

Opportunistic data collection through Natural Heritage Program

SWG Accomplishments (Appendix F):

Monitoring butterfly species of concern in South Dakota (T-17B)

Priority Research & Monitoring Needs (Appendices G-K):

Population surveys

Map and assess quality of native prairie on a recurring basis

Existing Recovery Plans/Conservation Strategies:

1) Selby, G. 2007. Regal Fritillary (*Speyeria idalia* Drury): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/regalfritillary.pdf; 2) Royer, R.A. and G.M. Marrone, 1992. Conservation status of the regal fritillary (*Speyeria idalia*) in North and South Dakota. Report to the U.S. Fish and Wildlife Service, Region 6.

Cooper's Rocky Mountainsnail CRMO *Oreohelix strigosa cooperi*

Description:

Land snail

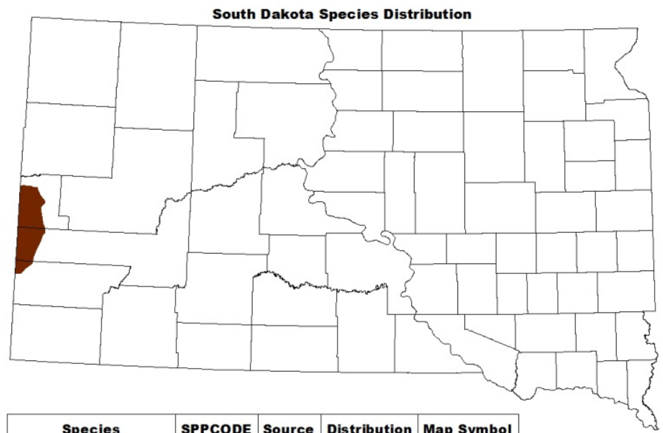
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 61 and 62. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Coopers rocky mountainsnail	CRMO	SDNHD	Year Round	

Key Habitat:

Prefers calcareous soils in moist ponderosa pine forests above 3000 feet; also found in white spruce/ponderosa pine riparian communities.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: road construction/salting; recreation; and herbicides/pesticides

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and industry to reduce pesticide/herbicide use in habitat

Current Monitoring & Inventory Programs (Appendix E):

Black Hills land snail surveys

SWG Accomplishments (Appendix F):

A proposal to examine the endemism and population relationships of the Black Hills *Oreoheli*x snails (T-11)

Priority Research & Monitoring Needs (Appendices G-K):

Periodic surveys to monitor population status and trends

Dakota Vertigo | DAVE | *Vertigo arthuri*

Description:

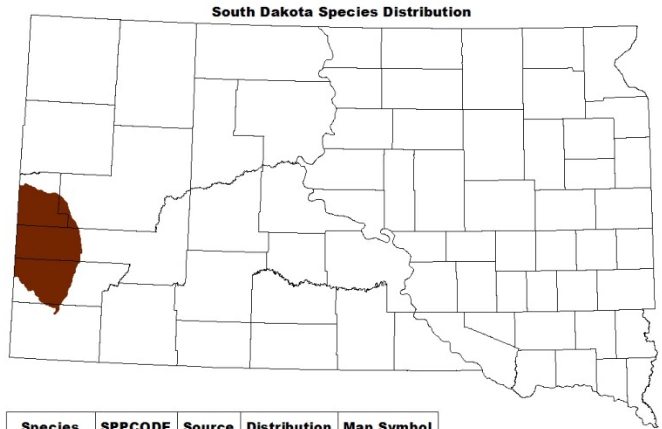
Land snail with a dark orange/brown shell.

Protection Status:

Federal: None
State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MRLAs 61 and 62. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Dakota vertigo	DAVE	SDNHD	Year Round	

Key Habitat:

Prefers undisturbed, moist forests of white spruce or ponderosa pine; understory often characterized by deep litter

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: road construction/salting; recreation; and herbicides/pesticides

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies, landowners, and industry to reduce pesticide/herbicide use in habitat

Current Monitoring & Inventory Programs (Appendix E):

Black Hills land snail surveys

Priority Research & Monitoring Needs (Appendices G-K):

Periodic surveys to monitor status and trends

Existing Recovery Plans/Conservation Strategies:

Anderson, T. (2004, September 16). Callused Vertigo (*Vertigo arthuri*): A technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/callusedvertigo.pdf

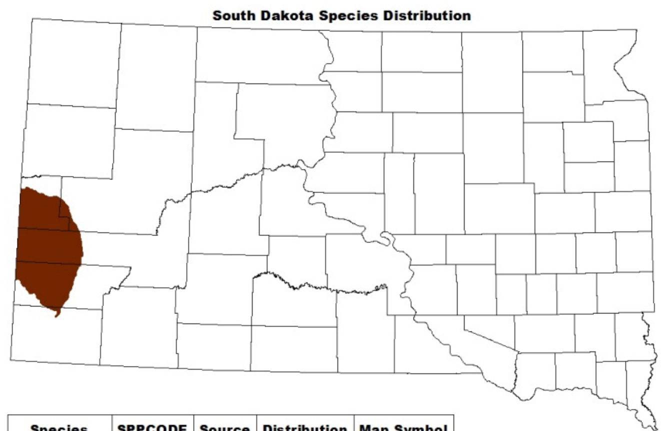
Frigid Ambersnail FRAM *Catinella gelida*

Description:
Land snail

Protection Status:
Federal: None
State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 61 and 62. See map at right for current distribution.



Species	SPPCODE	Source	Distribution	Map Symbol
Frigid ambersnail	FRAM	SDNHD	Year Round	

Key Habitat:

Prefers low to medium elevation well-forested, cold-air drainage slopes; often located near limestone talus near the base of a slope.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: road construction/salting; recreation; and herbicides/pesticides

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and industry to reduce disturbance; work with agencies, landowners, and industry to reduce pesticide/herbicide use in habitat

Current Monitoring & Inventory Programs (Appendix E):

Black Hills land snail surveys

Priority Research & Monitoring Needs (Appendices G-K):

Periodic surveys to monitor population status and trends

Mystery Vertigo | MYVE | *Vertigo paradoxa*

Description:

Very small land snail; cinnamon colored with a "beehive" or cylindrical shell.

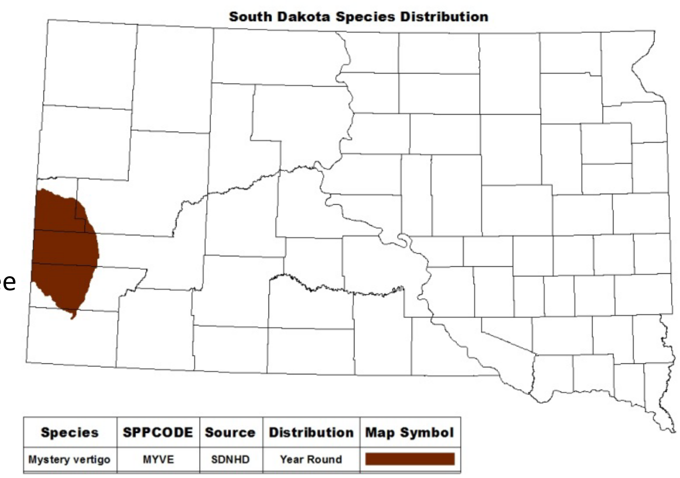
Protection Status:

Federal: None

State: None

Distribution:

This species is believed to have historically occurred in appropriate habitat found in MLRAs 61 and 62. See map at right for current distribution.



Key Habitat:

Prefers forest dominated by white spruce or ponderosa pine; north-facing slopes; limestone or schist substrates.

Conservation Challenges:

Habitat: see conservation challenges for native ecosystem diversity in Chapter 5

Non-habitat: herbicides/pesticides

Conservation Actions:

Habitat: see conservation actions for native ecosystem diversity in Chapter 6

Non-habitat: work with agencies and landowners to reduce pesticide/herbicide use in habitat

Current Monitoring & Inventory Programs (Appendix E):

Black Hills land snail surveys

Priority Research & Monitoring Needs (Appendices G-K):

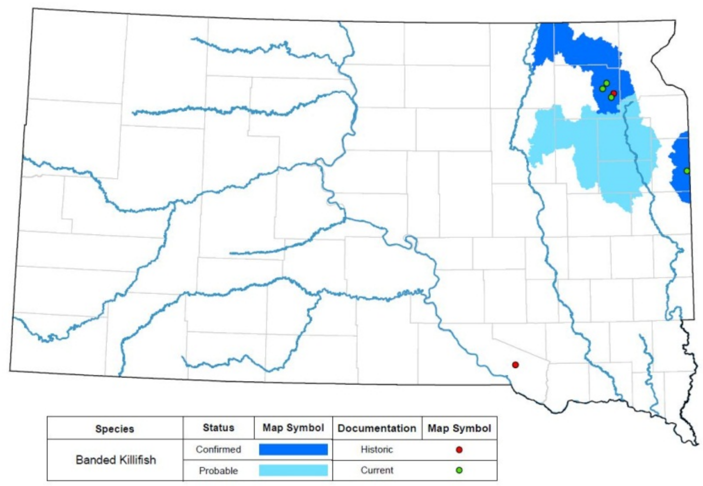
Periodic surveys to monitor population status and trends

Existing Recovery Plans/Conservation Strategies:

Anderson, T. (2004, November 4). Mystery Vertigo (*Vertigo paradoxa*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/mysteryvertigo.pdf

Banded Killifish BAKI *Fundulus diaphanus*

Description:
- Small, olive colored fish with yellow sides having green-brown vertical bands
- Protruding lower jaw & rounded caudal fin
- SIMILAR SPECIES: Central Mudminnow & Plains Topminnow, mudminnow are darker in color with irregular dark bands & topminnow lack bands



Protection Status:
- Federal: None
- State: Endangered
- Global Rank: G5 (Secure)
- State Rank: S1 (Critically imperiled)

Distribution:
- Eastern SD- tributaries to the James, Vermillion & Big Sioux River basins
- SD is on the western periphery of the range for this species

Key Habitat:
- Prefer quiet, shallow lakes, ponds & streams with abundant aquatic vegetation & sandy, gravel substrates

Conservation Challenges:
- Modified flood regime
- Ecosystem/habitat conversion or loss
  - Shoreline development
  - Conversion of wetlands to agriculture
- Ecosystem alteration/habitat degradation
- Pollution/pesticides/herbicides

Conservation Actions:
- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff

Current Monitoring & Inventory Programs (Appendix E):
- None.

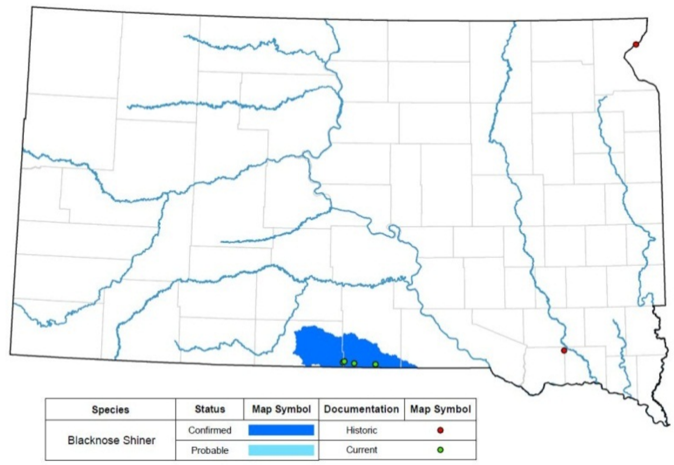
SWG Accomplishments (Appendix F):
- Evaluation of a decision support tool to help support fish species at risk in South Dakota streams–T-9

Priority Research & Monitoring Needs (Appendices G-K):
- Determine baseline data & status through monitoring efforts
- Develop a management plan
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities

Blacknose Shiner | BLSH | *Notropis heterolepis*

Description

- Slender, silvery minnow with dark edged scales above lateral line & large eyes
- Black crescent-shaped marks forming stripe along sides from nose to caudal fin & passing through the eye



Protection Status:

- Federal: None
- State: Endangered
- Global Rank: G4 (Apparently secure)
- State Rank: S1 (Critically imperiled)

Distribution:

- Southern SD- tributaries to the James & Keya Paha River basin
- SD is on the western periphery of the range for this species

Key Habitat:

- Prefer cool, highly vegetated streams, small rivers & lakes with sandy substrates

Conservation Challenges:

- Ecosystem alteration/habitat degradation
  - Increased turbidity & siltation of stream bottoms
  - Reduced aquatic & riparian vegetation
- Grazing/Agricultural practices
- Moderately vulnerable to climate change

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff

Current Monitoring & Inventory Programs (Appendix E):

- Western prairie streams & rivers inventory surveys (SDGFP, SDSU)

SWG Accomplishments (Appendix F):

- Glacial relict fishes in spring fed headwater streams of South Dakota's Sandhills region – T-2-8

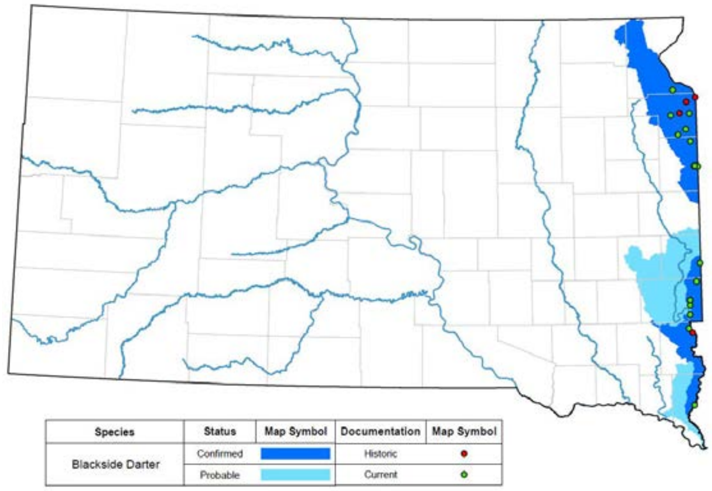
Priority Research & Monitoring Needs (Appendices G-K):

- Determine current distribution & status through continued monitoring efforts
- Develop a management plan
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities

Blackside Darter | BLDA | *Percina maculata*

Description:

- Olive colored darter with a broad black stripe along sides made up of 8 to 9 blotches.
- Black spot at base of rounded tail fin
- Fully scaled head with tear drop spot below eye
- SIMILAR SPECIES: Logperch



Protection Status:

- Federal: None
- State: None
- Global Rank: G5 (Secure)
- State Rank: S2 (Imperiled)

Distribution:

- Eastern SD-tributaries to the Big Sioux & Minnesota River basins
- SD is on the western periphery of the range for this species

Key Habitat:

- Prefers pools of streams to medium sized rivers with moderate current & sand or gravel substrates

Conservation Challenges:

- Modified flood regimes
- Reduced number of beaver ponds/dams
- Ecosystem/habitat conversion or loss
- Ecosystem alteration/habitat degradation
  - Impoundments
  - Channelization
- Pollution/pesticides/herbicides
  - Increased turbidity
- Grazing/Agricultural practices

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Restore & maintain habitat & stream connectivity

Current Monitoring & Inventory Programs (Appendix E):

- None.

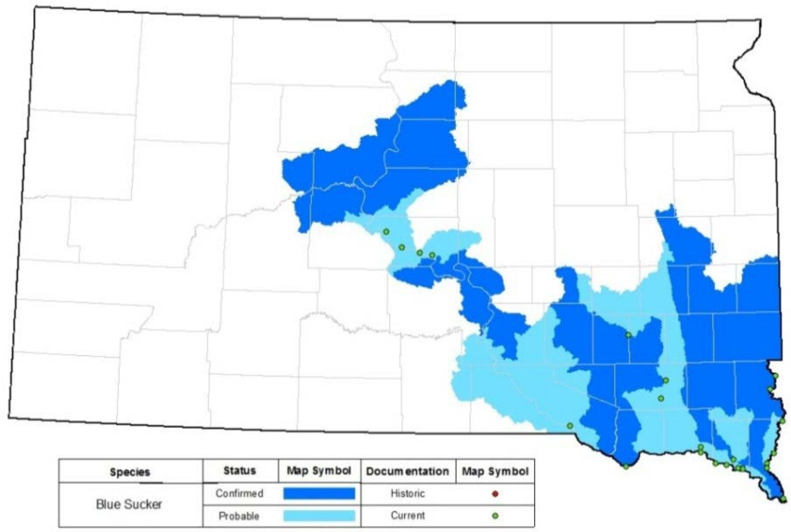
SWG Accomplishments (Appendix F):

- Comprehensive aquatics survey of the Minnesota River tributaries – T-17D

Priority Research & Monitoring Needs (Appendices G-K):

- Determine baseline data & status through monitoring efforts
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities

Blue Sucker BLSU *Cycleptus elongatus*



Description:
- Large, slender, dark bodied fish
- Small head and a long sickle shaped dorsal fin
- Most range in size from 16-24 inches and 1.5-3 pounds

Protection Status:
- Federal: None
- State: None
- Global Rank: G3 (Vulnerable)
- State Rank: S3 (Vulnerable)

Distribution:
- Central SD-Missouri River basin
- SD is on the northern edge of the range for this species

Key Habitat:
- Prefers large, rivers with natural hydrographs
- Prefers riffle habitats with clear, fast flowing water and smooth, hard substrates.

Conservation Challenges:
- Modified flood regimes
- Ecosystem/habitat conversion or loss
- Ecosystem alteration/habitat degradation
  - Impoundments
  - Channelization
  - Dredging
- Pollution/pesticides/herbicides
- Moderately vulnerable to climate change

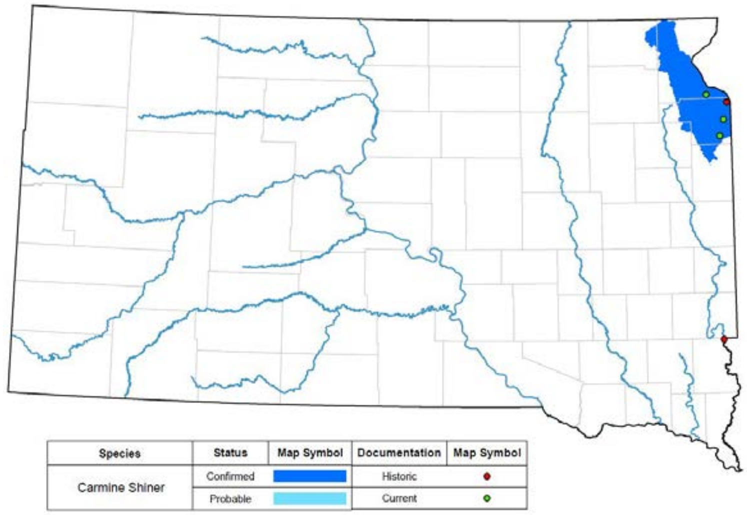
Conservation Actions:
- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible
- Partner with federal fish hatcheries to develop a captive breeding and stocking program
- River corridor habitat protection through conservation programs/incentives or purchase

Current Monitoring & Inventory Programs (Appendix E):
- Lower Missouri River Fish Surveys (USACE, USFWS, SDGFP)
- Missouri River reservoir fisheries surveys (SDGFP)

Priority Research & Monitoring Needs (Appendices G-K):
- Continue & expand current monitoring efforts
- Develop standardized protocols for monitoring all life history stages among all habitats
- Evaluate the role of sediment transport & discharge on the creation & maintenance of habitats for all life stages
- Identify reproductive potential and life history
- Identify natal and spawning areas
- Research seasonal movements

Carmine Shiner | CASH | *Notropis percobromus*

Description:
- Small, slender minnow that is olive colored above the lateral line & silvery below
- Black line above the silver line along sides
- Snout is pointed & longer than the diameter of the eye
- Breeding adults develop red color on heads, bellies & fins
- SIMILAR SPECIES: Emerald Shiner, outside of spawning seasons they look similar



Protection Status:
- Federal: None
- State: None
- Global Rank: G5 (Secure)
- State Rank: S2 (Imperiled)

Distribution:
- Eastern SD-tributaries to the Big Sioux & Minnesota River basins
- SD is on the western periphery of the range for this species

Key Habitat:
- Prefers clear, swift, large streams & small rivers with gravel or rocky substrates
- Usually occurs in riffles, rocky runs or flowing pools

Conservation Challenges
- Modified flood regimes
- Ecosystem alteration/habitat degradation
  - Channelization
  - Impoundments
  - Increased turbidity
- Pollution/pesticides/herbicides
- Grazing/Agricultural practices
- Moderately vulnerable to climate change

Conservation Actions:
- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff

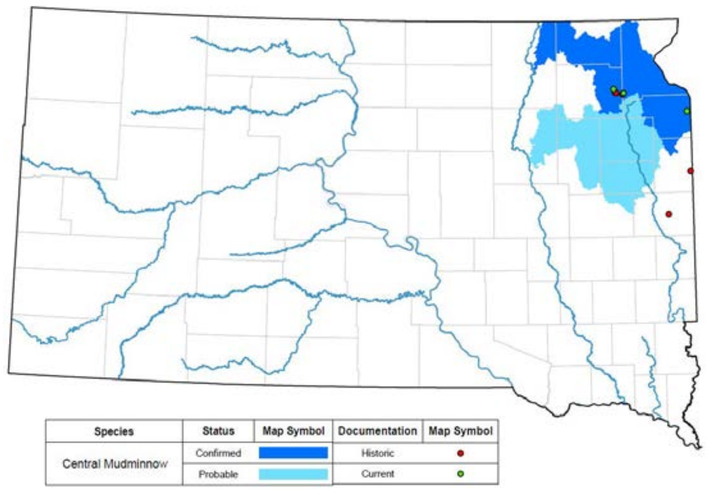
SWG Accomplishments (Appendix F):
- Evaluation of a decision support tool to help support fish species at risk in South Dakota streams – T-9
- Comprehensive aquatics survey of the Minnesota River tributaries – T-17D

Priority Research & Monitoring Needs (Appendices G-K):
- Determine baseline data & status through monitoring efforts
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities

Central Mudminnow CEMU *Umbra limi*

Description:

- Small, slender fish that is dark olive-brown in color with light belly
- Lacking lateral line with several irregular dark vertical bars
- Caudal fin is rounded with a black vertical bar at the base
- SIMILAR SPECIES: Banded Killifish & Plains Topminnow, differences are these fish are lighter in color. Banded Killifish have narrower more regular vertical bars & Plains Topminnow lack bars on the sides



Protection Status:

- Federal: None
- State: None
- Global Rank: G5 (Secure)
- State Rank: S2 (Imperiled)

Distribution:

- North eastern SD- tributaries to the Big Sioux & Minnesota River basins
- SD is on the western periphery of the range for this species

Key Habitat:

- Prefer cool, slow moving streams, marshes, ponds & backwater areas with dense aquatic vegetation & muddy substrates

Conservation Challenges:

- Reduced number of beaver ponds/dams
- Ecosystem habitat conversion or loss
    - Impoundments
    - Conversion of wetlands to agriculture
- Ecosystem alteration/habitat degradation
    - Urbanization
- Moderately vulnerable to climate change

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Maintain/restore natural hydrology & stream connectivity when possible

SWG Accomplishments (Appendix F):

- Evaluation of a decision support tool to help support fish species at risk in South Dakota streams – T-9
- Comprehensive aquatics survey of the Minnesota River tributaries - T-17D

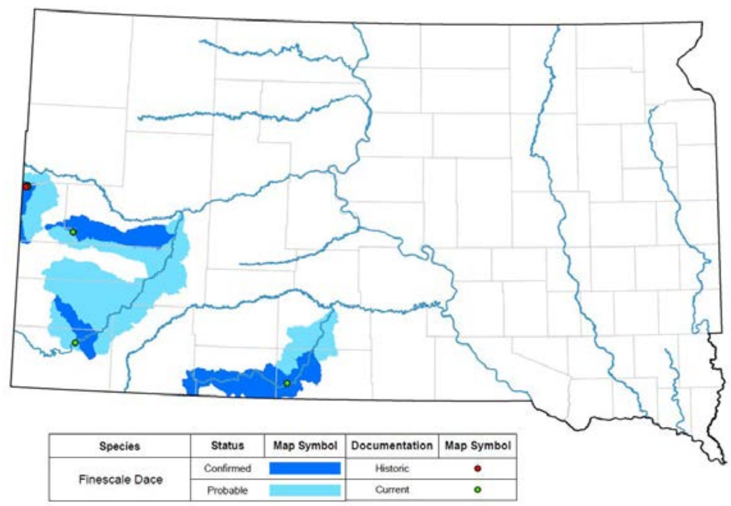
Priority Research & Monitoring Needs (Appendices G-K):

- Determine baseline data & status through monitoring efforts
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities

Finescale Dace | FIDA | *Chrosomus neogaeus*

Description:

- Small fish with olive back & dark lateral stripe ending with spot at base of caudal fin
- Iridescent, silvery band above lateral stripe
- Breeding males have yellow to red belly



Protection Status:

- Federal: None
- State: Endangered
- Global Rank: G5 (Secure)
- State Rank: S1 (Critically imperiled)

Distribution:

- Western SD- tributaries to the Cheyenne, Belle Fourche & Little White River basins
- SD is on the southern periphery of the range for this species

Key Habitat:

- Prefers areas with dense aquatic vegetation of cool, headwaters, small streams & ponds
- Found in association with Northern Redbelly Dace

Conservation Challenges:

- Reduced number of beaver ponds/dams
- Ecosystem alteration/habitat degradation
    - Degraded water quality
- Extremely vulnerable to climate change

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Develop reintroduction programs for Finescale Dace into suitable habitats

Current Monitoring & Inventory Programs (Appendix E):

- Western prairie streams & rivers inventory surveys (SDGFP, SDSU)

SWG Accomplishments (Appendix F):

- Glacial relict fishes in spring fed headwater streams of South Dakota's Sandhills region – T-2-8
- Evaluation of a decision support tool to help support fish species at risk in South Dakota streams–T-9

Priority Research & Monitoring Needs (Appendices G-K):

- Continue & expand current monitoring efforts
- Develop a management plan
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities
- Investigate reintroduction capabilities

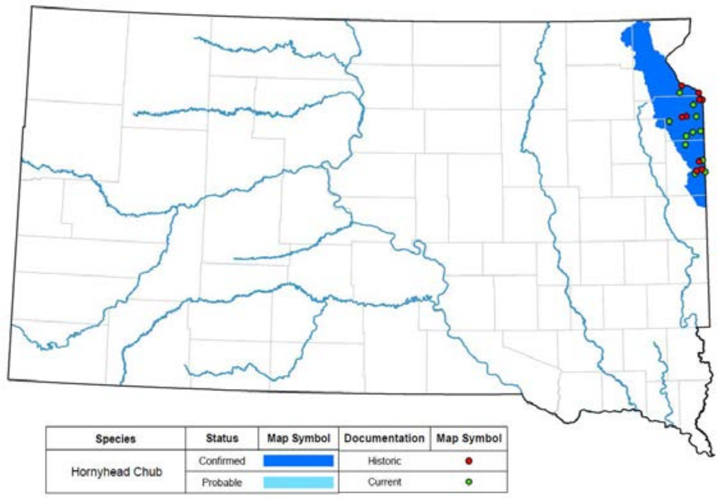
Existing Recovery Plan/Conservation Strategies:

Isaak, D.J., W.A. Hubert, and C.R. Berry, Jr. 2002. Conservation Assessment for Lake Chub, Mountain Sucker, and Finescale Dace in the Black Hills National Forest, South Dakota and Wyoming. USDA Forest Service, Rocky Mountain Region.

Hornyhead Chub HOCH *Nocomis biguttatus*

Description:

- Stout minnow with olive-brown back, iridescent green sides & white belly
- Barbels on edges of mouth & red spot behind eye, which is less prominent in adults
- Dark stripe along sides with black spot at base of caudal fin
- Breeding males display horn-like structures (tubercles) on their head
- SIMILAR SPECIES: Creek Chub & Central Stoneroller



Protection Status:

- Federal: None
- State: None
- Global Rank: G5 (Secure)
- State Rank: S3 (Vulnerable)

Distribution:

- Eastern SD-tributaries to the Big Sioux & Minnesota River basins
- SD is within the center of the range for this species

Key Habitat:

- Prefers pools & runs of small to medium sized streams with gravel substrates & moderate to no flow

Conservation Challenges:

- Ecosystem/habitat conversion or loss
- Ecosystem alteration/habitat degradation
  - Impoundments
  - Channelization
- Pollution/pesticides/herbicides
  - Increased water turbidity
- Grazing/Agricultural practices

Conservation Actions:

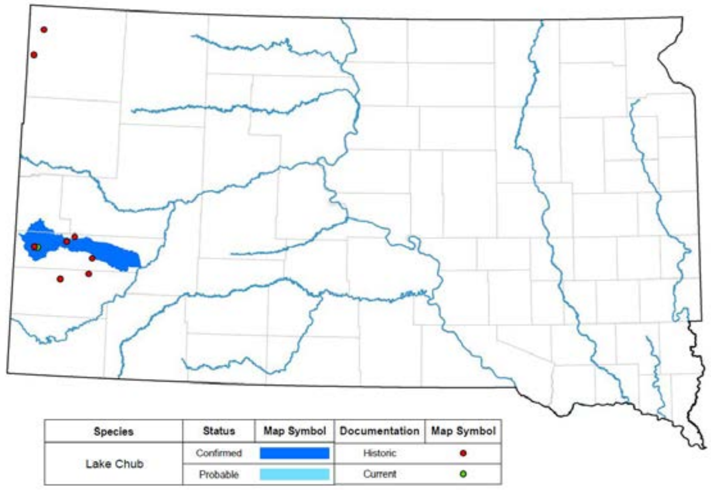
- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff

Priority Research & Monitoring Needs (Appendices G-K):

- Develop baseline data & current status through monitoring efforts
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities

Lake Chub | LACH | *Couesius plumbeus*

Description:



- Silver-gray color with light belly
- Lead colored mid lateral stripe is present but not conspicuous
- Scattered dark scales give a speckled appearance
- Well-developed barbel located at corners of mouth

Protection Status:

- Federal: None
- State: None
- Global Rank: G5 (Secure)
- State Rank: S1 (Critically imperiled)

Distribution:

- Western SD-tributaries to the Cheyenne & Belle Fourche River basins
- SD is on the southern periphery of the range for this species

Key Habitat:

- Occurs in varied habitats, both large/small water bodies & standing/flowing waters
- Prefer gravel bottomed pools & runs of streams & along rocky lake margins

Conservation Challenges:

- Modified/suppressed fire regimes
- Exotic/introduced species impacts
- Ecosystem alteration/habitat degradation
  - Mining
- Pollution/pesticides/herbicides
- Grazing/Agricultural practices
  - Heavy grazing
- Forest Management Practices
  - Logging

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Develop programs to reduce or eliminate the treat non-native species on Lake Chub
- Develop captive breeding and reintroduction programs for Lake Chub into suitable habitats

Current Monitoring & Inventory Programs (Appendix E):

- Western prairie streams and rivers inventory survey

SWG Accomplishments (Appendix F):

- An aquatic invasive species risk assessment for South Dakota – T-36

Priority Research & Monitoring Needs (Appendices G-K):

- Determine distribution & current status through monitoring efforts
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities
- Investigate captive breeding capabilities for future reintroductions

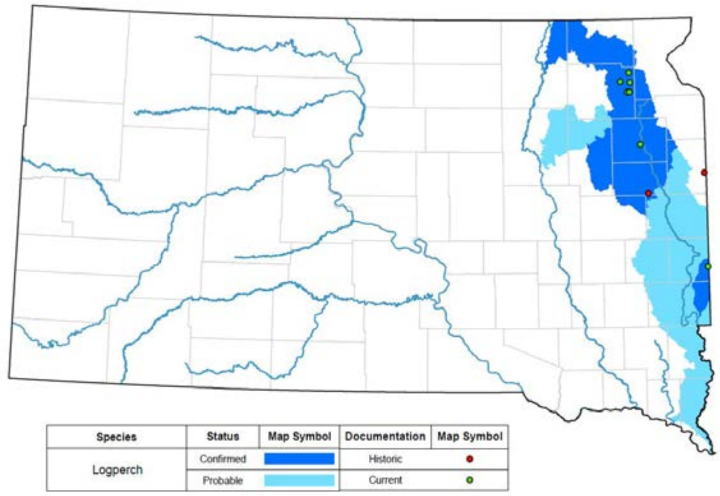
Existing Recovery Plan/Conservation Strategies:

Isaak, D.J., W.A. Hubert, and C.R. Berry. Jr. 2002. Conservation Assessment for Lake Chub, Mountain Sucker, and Finescale Dace in the Black Hills National Forest, South Dakota and Wyoming. USDA Forest Service, Rocky Mountain Region

Logperch LOGP *Percina caprodes*

Description:

- Yellowish-brown fish with several vertical bars of alternating length on the sides
- Black spot at base of rounded caudal fin
- Lacks scales on head, with tear drop spot below eyes
- SIMILAR SPECIES: Blackside Darter



Protection Status:

- Federal: None
- State: None
- Global Rank: G5 (Secure)
- State Rank: S3 (Vulnerable)

Distribution:

- Eastern SD-tributaries to the Big Sioux & Minnesota River basins
- SD is on the western periphery of the range for this species

Key Habitat:

- Prefers rivers, lakes & reservoirs with sand or gravel substrates & aquatic vegetation

Conservation Challenges:

- Modified flood regimes
- Reduced number of beaver ponds/dams
- Ecosystem/habitat conversion or loss
- Ecosystem alteration/habitat degradation
    - Impoundments
    - Channelization
- Pollution/pesticides/herbicides
- Grazing/Agricultural practices
- Moderately vulnerable to climate change

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff

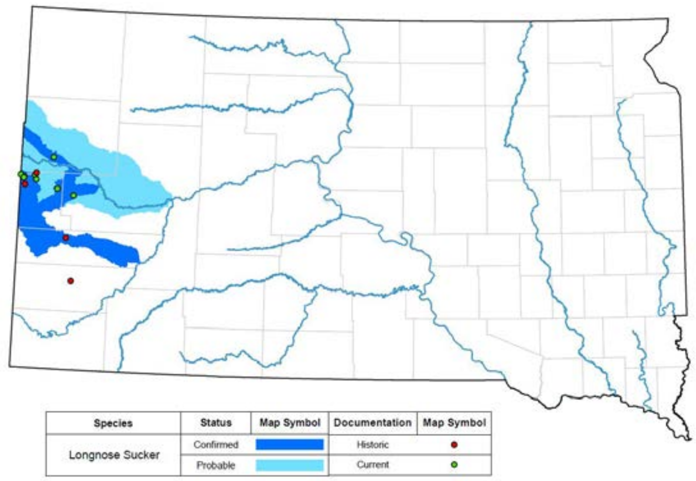
Priority Research & Monitoring Needs (Appendices G-K):

- Develop baseline data & current status through monitoring efforts
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities

Longnose Sucker LOSU *Catostomus catostomus*

Description:

- Elongated, cylindrical sucker with long pointed snout
- Gray to black back with light belly
- Breeding males have a wide, crimson band on their side that extends onto the snout



Protection Status:

- Federal: None
- State: Threatened
- Global Rank: G5 (Secure)
- State Rank: S1 (Critically imperiled)

Distribution:

- Western SD- tributaries to the Cheyenne & Belle Fourche River basins
- SD is within the center of the range for this species

Key Habitat:

- Prefers cool, clear, spring-fed streams & lakes

Conservation Challenges:

- Ecosystem alteration/habitat degradation
  - Mining
  - Logging
  - Road construction
- Grazing/agricultural practices
  - Heavy grazing
- Highly vulnerable to climate change

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Restore & maintain habitat & stream connectivity

Current Monitoring & Inventory Programs (Appendix E):

- Western prairie streams & rivers inventory surveys (SDGFP, SDSU)

SWG Accomplishments (Appendix F):

- Evaluation of a decision support tool to help support fish species at risk in South Dakota streams – T-9

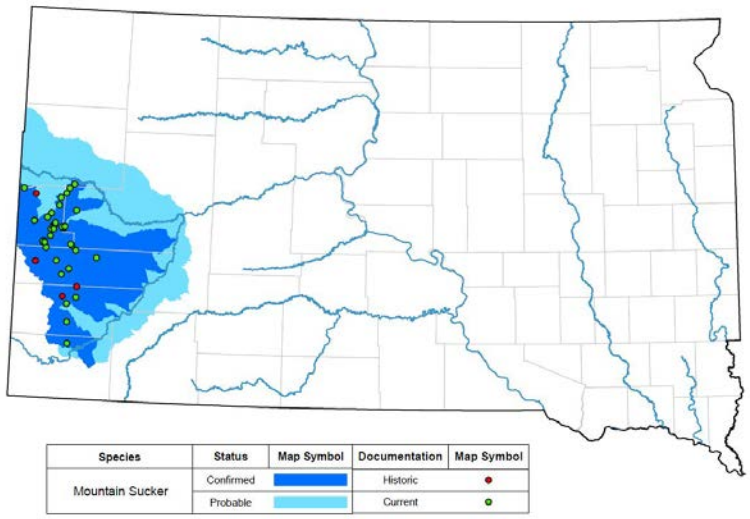
Priority Research & Monitoring Needs (Appendices G-K):

- Determine baseline data & status through monitoring efforts
- Develop a management plan
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities

Mountain Sucker | MOSU | *Catostomus platyrhynchus*

Description:

- Stout sucker with a small, round head
- Dark brown with black/dark mottling shaped saddles across back, fading to white on the belly



Protection Status:

- Federal: None
- State: None
- Global Rank: G5 (Secure)
- State Rank: S3 (Vulnerable)

Distribution:

- Western SD-tributaries to the Cheyenne & Belle Fourche River basins
- SD is on the eastern periphery of the range for this species

Key Habitat:

- Clear, cold streams & small to medium sized rivers
- Waters with clear rubble, gravel or sand substrates
- Juveniles inhabit slower moving water in side channels or weedy backwater areas

Conservation Challenges:

- Modified/suppressed fire regimes
- Exotic/introduced species impacts
- Ecosystem alteration/habitat degradation
    - o Mining
- Pollution/pesticides/herbicides
- Grazing/Agricultural practices
    - o Heavy grazing
- Forest Management Practices
    - o Logging
- Extremely vulnerable to climate change

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Provide conservation programs/incentives to landowners to secure the long-term protection of unique & high quality Mountain Sucker habitats
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Develop programs to reduce or eliminate the treat of predation on Mountain Sucker by non-native trout species
- Develop captive breeding and reintroduction programs for Mountain Suckers into suitable habitats

Current Monitoring & Inventory Programs (Appendix E):

- Western prairie streams & rivers inventory surveys (SDGFP, SDSU)

SWG Accomplishments (Appendix F):

- Conservation status of the mountain sucker in South Dakota – T-2-2
- An aquatic invasive species risk assessment for South Dakota – T-36

Priority Research & Monitoring Needs (Appendices G-K):

- Continue & expand current monitoring efforts
- Assess current density & genetic variation for Mountain Suckers
- Identify limiting factors in current populations
- Research seasonal movements, migration patterns, & recolonization capabilities
- Investigate captive breeding capabilities for future reintroductions

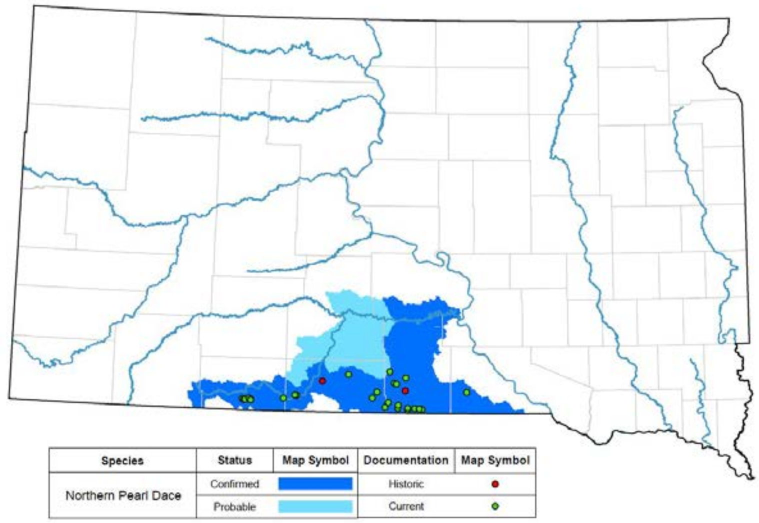
Existing Recovery Plans:

Isaak, D.J., W.A. Hubert, and C.R. Berry. Jr. 2002. Conservation Assessment for Lake Chub, Mountain Sucker, and Finescale Dace in the Black Hills National Forest, South Dakota and Wyoming. USDA Forest Service, Rocky Mountain Region

Northern Pearl Dace | NPDA | *Margariscus nachtriebi*

Description:

- Small, dark colored minnow with light belly & spot near base of caudal fin
- Young have a dark lateral stripe
- Flap-like barbel in front of jaw
- Breeding males have red sides & belly



Protection Status:

- Federal: None
- State: Threatened
- Global Rank: G5 (Secure)
- State Rank: S2 (Imperiled)

Distribution:

- South central SD- tributaries to the Little White & Keya Paha River basins
- SD is on the southern periphery of the range for this species

Key Habitat:

- Prefers cool, bogs, ponds, beaver ponds, lakes, & small clear streams

Conservation Challenges:

- Reduced number of beaver ponds/dams
- Ecosystem/habitat conversion or loss
  - Impoundments
  - Channelization
  - Pond drainage
  - Conversion of land to agriculture
- Ecosystem alteration/habitat degradation
- Pollution/pesticides/herbicides
- Extremely vulnerable to climate change

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Restore & maintain habitat & landscape connectivity
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff

Current Monitoring & Inventory Programs (Appendix E):

- Western prairie streams & rivers inventory surveys (SDGFP, SDSU)

SWG Accomplishments (Appendix F):

- Glacial relict fishes in spring fed headwater streams of South Dakota's Sandhills region – T-2-8
- Evaluation of a decision support tool to help support fish species at risk in South Dakota streams– T-9

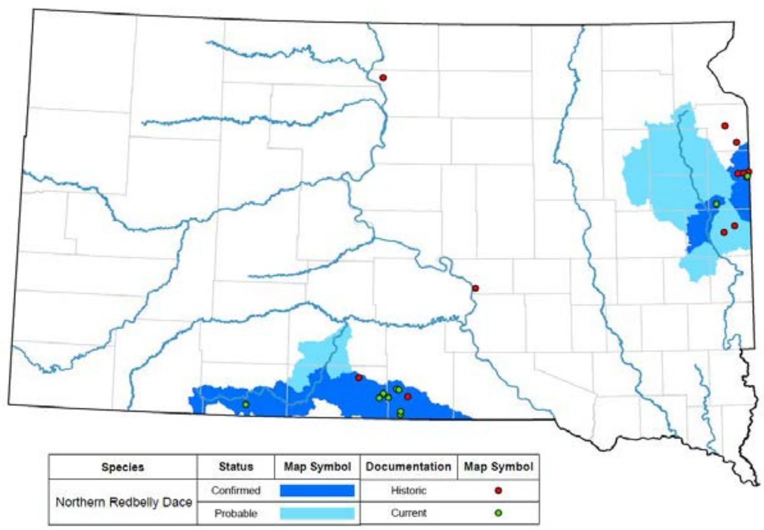
Priority Research & Monitoring Needs (Appendices G-K):

- Continue & expand current monitoring efforts
- Develop a management plan
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors

Northern Redbelly Dace	NRDA	*Chrosomus eos*

Description:

- Small fish with olive-brown back with 2 black stripes along sides
- Breeding males have brilliant red belly & yellow fins
- SIMILAR SPECIES: Finescale Dace, Northern Pearl Dace & Southern Redbelly Dace



Protection Status:

- Federal: None
- State: Threatened
- Global Rank: G5 (Secure)
- State Rank: S2 (Imperiled)

Distribution:

- Southern & north eastern SD-tributaries to the Missouri River, Minnesota, Big Sioux, White, Niobrara & Keya Paha River basins
- SD is on the southern periphery of the range for this species

Key Habitat:

- Prefer vegetated areas of quiet spring-fed streams, bogs, & beaver ponds

Conservation Challenges:

- Ecosystem alteration/habitat degradation
  - Reduced # of beaver dams/ponds
  - Mining
  - Logging
  - Construction of roads
  - Heavy grazing
  - Stream channelization
- Hybridization with Finescale Dace
- Extremely vulnerable to climate change

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff

Current Monitoring & Inventory Programs (Appendix E):

- Western prairie streams & rivers inventory surveys (SDGFP, SDSU)

SWG Accomplishments (Appendix F):

- Glacial relict fishes in spring fed headwater streams of South Dakota's Sandhills region – T-2-8
- Evaluation of a decision support tool to help support fish species at risk in South Dakota streams– T-9
- Comprehensive aquatics survey of the Minnesota River tributaries – T-17D

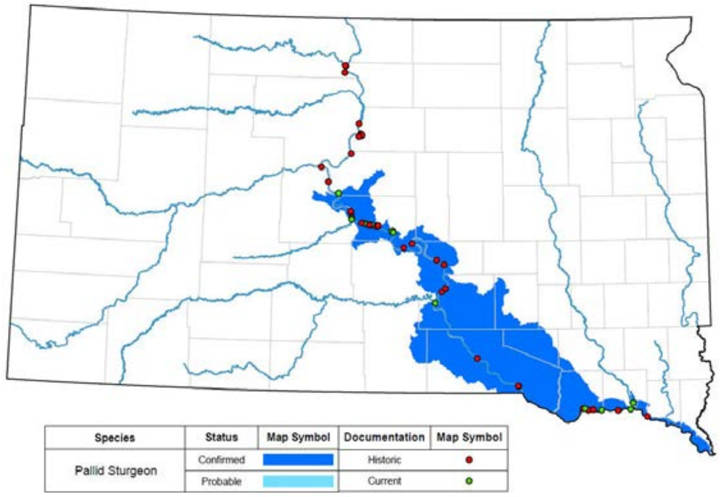
Priority Research & Monitoring Needs (Appendices G-K):

- Continue & expand current monitoring efforts
- Develop a management plan
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities

Pallid Sturgeon	PAST	*Scaphirhynchus albus*

Description:

- Large, flat bodied fish, wider towards the bottom, & grey-white color
- Flat, shovel-shaped snout
- Bony plates on top & sides, but LACKING on belly
- Bases of outer chin barbels slightly farther back & twice as long as inner barbels
- SIMILAR SPECIES: Shovelnose Sturgeon



Protection Status:

- Federal: Endangered
- State: Endangered
- Global Rank: G2 (Imperiled)
- State Rank: S1 (Critically imperiled)

Distribution:

- Central SD-Missouri River basin
- SD is within the center of the range for this species

Key Habitat:

- Prefers large, rivers with natural hydrographs
- Diverse depths & velocities, sand bars, sand flats & gravel bars

Conservation Challenges:

- Modified flood regimes
- Ecosystem/habitat conversion or loss
- Ecosystem alteration/habitat degradation
    - Impoundments
    - Channelization
    - Dredging
- Pollution/pesticides/herbicides
- Hybridization with shovelnose sturgeon
- Moderately vulnerable to climate change

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible
- Develop captive breeding and stocking programs
- River corridor habitat protection through conservation programs/incentives or purchase

Current Monitoring & Inventory Programs (Appendix E):

- Lower Missouri River Fish Surveys (USACE, USFWS, SDGFP)

SWG Accomplishments (Appendix F):

- Development & application of a habitat assessment tool for juvenile pallid sturgeon in the upper Missouri River – T-24

Priority Research & Monitoring Needs (Appendices G-K):

- Continue & expand current monitoring efforts
- Develop standardized protocols for monitoring all life history stages
- Evaluate the role of sediment transport & discharge on the creation & maintenance of habitats for all life stages
- Identify limiting factors associated with natural recruitment
- Research spawning & potential natural recruitment on the James River & below Gavin's Point Dam
- Research seasonal movements

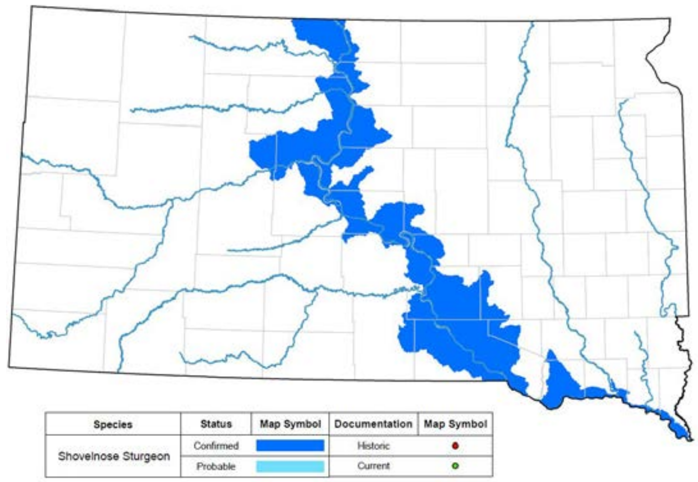
Existing Recovery Plans:

1) U.S. Fish and Wildlife Service. 1993. Pallid Sturgeon Recovery Plan. USFWS, Bismarck, North Dakota. 55 pp.; 2) SDGFP. 2005. South Dakota pallid sturgeon (*Scaphirhynchus albus*) management plan. South Dakota Dept. of Game, Fish and Parks, Pierre, SD, Wildlife Division Report 2006-01. 41 pp. plus appendices. Available online at: http://gfp.sd.gov/wildlife/management/plans/docs/FinalPallidPlan.pdf

Shovelnose Sturgeon SHST *Scaphirhynchus platorynchus*

Description:

- Large, flat bodied fish, wider towards the bottom, & yellowish-brown in color
- Flat shovel-shaped snout
- Bony plates on top, sides, & belly
- Bases of barbels aligned in a single straight row & similar in length
- SIMILAR SPECIES: Pallid Sturgeon



Protection Status:

- Federal: Threatened
- State: None
- Global Rank: G4 (Apparently secure)
- State Rank: S4 (Apparently secure)

Distribution:

- Central SD-tributaries to the Missouri River basin
- SD is within the center of the range for this species

Key Habitat:

- Prefers swift currents of large rivers with natural hydrographs & deep channels

Conservation Challenges:

- Modified flood regimes
- Ecosystem/habitat conversion or loss
- Ecosystem alteration/habitat degradation
    - Impoundments
    - Channelization
    - Dredging
- Pollution/pesticides/herbicides
- Hybridization with pallid sturgeon

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible

Current Monitoring & Inventory Programs (Appendix E):

- Lower Missouri River Fish surveys (USACE, USFWS, SDGFP)
- Missouri River reservoir fisheries surveys (SDGFP)

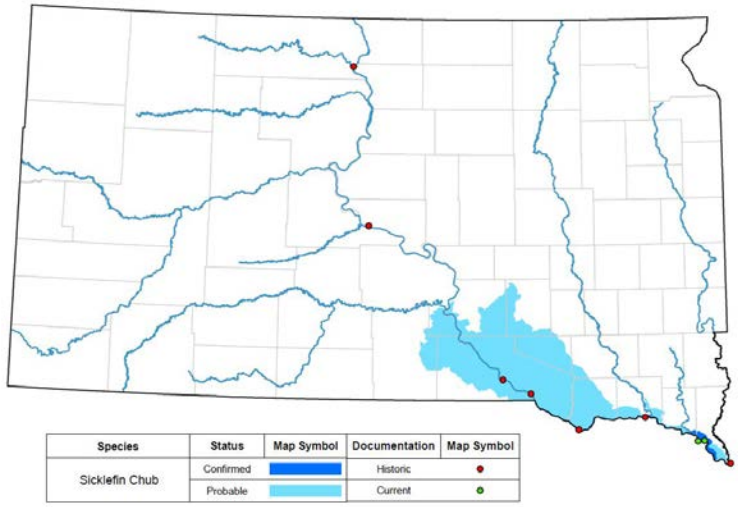
Priority Research & Monitoring Needs (Appendices G-K):

- Continue & expand current monitoring efforts
- Develop standardized protocols for monitoring all life history stages
- Evaluate the role of sediment transport & discharge on the creation & maintenance of habitats for all life stages
- Identify limiting factors associated with natural recruitment & hybridization with Pallid Sturgeon
- Research seasonal movements

Sicklefin Chub | SICH | *Macrhybopsis meeki*

Description:

- Small, slender bodied minnow with small eyes & long sickle shaped pectoral fins
- Body yellowish-brown with silvery-white belly
- Conspicuous barbel at corners of mouth



Protection Status:

- Federal: None
- State: Endangered
- Global Rank: G3 (Vulnerable)
- State Rank: S1 (Critically imperiled)

Distribution:

- Central SD-tributaries to the Missouri River basin
- SD is on the northern periphery of the range for this species

Key Habitat:

- Prefer the main channels of large, turbid rivers with strong currents & sand or fine gravel substrates

Conservation Challenges:

- Exotic/introduced species impacts
- Modified flood regimes
- Ecosystem/habitat conversion or loss
- Ecosystem alteration/habitat degradation
    - Impoundments
    - Channelization
- Pollution/pesticides/herbicides
- Grazing/Agricultural practices
- Moderately vulnerable to climate change

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible
- Develop programs to reduce or eliminate the treat non-native species on Sicklefin Chub

Current Monitoring & Inventory Programs (Appendix E):

- Lower Missouri River Fish surveys (USACE, USFWS, SDGFP)
- Missouri River Reservoir fisheries surveys (SDGFP)

Priority Research & Monitoring Needs (Appendices G-K):

- Determine baseline data & status through monitoring efforts
- Develop a management plan
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities

Existing Recovery Plan/Conservation Strategies:

U.S. Fish and Wildlife Service. 2001. Updated status review of Sicklefin and Sturgeon Chub. United States Department of the Interior, Region 6, Denver, Colorado.

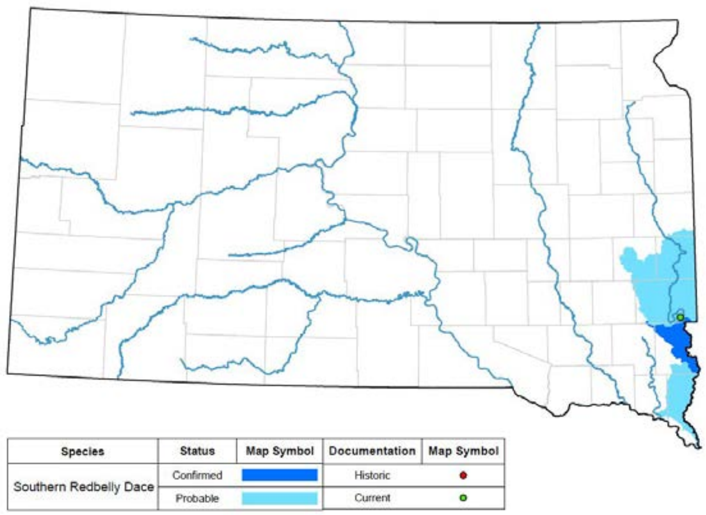
Southern Redbelly Dace | SRDA | *Chrosomus erythrogaster*

Description:

- Small, slender minnow with olive-brown back, light belly & extremely small scales
- Wedge shaped spot at the base of the caudal fin
- Two black strips along sides, upper stripe less prominent & lower stripe extending through the snout
- Breeding males have brilliant red belly & yellow fins
- SIMILAR SPECIES: Northern Redbelly Dace

Protection Status:

- Federal: None
- State: None
- Global Rank: G5 (Secure)
- State Rank: S1 (Critically Imperiled)



Distribution:

- Eastern SD-tributaries to the Big Sioux River basin
- SD is on the north western periphery of the range for this species

Key Habitat:

- Clear, cool, spring-fed headwater streams with rubble, gravel or sand substrates

Conservation Challenges:

- Ecosystem alteration/habitat degradation
    - Urban development
- Pollution/pesticides/herbicides
- Grazing/Agricultural practices
- Extremely vulnerable to climate change

Conservation Actions:

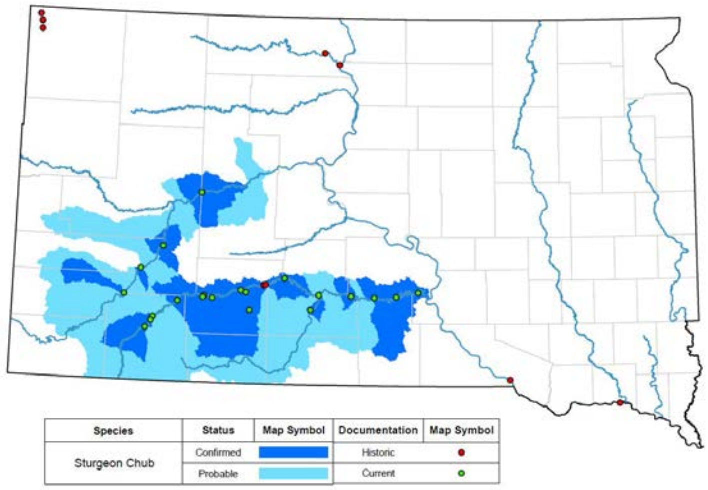
- Increase partnerships & cooperative arrangements
- Increase educational efforts

Priority Research & Monitoring Needs (Appendices G-K):

- Develop baseline data & current status through monitoring efforts
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities

Sturgeon Chub STCH *Macrhybopsis gelida*

Description:
- Slender minnow with small eyes, brownish-blue back with dark specks & light belly
- Mouth inferior with conspicuous barbels



Protection Status:
- Federal: None
- State: Threatened
- Global Rank: G3 (Vulnerable)
- State Rank: S2 (Imperiled)

Distribution:
- Western SD- tributaries to the Cheyenne, White, Grand & Missouri River basins
- SD is within the central part of the range for this species

Key Habitat:
- Prefer areas with moderate to strong current on large rivers with rocks, gravel or coarse sand substrates

Conservation Challenges:
- Exotic/introduced species impacts
- Modified flood regimes
- Ecosystem/habitat conversion or loss
- Ecosystem alteration/habitat degradation
  - Impoundments
  - Channelization
  - Water diversion
- Pollution/pesticides/herbicides
- Grazing/Agricultural practices
- Highly vulnerable to climate change

Conservation Actions:
- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Restore & maintain habitat & stream connectivity
- Develop programs to reduce or eliminate the treat of non-native fish competing with Sturgeon Chub

Current Monitoring & Inventory Programs (Appendix E):
- Western prairie streams & rivers inventory surveys (SDGFP, SDSU)
- Lower Missouri River Fish Surveys (USACE, SDGFP, USFWS)

SWG Accomplishments (Appendix F):
- Evaluation of a decision support tool to help support fish species at risk in South Dakota streams – T-9

Priority Research & Monitoring Needs (Appendices G-K):
- Determine baseline data & status through monitoring efforts
- Develop a management plan
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities

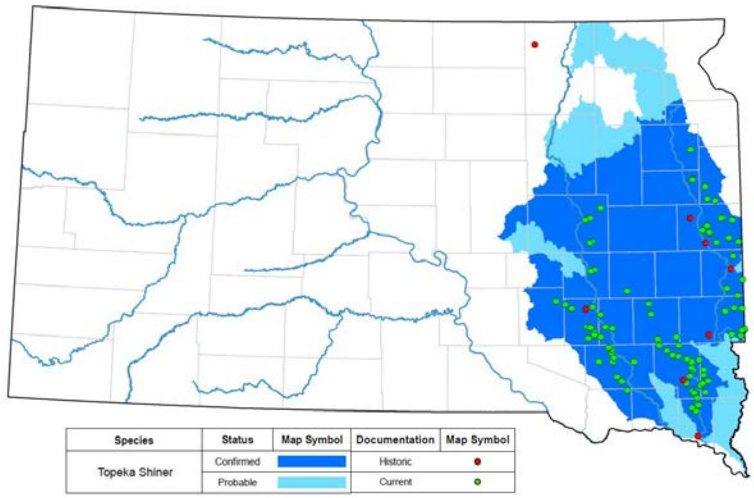
Existing Recovery Plan/Conservation Strategies:

U.S. Fish and Wildlife Service. 2001. Updated status review of sicklefin and sturgeon chub. United States Department of the Interior, Region 6, Denver, Colorado.

Topeka Shiner | TOSH | *Notropis topeka*

Description:
- Small, stout bodied minnow.
- Olive colored back with dark edged scales, lateral stripe & light underside.
- Caudal fin with chevron-shaped spot at the base.
- SIMILAR SPECIES: Sand Shiner

Protection Status:
- Federal: Endangered
- State: None
- Global Rank: G3 (Vulnerable)
- State Rank: S2 (Imperiled)



Distribution:
- Eastern SD- tributaries to the James, Vermillion & Big Sioux River basins.
- SD is on the northern periphery of the range for this species.

Key Habitat:
- Small streams with groundwater input & good water quality.
- Backwater areas, pools & dugouts with sand or gravel substrates.

Conservation Challenges:
- Exotic/introduced species impacts
- Ecosystem/habitat conversion or loss
  - Urban development
  - Road-stream crossings
- Ecosystem alteration/habitat degradation
  - Impoundments
  - Channelization
  - Water diversion
- Pollution/pesticides/herbicides
- Grazing/Agricultural practices

Conservation Actions:
- Increase partnerships & cooperative arrangements
- Provide conservation programs/incentives to landowners to secure the long-term protection of unique & high quality Topeka Shiner habitats
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible

Current Monitoring & Inventory Programs (Appendix E):
- Topeka Shiner Monitoring (SDGFP)

SWG Accomplishments (Appendix F):
- Topeka Shiner monitoring in eastern South Dakota streams – T-12
- Topeka Shiner monitoring in eastern South Dakota streams (round two) – T-2-9

Priority Research & Monitoring Needs (Appendices G-K):
- Continue & expand current monitoring efforts
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities

Existing Recovery Plans:

1) Shearer, J.S. 2003. Topeka shiner management plan for the state of South Dakota. South Dakota Department of Game, Fish & Parks, Pierre, Wildlife Division Report No. 2003-10, 82 pp.; 2) U.S. Fish and Wildlife Service. 2009. Topeka shiner (*Notropis topeka*) Five year review: summary and evaluation. USFWS, Manhattan, Kansas. 44 pp.

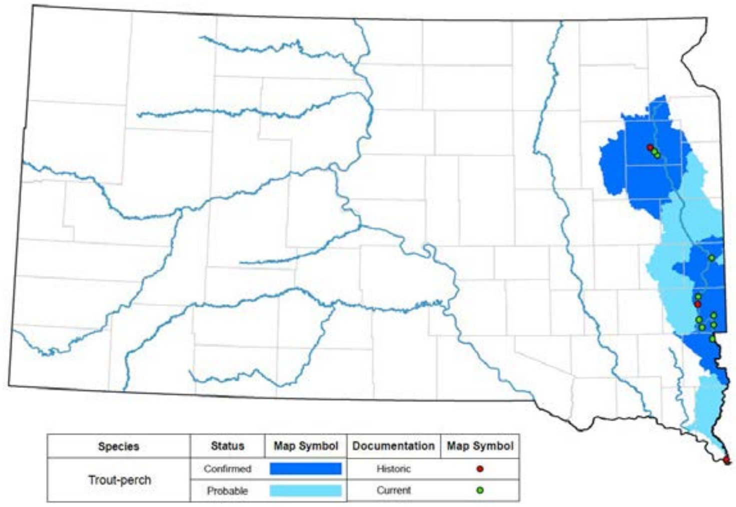
Trout-Perch | TRPE | *Percopsis omiscomaycus*

Description:

- Small, thick bodied fish with a large scaleless head, adipose fin & spines
- Silvery to almost transparent in color with rows of dark spots along back & sides

Protection Status:

- Federal: None
- State: None
- Global Rank: G5 (Secure)
- State Rank: S2 (Imperiled)



Distribution:

- Eastern SD-tributaries to the Big Sioux River basin
- SD is on the western periphery of the range for this species

Key Habitat:

- Prefer deep flowing pools of streams, & small to large rivers, also found in lakes with sand or gravel substrates

Conservation Challenges:

- Exotic/introduced species impacts
- Ecosystem/habitat conversion or loss
    - Impoundments
    - Channelization
- Ecosystem alteration/habitat degradation
    - Water diversion
- Pollution/pesticides/herbicides
- Grazing/Agricultural practices

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Restore & maintain habitat & stream connectivity
- Develop programs to reduce or eliminate the treat of non-native fish competing with Trout-perch

SWG Accomplishments (Appendix F):

- Evaluation of a decision support tool to help support fish species at risk in South Dakota streams – T-9

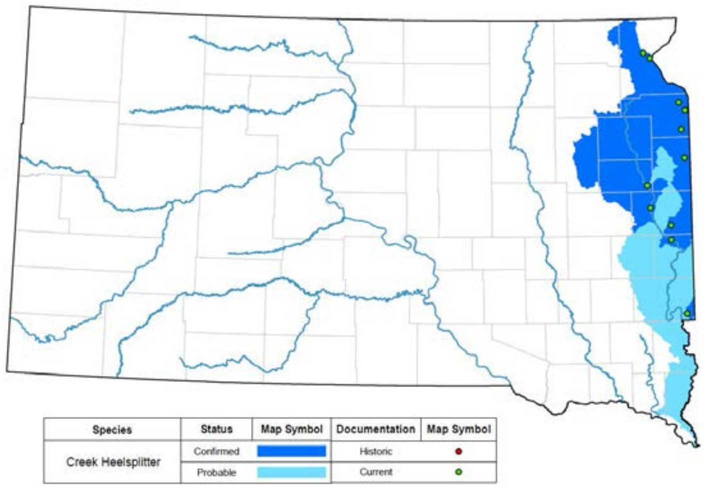
Priority Research & Monitoring Needs (Appendices G-K):

- Determine baseline data & status through monitoring efforts
- Assess population dynamics & genetic variation
- Identify critical habitats & limiting factors
- Research seasonal movements & recolonization capabilities

Creek Heelsplitter CRHE *Lasmigona compressa*

Description:

- Small to medium sized mussel under 4 in.
- Relatively thin, elongate shell with lateral teeth
- Outer shell is greenish (young) to greenish-black (adults), sometimes with fine green rays in young mussels



Protection Status:

- Federal: None
- State: None
- Global Rank: G5 (Secure)
- State Rank: S1 (Critically Imperiled)

Distribution:

- Eastern SD- tributaries to the Big Sioux & Minnesota River basins
- SD is on the western periphery of the range for this species

Key Habitat:

- Prefers headwater streams of small to medium sized rivers with mud or sand substrates

Conservation Challenges:

- Modified flood regimes
    - Major hydrologic alterations
- Exotic/introduced species impacts
- Ecosystem/habitat conversion or loss
    - Dams
- Ecosystem alteration/habitat degradation
    - Impervious surfaces
- Pollution/pesticides/herbicides
    - Concentrated Animal Feeding Operations (CAFOs)
    - Agricultural runoff

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible
- Develop programs to reduce/eliminate the threat of non-native species competing with native mussels

Current Monitoring & Inventory Programs (Appendix E):

- Statewide comprehensive mussel survey (SDGFP, SDSU)

SWG Accomplishments (Appendix F):

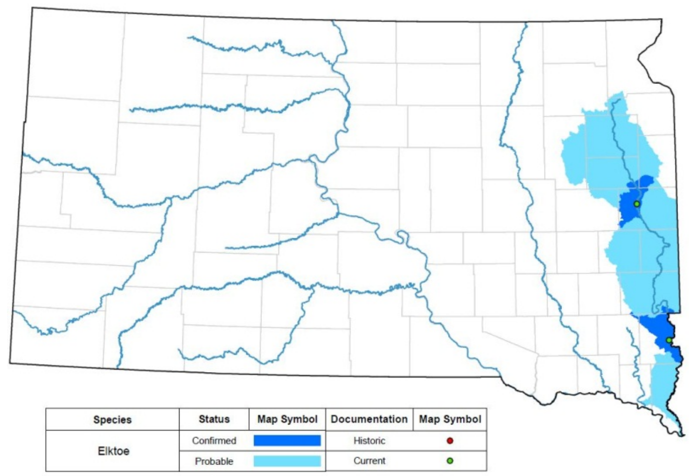
- Comprehensive aquatics survey of the Minnesota River tributaries – T-17D
- An aquatic invasive species risk assessment for South Dakota – T-36
- A population survey of mussels in South Dakota rivers – T-61

Priority Research & Monitoring Needs (Appendices G-K):

- Facilitate a state-wide comprehensive survey and long-term monitoring program for mussels
- Conduct research on life history, reproductive behaviors & potential
- Identify suitable & critical habitats
- Identify limiting factors

Elktoe ELKT *Alasmidonta marginata*

Description:



- Adults commonly 2.5 to 4 in.
- Small to medium sized mussel with elongate, triangular, inflated, & relatively thin, smooth shell
- Outer shell is yellowish-green in color with numerous dark green rays & spots present
- Sharp angled posterior ridge, poorly developed teeth & heavy beak sculpture

Protection Status:

- Federal: None
- State: None
- Global Rank: G4 (Apparently Secure)
- State Rank: S1 (Critically Imperiled)

Distribution:

- Eastern SD- tributaries to the Big Sioux River basin
- SD is on the western periphery of the range for this species

Key Habitat:

- Prefers small streams to medium rivers with swift current & sand or gravel substrates

Conservation Challenges:

- Modified flood regimes
  - Major hydrologic alterations
- Exotic/introduced species impacts
- Ecosystem/habitat conversion or loss
- Ecosystem alteration/habitat degradation
  - Impervious surfaces
- Pollution/pesticides/herbicides
  - CAFOs
  - Agricultural runoff
- Water Management Practices
  - Permitted discharges
- Moderately vulnerable to climate change

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible
- Develop programs to reduce/eliminate the threat of non-native species competing with native mussels

SWG Accomplishments (Appendix F):

- An aquatic invasive species risk assessment for South Dakota – T-36
- A population survey of mussels in South Dakota rivers – T-61

Priority Research & Monitoring Needs (Appendices G-K):

- Facilitate a state-wide comprehensive survey and long-term monitoring program for mussels
- Conduct research on life history, reproductive behaviors & potential
- Identify suitable & critical habitats
- Identify limiting factors

Hickorynut | HICK | *Obovaria olivaria*

Description:

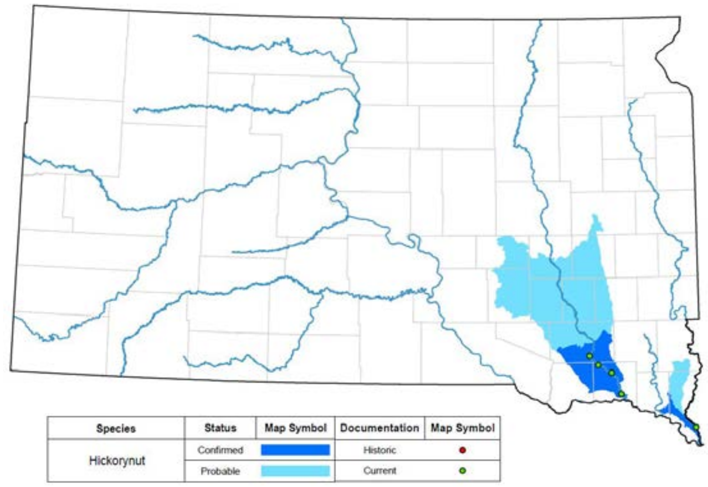
- Small to medium sized mussel with thick, inflated rounded to oblong shell
- Outer shell is smooth & greenish or yellowish-brown in color

Distribution:

- Eastern SD- tributaries to the James & Big Sioux River basins
- SD is on the northern periphery of the range for this species

Protection Status:

- Federal: None
- State: None
- Global Rank: G4 (Apparently Secure)
- State Rank: S1 (Critically Imperiled)



Key Habitat:

- Prefers large to medium sized rivers with good current with sand or gravel substrates
- Typically found in waters 6 to 8 feet deep

Conservation Challenges:

- Modified flood regimes
  - Major hydrologic alterations
  - Permitted discharges
- Exotic/introduced species impacts
- Ecosystem/habitat conversion or loss
  - Dams
- Ecosystem alteration/habitat degradation
  - Impervious surfaces
  - Road stream crossings
- Pollution/pesticides/herbicides
  - CAFOs
  - Agricultural runoff
- Moderately vulnerable to climate change

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible
- Develop programs to reduce/eliminate the threat of non-native species competing with native mussels

Current Monitoring & Inventory Programs (Appendix E):

- Statewide comprehensive mussel survey (SDGFP, SDSU)

SWG Accomplishments (Appendix F):

- A population survey of mussels in South Dakota rivers – T-61

Priority Research & Monitoring Needs (Appendices G-K):

- Facilitate a state-wide comprehensive survey and long-term monitoring program for mussels
- Conduct research on life history, reproductive behaviors & potential
- Identify suitable & critical habitats

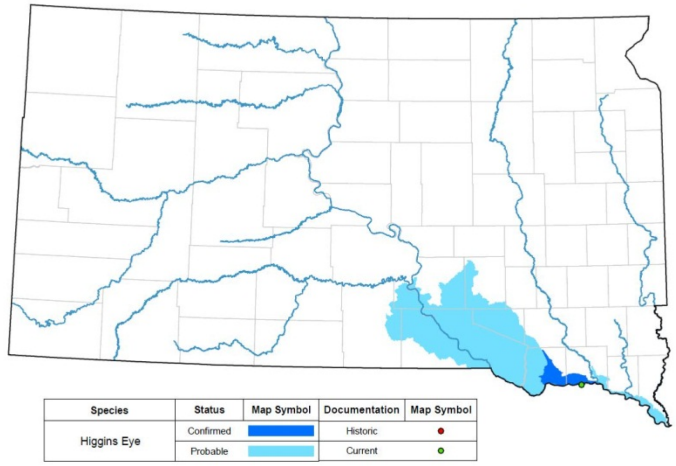
Higgins Eye | HIEY | *Lampsilis higginsii*

Description:

- Small to medium sized mussel with slightly elongate, thick, smooth, inflated shell
- Yellowish-brown color with green rays
- Male has bluntly pointed posterior end

Distribution:

- Southern SD- single specimen collected within the Missouri River basin
- SD is on the northern periphery of the range for this species



Protection Status:

- Federal: Endangered
- State: Take not allowed
- Global Rank: G1 (Critically Imperiled)
- State Rank: S1 (Critically Imperiled)

Key Habitat:

- Prefer medium to large rivers with sand or mud substrates & moderate currents

Conservation Challenges:

- Modified flood regimes
    - Major hydrologic alterations
- Exotic/introduced species impacts
- Ecosystem/habitat conversion or loss
    - Dams
- Ecosystem alteration/habitat degradation
    - Road stream crossings
    - Impervious surfaces
- Pollution/pesticides/herbicides
    - CAFOs
    - Agricultural runoff
    - Permitted discharges
- Highly vulnerable to climate change

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible
- Develop programs to reduce/eliminate the threat of non-native species competing with native mussels

Current Monitoring & Inventory Programs (Appendix E):

- Mussel surveys – 39 mile & 59 mile (USACE, SDGFP, NPS)
- Statewide comprehensive mussel survey (SDGFP, SDSU)
- Western prairie streams & rivers mussel survey (SDGFP, SDSU)

SWG Accomplishments (Appendix F):

- A population survey of mussels in South Dakota rivers – T-61

Priority Research & Monitoring Needs (Appendices G-K):

- Facilitate a state-wide comprehensive survey and long-term monitoring program for mussels
- Develop a management plan
- Conduct research on life history, reproductive behaviors & potential
- Identify suitable & critical habitats
- Identify limiting factors

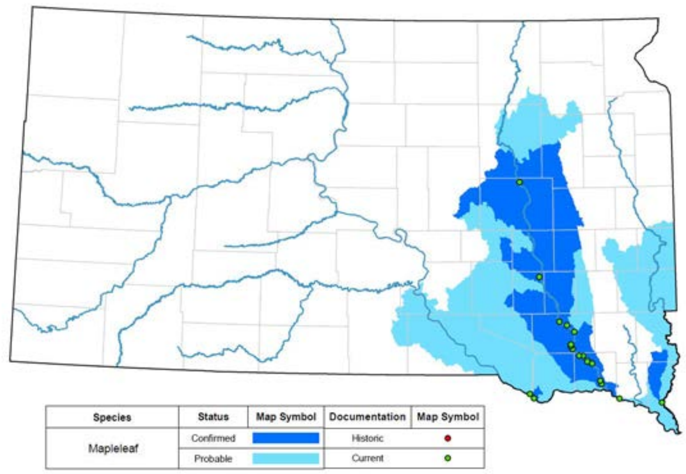
Existing Recovery Plan/Conservation Strategies:

U.S. Fish and Wildlife Service. 2004. Higgins Eye Pearly mussel Recovery Plan: First Revision. Ft. Snelling, Minnesota. 126 pp.

Mapleleaf	MAPL	*Quadrula quadrula*

Description:

- Small to medium mussel with thick, square shell
- Outer shell is yellowish green to brown in color with two rows of raised bumps extending in a v-shape from the beak to ventral margin



Protection Status:

- Federal: None
- State: None
- Global Rank: G5 (Secure)
- State Rank: S2 (Imperiled)

Distribution:

- Eastern SD- tributaries to the Missouri, James & Big Sioux River basins
- SD is on the western periphery of the range for this species

Key Habitat:

- Can be found in shallow lakes, large rivers or deep reservoirs with sand or fine gravel substrates

Conservation Challenges:

- Modified flood regimes
  - Major hydrologic alterations
- Exotic/introduced species impacts
- Ecosystem/habitat conversion or loss
  - Dams
- Ecosystem alteration/habitat degradation
  - Road stream crossings
  - Impervious surfaces
- Pollution/pesticides/herbicides
  - CAFOs
  - Agricultural runoff
  - Permitted discharges

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible
- Develop programs to reduce/eliminate the threat of non-native species competing with native mussels

Current Monitoring & Inventory Programs (Appendix E):

- Mussel surveys – 39 mile & 59 mile (USACE, SDGFP, NPS)
- Statewide comprehensive mussel survey (SDGFP, SDSU)
- Western prairie streams & rivers mussel survey (SDGFP, SDSU)

SWG Accomplishments (Appendix F):

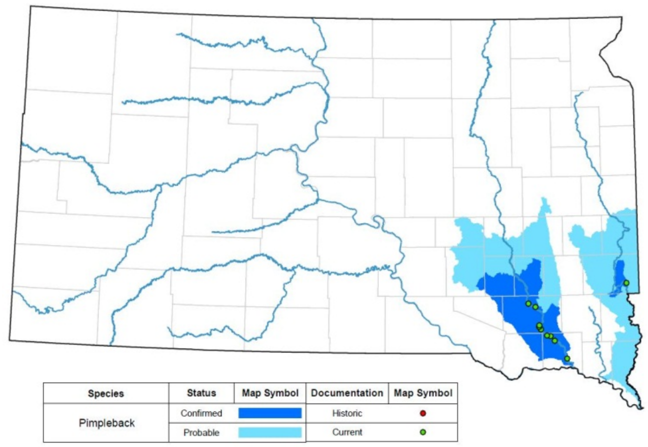
- A population survey of mussels in South Dakota rivers – T-61

Priority Research & Monitoring Needs (Appendices G-K):

- Facilitate a state-wide comprehensive survey and long-term monitoring program for mussels
- Conduct research on life history, reproductive behaviors & potential
- Identify suitable & critical habitats

Pimpleback | PIMP | *Quadrula pustulosa*

Description:



- Small to medium mussel with thick, rounded, & compressed to moderately inflated shell
- Outer shell is yellowish-green to light brown in younger mussels & chestnut to dark brown in older mussels
- Outer shell is relatively smooth on the anterior half & covered with bumps on the posterior half or two-thirds

Protection Status:

- Federal: None
- State: None
- Global Rank: G5 (Secure)
- State Rank: S1 (Critically Imperiled)

Distribution:

- Eastern SD- tributaries to the James and Big Sioux River basins
- SD is on the western periphery of the range for this species

Key Habitat:

- Prefer reservoirs & medium to large rivers with sand, mud or gravel substrates

Conservation Challenges:

- Ecosystem/habitat conversion or loss
- Ecosystem alteration/habitat degradation
  - Watershed destabilization
- Pollution/pesticides/herbicides
  - Degraded water quality
  - CAFOs
  - Agricultural runoff

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible
- Develop programs to reduce/eliminate the threat of non-native species competing with native mussels

Current Monitoring & Inventory Programs (Appendix E):

- Statewide comprehensive mussel survey (SDGFP, SDSU)

SWG Accomplishments (Appendix F):

- A population survey of mussels in South Dakota rivers – T-61

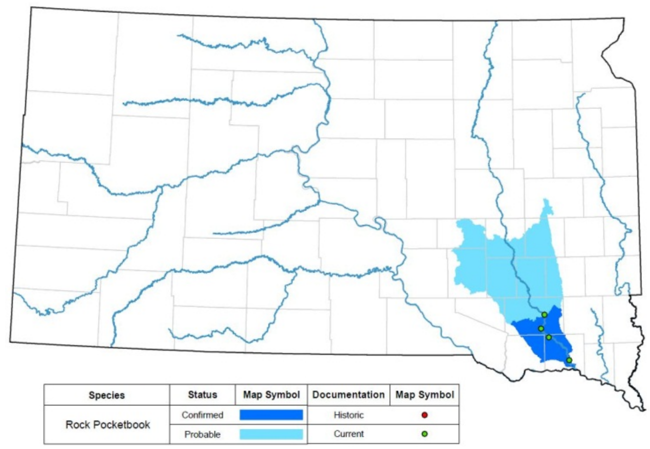
Priority Research & Monitoring Needs (Appendices G-K):

- Facilitate a state-wide comprehensive survey and long-term monitoring program for mussels
- Conduct research on life history, reproductive behaviors & potential
- Identify suitable & critical habitats
- Identify limiting factors

Rock Pocketbook   ROPO   *Arcidens confragosus*

Description:

- Large mussel with thin to moderately thick elliptical & inflated shell.
- Outer shell dark green, brown or black.



Protection Status:

- Federal: None
- State: None
- Global Rank: G4 (Apparently Secure)
- State Rank: S1 (Critically Imperiled)

Distribution:

- Eastern SD- tributaries to the James River basin
- SD is on the northern periphery of the range for this species

Key Habitat:

- Prefers medium to large rivers with standing or slow flowing water with mud or sand substrates

Conservation Challenges:

- Modified flood regimes
  - Major hydrologic alterations
- Exotic/introduced species impacts
- Ecosystem/habitat conversion or loss
  - Dams
- Ecosystem alteration/habitat degradation
  - Impervious surfaces
  - Road stream crossings
- Pollution/pesticides/herbicides
  - CAFOs
  - Agricultural runoff
- Water Management Practices
  - Permitted discharges

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible
- Develop programs to reduce/eliminate the threat of non-native species competing with native mussels

Current Monitoring & Inventory Programs (Appendix E):

- Statewide comprehensive mussel survey (SDGFP, SDSU)

SWG Accomplishments (Appendix F):

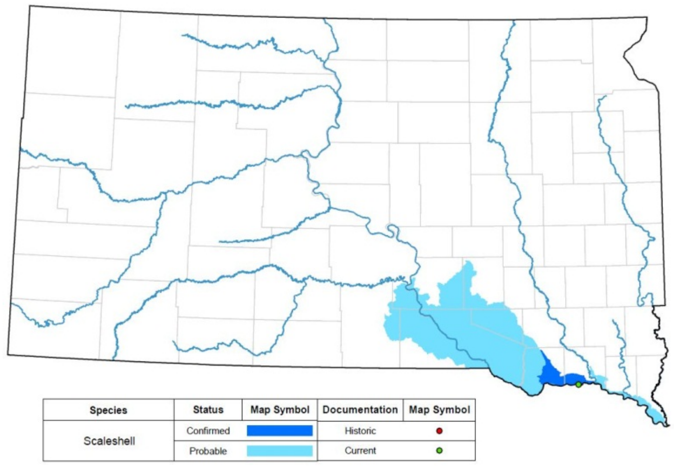
- An aquatic invasive species risk assessment for South Dakota – T-36
- A population survey of mussels in South Dakota rivers – T-61

Priority Research & Monitoring Needs (Appendices G-K):

- Facilitate a state-wide comprehensive survey and long-term monitoring program for mussels
- Conduct research on life history, reproductive behaviors & potential
- Identify suitable & critical habitats
- Identify limiting factors

Scaleshell | SCAL | *Leptodea loptodon*

Description:



- Small to medium sized mussel with elongated, compressed, thin, translucent shell.
- Outer shell is smooth & yellowish to brown with faint green rays
- Beak has 4-5 double looped ridges that are sometimes eroded

Protection Status:

- Federal: Endangered
- State: Take not allowed
- Global Rank: G1 (Critically Imperiled)
- State Rank: S1 (Critically Imperiled)

Distribution:

- Southern SD- tributaries to the Missouri River basin
- SD is on the western periphery of the range for this species

Key Habitat:

- Prefer medium to large unpolluted rivers with sand, mud, or gravel substrates
- Occurs in riffles with moderate to high current

Conservation Challenges:

- Modified flood regimes
  - Major hydrologic alterations
- Exotic/introduced species impacts
- Ecosystem/habitat conversion or loss
  - Dams
- Ecosystem alteration/habitat degradation
  - Road stream crossings
  - Impervious surfaces
- Pollution/pesticides/herbicides
  - CAFOs
  - Agricultural runoff
  - Permitted discharges
- Highly vulnerable to climate change

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible
- Develop programs to reduce/eliminate the threat of non-native species competing with native mussels

Current Monitoring & Inventory Programs (Appendix E):

- Mussel surveys – 39 mile & 59 mile (USACE, SDGFP, NPS)
- Statewide comprehensive mussel survey (SDGFP, SDSU)
- Western prairie streams & rivers mussel survey (SDGFP, SDSU)

SWG Accomplishments (Appendix F):

- A population survey of mussels in South Dakota rivers – T-61

Priority Research & Monitoring Needs (Appendices G-K):

- Facilitate a state-wide comprehensive survey and long-term monitoring program for mussels
- Develop a management plan
- Conduct research on life history, reproductive behaviors & potential
- Identify suitable & critical habitats
- Identify limiting factors

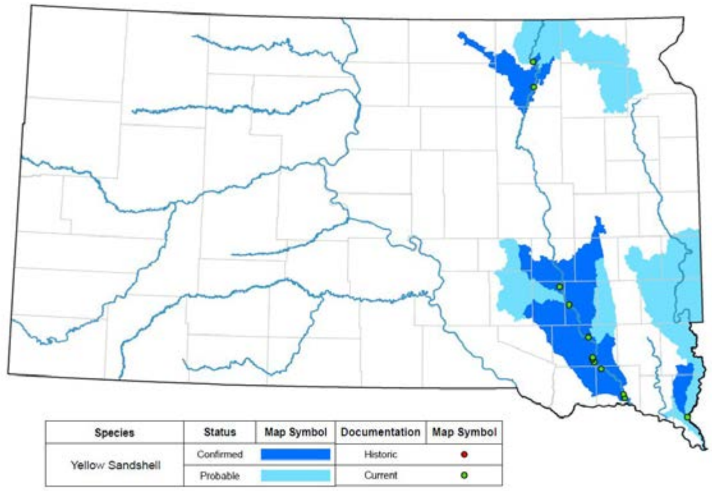
Existing Recovery Plan/Conservation Strategies:

U.S. Fish and Wildlife Service. 2004. Scaleshell Mussel Draft Recovery Plan. U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 90 pp.

Yellow Sandshell | YESA | *Lampsilis teres*

Description:

- Medium sized mussel with thick, inflated & elongated shell
- Shell is smooth, extremely shiny in young mussels becoming dull with age
- Outer shell yellowish in color and lacking rays



Protection Status:

- Federal: None
- State: None
- Global Rank: G5 (Secure)
- State Rank: S1 (Critically Imperiled)

Distribution:

- Eastern SD- tributaries to the James & Big Sioux River basins
- SD is on the northern periphery of the range for this species

Key Habitat:

- Prefers medium to large rivers with low to medium flow & mud or sand substrates

Conservation Challenges:

- Modified flood regimes
  - Major hydrologic alterations
- Ecosystem/habitat conversion or loss
  - Dams
- Ecosystem alteration/habitat degradation
  - Impervious surfaces
- Pollution/pesticides/herbicides
  - CAFOs
  - Agricultural runoff
- Water Management Practices
  - Permitted discharges

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible
- Develop programs to reduce/eliminate the threat of non-native species competing with native mussels

Current Monitoring & Inventory Programs (Appendix E):

- Statewide comprehensive mussel survey (SDGFP, SDSU)

SWG Accomplishments (Appendix F):

- A population survey of mussels in South Dakota rivers – T-61

Priority Research & Monitoring Needs (Appendices G-K):

- Facilitate a state-wide comprehensive survey and long-term monitoring program for mussels
- Conduct research on life history, reproductive behaviors & potential
- Identify suitable & critical habitats
- Identify limiting factors

A Mayfly | ANEX | *Analetris eximia*

Description:

- Mayfly, color markings are on abdomen are similar between adult & nymph stages
- Adults have small, distinct white projection between fore-coxae, with smaller projection between mid-coxae
- Distinct semi-membranous spine on each side postero-dorsally to the front coxae
- Front to hind wing length ratio 7.5:4
- Longitudinal veins slightly pigmented with black, crossveins & wing membrane colorless

Protection Status:

- Federal: None
- State: None
- Global Rank: G3 (Vulnerable)
- State Rank: SNR (Not ranked)

Distribution:

- South Dakota distribution unknown
- Reports suggest native to the Upper Missouri River basin (NatureServe)
- South Dakota is on the eastern periphery of the range for this species

Key Habitat:

- Confined to backwaters of low gradient creeks to medium rivers with shifting sand substrates

Conservation Challenges:

- Ecosystem/habitat conversion or loss
- Ecosystem alteration/habitat degradation
    - Increased turbidity & siltation of stream bottoms
    - Impoundments
    - Channelization
- Pollution/pesticides/herbicides
    - Increased turbidity
- Grazing/Agricultural practices
    - Heavy grazing practices

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff

Current Monitoring & Inventory Programs (Appendix E):

- Western prairie streams & rivers inventory & surveys (SDGFP, SDSU)

Priority Research & Monitoring Needs (Appendices G-K):

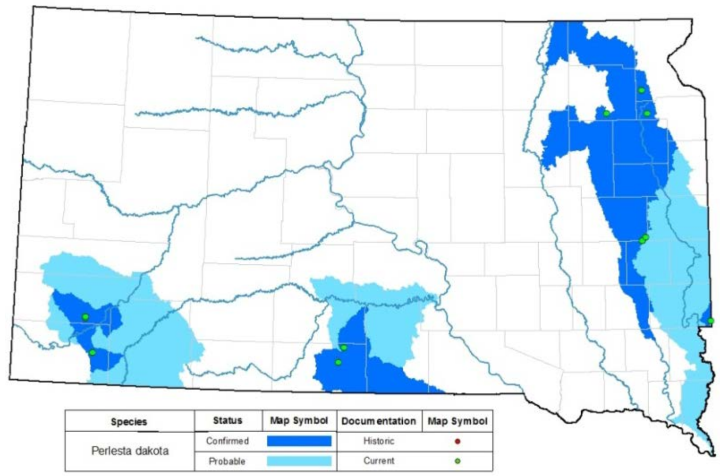
- Establish baseline distribution & current status data through monitoring efforts
- Identify suitable & critical habitats
- Conduct research on life history requirements
- Identify limiting factors

Dakota Stonefly PEDA *Perlesta dakota*

Description:
- Stonefly

Protection Status:
- Federal: None
- State: None
- Global Rank: G3 (Vulnerable)
- State Rank: SNR (Not ranked)

Distribution:
- Southern & Eastern SD- tributaries to the Cheyenne, White, & Big Sioux River basins
- Species range almost entirely isolated to South Dakota with only 3 records from North Dakota



Key Habitat:
- Small streams or rivers with low flow
- Adults prefer overhanging riparian vegetation

Conservation Challenges:
- Ecosystem/habitat conversion or loss
- Ecosystem alteration/habitat degradation
  - Increased turbidity & siltation of stream bottoms
  - Impoundments
  - Channelization
- Pollution/pesticides/herbicides
  - Increased turbidity
- Grazing/Agricultural practices
  - Heavy grazing practices

Conservation Actions:
- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff

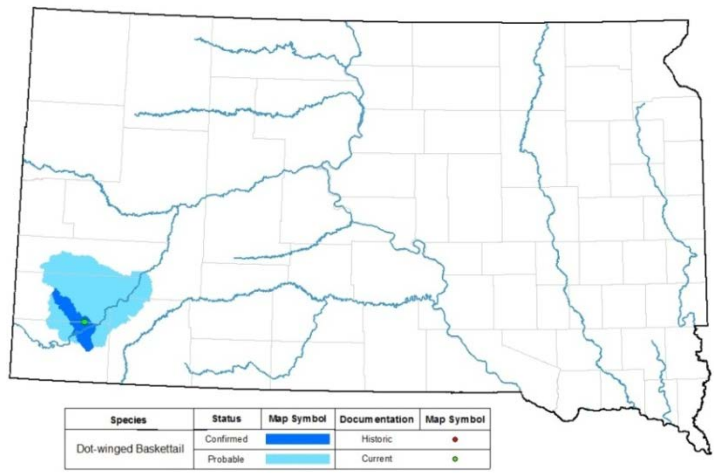
Current Monitoring & Inventory Programs (Appendix E):
- Western prairie streams & rivers inventory & surveys (SDGFP, SDSU)

Priority Research & Monitoring Needs (Appendices G-K):
- Establish baseline distribution & current status data through monitoring efforts
- Identify suitable & critical habitats
- Conduct research on life history requirements
- Identify limiting factors

Dot-winged Baskettail EPPE *Epitheca petechialis*

Description:

- Dragonfly-baskettail
- Brown with yellow spots along sides of slender abdomen
- Distinct row of brown spots on the leading edge of hindwings, however sometimes not prevalent
- SIMILAR SPECIES: Slender Baskettail



Protection Status:

- Federal: None
- State: None
- Global Rank: G4 (Apparently Secure)
- State Rank: SNR (Not ranked)

Distribution:

- Western SD-tributaries to the Cheyenne River basins
- South Dakota is on the northern edge of this species range

Key Habitat:

- Lakes, ponds, & low flow streams

Conservation Challenges:

- Ecosystem/habitat conversion or loss
- Ecosystem alteration/habitat degradation
  - Increased turbidity & siltation of stream bottoms
  - Impoundments
  - Channelization
- Pollution/pesticides/herbicides
  - Increased turbidity
- Grazing/Agricultural practices
  - Heavy grazing practices

Conservation Actions:

- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff

Current Monitoring & Inventory Programs (Appendix E):

- Western prairie streams & rivers inventory & surveys (SDGFP, SDSU)

Priority Research & Monitoring Needs (Appendices G-K):

- Establish baseline distribution & current status data through monitoring efforts
- Identify suitable & critical habitats
- Conduct research on life history requirements
- Identify limiting factors

Elusive Clubtail-A Dragonfly	STNO	*Stylurus notatus*

Description:
- Slender, greenish-yellow dragonfly with brown stripes on the thorax
- Abdomen has 8-9 segments with large pale green to yellow spots on the sides

Protection Status:
- Federal: None
- State: None
- Global Rank: G3 (Vulnerable)
- State Rank: SNR (Not ranked)

Distribution:
- South Dakota distribution unknown
- South Dakota is on the western periphery of the range for this species

Key Habitat:
- Prefers large rivers with moderate flow and sand or gravel substrates, also found in lakes
- Adults patrol open waters or perch from treetops making sightings extremely rare

Conservation Challenges:
- Ecosystem/habitat conversion or loss
- Ecosystem alteration/habitat degradation
  - Increased siltation of stream bottoms
  - Impoundments
  - Channelization
- Pollution/pesticides/herbicides
  - Increased turbidity
- Grazing/Agricultural practices
  - Heavy grazing practices
- Forest Management Practices
  - Logging

Conservation Actions:
- Increase partnerships & cooperative arrangements
- Increase educational efforts
- Promote management practices that reduce/limit soil erosion & nutrient/pesticide runoff
- Maintain/restore natural hydrology & stream connectivity when possible

Priority Research & Monitoring Needs (Appendices G-K):
- Establish baseline distribution & current status data through monitoring efforts
- Identify suitable & critical habitats
- Conduct research on life history requirements
- Identify limiting factors

Appendix D. Species codes used in South Dakota Wildlife Action Plan.

Common Name	Scientific Name	Species Code
BIRDS		
American Dipper	*Cinclus mexicanus*	AMDI
American Three-toed Woodpecker	*Picoides dorsalis*	ATTW
American White Pelican	*Pelecanus erythrorhynchos*	AWPE
Baird's Sparrow	*Ammodramus bairdii*	BAIS
Bald Eagle	*Haliaeetus leucocephalus*	BAEA
Black Tern	*Chlidonias niger*	BLTE
Black-backed Woodpecker	*Picoides arcticus*	BBWO
Burrowing Owl	*Athene cunicularia*	BUOW
Chestnut-collared Longspur	*Calcarius ornatus*	CCLO
Ferruginous Hawk	*Buteo regalis*	FEHA
Greater Prairie-Chicken	*Tympanuchus cupido*	GRPC
Greater Sage-Grouse	*Centrocercus urophasianus*	SAGR
Interior Least Tern	*Sternula antillarum athalassos*	LETE
Lark Bunting	*Calamospiza melanocorys*	LARB
Le Conte's Sparrow	*Ammodramus leconteii*	LCSP
Lewis's Woodpecker	*Melanerpes lewis*	LEWO
Long-billed Curlew	*Numenius americanus*	LBCU
Marbled Godwit	*Limosa fedoa*	MAGO
Northern Goshawk	*Accipiter gentilis*	NOGO
Osprey	*Pandion haliaetus*	OSPR
Peregrine Falcon	*Falco peregrinus*	PEFA
Piping Plover	*Charadrius melodus*	PIPL
Ruffed Grouse	*Bonasa umbellus*	RUGR
Sprague's Pipit	*Anthus spragueii*	SPPI
Trumpeter Swan	*Cygnus buccinator*	TRUS
White-winged Junco	*Junco hyemalis aikeni*	WWJU
Whooping Crane	*Grus americana*	WHCR
Willet	*Tringa semipalmata*	WILL
Wilson's Phalarope	*Phalaropus tricolor*	WIPH
GASTROPODS		
Callused (Dakota) Vertigo	*Vertigo arthuri*	DAVE
Cooper's Rocky Mountainsnail	*Oreohelix strigosa cooperi*	CRMO
Frigid Ambersnail	*Catinella gelida*	FRAM

Appendix D (continued). Species codes used in South Dakota Wildlife Action Plan.

Mystery Vertigo	*Vertigo paradoxa*	MYVE
AMPHIBIANS AND REPTILES		
Black Hills Redbelly Snake	*Storeria occipitomaculata pahasapae*	BHRS
Blanchard's Cricket Frog	*Acris blanchardi*	BCFR
Cope's Gray Treefrog	*Hyla chrysoscelis*	CGTR
Eastern Hognose Snake	*Heterodon platirhinos*	EHSN
False Map Turtle	*Graptemys pseudogeographica*	FMTU
Lesser Earless Lizard	*Holbrookia maculata*	LELI
Lined Snake	*Tropidoclonion lineatum*	LISN
Many-lined Skink	*Plestiodon multivirgatus*	MLSK
Sagebrush Lizard	*Sceloporus graciosus*	SALI
Short-horned Lizard	*Phrynosoma hernandesi*	SHLI
Smooth Softshell	*Apalone mutica*	SMSO
Western (Ornate) Box Turtle	*Terrapene ornata*	WBTU
MAMMALS		
Black-footed Ferret	*Mustela nigripes*	BFFE
Black Hills Red Squirrel	*Tamiasciurus hudsonicus dakotensis*	BHSQ
Franklin's Ground Squirrel	*Poliocitellus franklinii*	FGSQ
Fringe-tailed Myotis	*Myotis thysanodes pahasapensis*	FTMY
Northern Flying Squirrel	*Glaucomys sabrinus*	NFSQ
Northern Myotis	*Myotis septentrionalis*	NOMY
Northern River Otter	*Lontra canadensis*	NROT
Richardson's Ground Squirrel	*Urocitellus richardsonii*	RGSQ
Silver-haired Bat	*Lasionycteris noctivagans*	SHBA
Swift Fox	*Vulpes velox*	SWFO
Townsend's Big-eared Bat	*Corynorhinus townsendii*	TBBA
TERRESTRIAL INSECTS		
American Burying Beetle	*Nicrophorus americanus*	AMBE
Dakota Skipper	*Hesperia dacotae*	DASK
Great Plains Tiger Beetle	*Amblycheila cylindriformis*	GPTB
Indian Creek Tiger Beetle	*Cicindela nevadica makosika*	ICTB
Iowa Skipper	*Atrytone arogos iowa*	IOSK
Little White Tiger Beetle	*Cicindela lepida*	LWTB
Northern Sandy Tiger Beetle	*Cicindela limbata nympha*	NSTB
Ottoe Skipper	*Hesperia ottoe*	OTSK
Pahasapa Fritillary	*Speyeria atlantis pahasapa*	PAFR

Appendix D (continued). Species codes used in South Dakota Wildlife Action Plan.

Poweshiek Skipperling	*Oarisma poweshiek*	POSK
Regal Fritillary	*Speyeria idalia*	REFR
AQUATIC INSECTS		
A Mayfly	*Analetris eximia*	ANEX
Dakota Stonefly	*Perlesta dakota*	PEDA
Dot-winged Baskettail	*Epitheca petechialis*	EPPE
Elusive Clubtail	*Stylurus notatus*	STNO
FRESHWATER MUSSELS		
Creek Heelsplitter	*Lasmigona compressa*	CRHE
Elktoe	*Alasmidonta marginata*	ELKT
Hickorynut	*Obovaria olivaria*	HICK
Higgins Eye	*Lampsilis higginsii*	HIEY
Mapleleaf	*Quadrula quadrula*	MAPL
Pimpleback	*Quadrula pustulosa*	PIMP
Rock Pocketbook	*Arcidens confragosus*	ROPO
Scaleshell	*Leptodea leptodon*	SCAL
Yellow Sandshell	*Lampsilis teres*	YESA
FISHES		
Banded Killifish	*Fundulus diaphanus*	BAKI
Blacknose Shiner	*Notropis heterolepis*	BLSH
Blackside Darter	*Percina maculata*	BLDA
Blue Sucker	*Cycleptus elongatus*	BLSU
Carmine Shiner	*Notropis percobromus*	CASH
Central Mudminnow	*Umbra limi*	CEMU
Finescale Dace	*Chrosomus neogaeus*	FIDA
Hornyhead Chub	*Nocomis biguttatus*	HOCH
Lake Chub	*Couesius plumbeus*	LACH
Logperch	*Percina caprodes*	LOGP
Longnose Sucker	*Catostomus catostomus*	LOSU
Mountain Sucker	*Catostomus platyrhynchus*	MOSU
Northern Pearl Dace	*Margariscus nachtriebi*	NPDA
Northern Redbelly Dace	*Chrosomus eos*	NRDA
Pallid Sturgeon	*Scaphirhynchus albus*	PAST
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*	SHST
Sicklefin Chub	*Macrhybopsis meeki*	SICH
Southern Redbelly Dace	*Chrosomus erythrogaster*	SRDA
Sturgeon Chub	*Macrhybopsis gelida*	STCH
Topeka Shiner	*Notropis topeka*	TOSH
Trout-perch	*Percopsis omiscomaycus*	TRPE

Appendix E. Summary of aquatic and terrestrial species-level monitoring programs in South Dakota, as of 2013.

MONITORING/INVENTORY PROGRAM and TIMEFRAME (Efforts are ongoing unless otherwise indicated.)	PRIMARY AGENCY/ORGANIZATION	DESCRIPTION
BIRDS		
North America Breeding Bird Surveys	U.S. Geological Survey and cooperating agencies, tribes and volunteers	Status and trends of bird populations
Christmas Bird Count	National Audubon Society and cooperating NAS chapters, agencies, tribes and volunteers	Status and trends of bird populations
Breeding waterfowl survey	U.S. Fish and Wildlife Service	Estimates of waterfowl numbers by species
South Dakota Breeding Bird Atlas 2 (2008-2014)	SD Ornithologists' Union and SD Game, Fish, and Parks (SDGFP)	Determine the abundance and distribution of breeding birds in South Dakota 20 years after initial atlas project
Trumpeter Swan	U.S. Fish and Wildlife Service and NE Game and Parks Commission	Annual fall survey to determine production and distribution for portion of Interior Population of High Plains Flock
Bird banding – Farm Island and Oahe Downstream, South Dakota	SDGFP	Migratory bird occurrence and abundance data
Colonial Waterbird Inventory and Monitoring Program (5- to 10-year rotation or as funding allows)	Rocky Mountain Bird Observatory and SDGFP	Census of waterbirds in South Dakota on a 5-10 year rotational basis
Monitoring Avian Productivity and Survivorship (MAPS) Program	The Institute for Bird Populations	Monitor population dynamics of over 120 species of land birds (as of 2013, one station in Brookings County, South Dakota)

Appendix E (continued). Summary of aquatic and terrestrial species-level monitoring programs in South Dakota, as of 2013.

Bald Eagle Midwinter Survey	SDGFP, Nebraska Game and Parks Commission, U.S. Fish and Wildlife Service and U.S.G.S.	Annual winter population surveys on standardized routes along Missouri River
Bald Eagle Nest Surveys (conducted at 2- to 3-year intervals)	SDGFP, U.S. Fish and Wildlife Service, and other participants	Biennial surveys of bald eagle nest occurrences and success
Least Tern and Piping Plover Nesting Surveys	U.S. Army Corps of Engineers and SDGFP	Annual surveys of nest colony locations and success
Whooping Crane Migration Monitoring	SDGFP, U.S. Fish and Wildlife Service	Collect information on migrating whooping cranes to assure their safe passage through the state
Seasonal Bird Observation Report System	Dakota State University and South Dakota Ornithologists' Union	Seasonal reporting and publication of bird observations and nest records, including verified reports of rare bird species
Northern Goshawk Nesting Surveys (conducted at 2- to 3-year intervals)	Black Hills National Forest	Determine locations of known territories and nests to monitor population status
Project FeederWatch	Cornell Lab of Ornithology	Annual volunteer-based monitoring of winter feeding birds
Project NestWatch	Cornell Lab of Ornithology	Annual volunteer-based monitoring of bird nests.
Great Backyard Bird Count	Cornell Lab of Ornithology, National Audubon Society, Bird Studies Canada	Annual volunteer-based monitoring of backyard birds during mid-February
eBird	Cornell Lab of Ornithology and National Audubon Society	Online system that allows birders to keep track of their bird sightings and lists. Data used to monitor bird species occurrences and patterns
Sage-Grouse lek surveys	SD Game, Fish and Parks, Forest Service, Bureau of Land Management	Counts of males on priority leks. Periodic counts of all males on all known leks.

Appendix E (continued). Summary of aquatic and terrestrial species-level monitoring programs in South Dakota, as of 2013.

Sharp-tailed Grouse and Greater Prairie-Chicken lek surveys	Forest Service, South Dakota Game, Fish and Parks and Fish and Wildlife Service.	Lek counts on 10, 40 $mile^2$ survey blocks and established blocks within the Fort Pierre National Grassland. Listening surveys are also completed on 33 established routes. Additional surveys conducted throughout western South Dakota.
Integrated Monitoring in Bird Conservation Regions (IMBCR)	Rocky Mountain Bird Observatory	Monitor bird populations and trends from local to regional scales. West River only.
Turkey Management Surveys • turkey brood survey • turkey harvest survey • turkey trapping and transfer • turkey winter flock counts	SDGFP	Determine population and harvest information to assist in making and evaluating management decisions, including hunting regulations
Turkey Management Surveys • brood survey • harvest survey	Lower Brule Sioux Tribe	Determine current status and trends and estimate harvest annually through questionnaires.
Pheasant Management Surveys • pheasant brood surveys • pheasant winter sex ratio surveys	SDGFP	Determine current status and trends, population composition, and appropriate hunting regulations.
Pheasant Management Surveys • brood survey • harvest survey • wing collection	Lower Brule Sioux Tribe	Determine current status and trends, estimate harvest annually through questionnaires and estimate hatching dates.
Grouse Management Surveys • sharp-tailed grouse and prairie chicken spring lek survey • sharp-tailed grouse and prairie chicken harvest field survey • sage grouse spring survey and lek inventory • sage grouse hunter harvest survey	SDGFP	Determine current status and trends, population composition, appropriate hunting regulations, and extent of utilization and recreation.

Appendix E (continued). Summary of aquatic and terrestrial species-level monitoring programs in South Dakota, as of 2013.

Sharp-tailed grouse and greater prairie-chicken Management Surveys • lek survey • harvest survey • wing collection	Lower Brule Sioux Tribe	Determine current status and trends, estimate harvest annually through questionnaires, and estimate hatching dates.
Gray Partridge Management Surveys • gray partridge harvest survey	SDGFP	Determine current status and trends, population composition, appropriate hunting regulations, and extent of utilization and recreation.
Quail Management Surveys • quail whistle count survey	SDGFP	Determine current status and trends, population composition, and appropriate hunting regulations.
Waterfowl Management Surveys • surveys of migrating and wintering waterfowl	SDGFP	Determine current status and trends, population composition, and appropriate hunting regulations.
Waterfowl Management Surveys • migration survey • harvest survey	Lower Brule Sioux Tribe	Estimate numbers of migrating waterfowl and estimate harvest annually through questionnaires.
Banding and Band Recovery Analysis of Migratory Birds	SDGFP	Determine current status and trends, population composition, appropriate hunting regulations, and extent of utilization and recreation.
Small Game Harvest Survey • upland game bird and waterfowl nesting success survey	SDGFP	Determine extent of utilization and recreation.
Game Bird Nesting Success Surveys	SDGFP	Determine current status and trends, population composition, and appropriate hunting regulations.
Mourning Dove Surveys • mourning dove call-count survey	SDGFP	Determine current status and trends and population composition.

Appendix E (continued). Summary of aquatic and terrestrial species-level monitoring programs in South Dakota, as of 2013.

Mourning Dove Management Surveys • roadside survey • harvest survey	Lower Brule Sioux Tribe	Determine current status and trends and estimate harvest annually through questionnaires.
Wildlife Mortality Investigations	SDGFP	Determine the presence and extent of diseases, parasites and other health anomalies that occur in the state's wildlife populations, and to initiate necessary and timely steps to clean-up or reduce abnormally large die-offs. (Also pertains to mammals).
Raptor Surveys • inventory of nesting raptors • survey of wintering raptors on Fort Pierre National Grassland • national park-specific surveys	SDGFP, U.S. Forest Service and Wind Cave National Park	Status and trend surveys
Raptor Surveys • winter aerial survey • nest survey	Lower Brule Sioux Tribe	Status and trends of wintering raptors and monitor success of bald and golden eagle nests.
Shorebird surveys	USFWS and cooperators	Develop broad-scale habitat models and maps to monitor populations and guide conservation efforts
Use of video cameras to identify prey selection of northern harriers, ferruginous hawks, golden eagles, and Swainson's hawks in the northern Great Plains (2012-2016)	SDSU Agricultural Experiment Station and USFWS	Document prey selection of these raptor species in SD and ND.
Annual bird surveys	National parks in SD	Part of Inventory and Monitoring Network
Grouse lek surveys	Wind Cave National Park	Status and trend surveys
Off-road breeding bird surveys	Wind Cave National Park	Status and trend surveys

Appendix E (continued). Summary of aquatic and terrestrial species-level monitoring programs in South Dakota, as of 2013.

Nightjar survey (Nightjar Survey Network)	Center for Biological Diversity and volunteers	Volunteer-based status and trend survey
MAMMALS		
Monitoring of Black Hills bats	SDGFP, BatWorks, Jewel Cave National Monument and Wind Cave National Park	Status and trend surveys
Black-tailed Prairie Dog distribution surveys	U.S. Forest Service and Wind Cave National Park	Status and trend surveys; WCNP monitors ½ of the colonies each year
Black-tailed Prairie Dog acreage survey	SDGFP	Statewide acreage estimation conducted at 3-year intervals
Black-tailed Prairie Dog management and surveys • colony mapping • windshield survey • harvest survey • insecticide application	Lower Brule Sioux Tribe	Estimate number and size of colonies and complexes, monitor colony activity related to plague occurrence, estimate harvest annually through questionnaires and apply deltamethrin to minimize plague occurrence.
Sylvatic Plague monitoring	SDGFP and other cooperators	Monitor distribution and prevalence of sylvatic plague in South Dakota
River Otter distribution	SDGFP	Monitor species occurrence and evaluate need for reintroduction
Deer Management Surveys • deer harvest survey • detectability survey	SDGFP	Determine population and harvest information to assist in making and evaluating management decisions, including hunting regulations
Deer Management Surveys • winter aerial survey • spotlight survey • age structure analysis • CWD and EHD monitoring	Lower Brule Sioux Tribe	Estimate population size, recruitment, sex ratios and age structure. Estimate harvest annually through questionnaires. Monitor occurrence of CWD and EHD.
Pronghorn Management Surveys • spring aerial survey • fall recruitment survey • pronghorn harvest survey	SDGFP	Determine population and harvest information to assist in making and evaluating management decisions, including hunting regulations

Appendix E (continued). Summary of aquatic and terrestrial species-level monitoring programs in South Dakota, as of 2013.

Pronghorn Surveys	Wind Cave National Park	Status and trend surveys
Elk Counts	Wind Cave National Park	Status and trend surveys
Pronghorn Management Surveys • winter aerial survey • summer aerial survey • harvest survey	Lower Brule Sioux Tribe	Estimate population size, recruitment and sex ratios. Estimate harvest annually from questionnaires.
Elk Management Surveys • elk aerial sightability survey • elk harvest age structure • fall herd composition survey • elk harvest survey	SDGFP	Determine population and harvest information to assist in making and evaluating management decisions, including hunting regulations
Elk Management Surveys • ground survey • harvest survey • CWD monitoring	Lower Brule Sioux Tribe	Estimate population size, recruitment and sex ratios, record annual harvest and monitoring CWD occurrence.
Mountain Goat Management Surveys • mountain goat aerial survey • hunter orientation and biological data of mountain goats	SDGFP	Determine population and harvest information to assist in making and evaluating management decisions, including hunting regulations
Bighorn Sheep Management Surveys • bighorn sheep population surveys • hunter orientation and biological data of bighorn sheep • bighorn sheep trap, transfer and monitoring	SDGFP	Determine population and harvest information to assist in making and evaluating management decisions, including hunting regulations

Appendix E (continued). Summary of aquatic and terrestrial species-level monitoring programs in South Dakota, as of 2013.

Mountain Lion Management Surveys • mountain lion harvest reporting • mountain lion mortality • mountain lion population trend surveys • mountain lion observation reporting	SDGFP	Determine population and harvest information to assist in making and evaluating management decisions, including hunting regulations
Furbearer Harvest Surveys • fur dealer survey	SDGFP	Determine furbearer population and harvest data to guide furbearer management programs.
Furbearer Management Surveys • winter aerial survey • harvest survey	Lower Brule Sioux Tribe	Monitor status and trends of coyotes and estimate harvest annually through questionnaires.
Bobcat Management Surveys • age, sex and reproductive characteristics of harvested bobcat	SDGFP	Determine bobcat population and harvest data to guide furbearer management programs.
Reintroduced populations of Swift Fox	Badlands National Park	Monitor success of reintroductions re: establishment of self-sustaining populations
Reintroduced populations of Black-footed Ferrets • Spotlight survey • Vaccinate against plague and other diseases	Forest Service, National Park Service, Cheyenne River Sioux Tribe, Rosebud Sioux Tribe, Lower Brule Sioux Tribe, U.S. Fish and Wildlife Service	Monitor success of reintroductions re: establishment of self-sustaining populations.
Bison Management Surveys • ground survey • harvest survey	Lower Brule Sioux Tribe	Estimate population size, recruitment and sex ratios. Record annual harvest.
Small Game Harvest Surveys • cottontails and squirrels	SDGFP	Surveys of hunters conducted at regular intervals to monitor harvest http://gfp.sd.gov/hunting/harvest/default.aspx

Appendix E (continued). Summary of aquatic and terrestrial species-level monitoring programs in South Dakota, as of 2013.

FRESHWATER MUSSELS		
Mussel surveys – 39 mile and 59 mile (5-year intervals or as funding allows)	Missouri River USCOE Districts SD Game, Fish and Parks; National Park Service; US Army Corps of Engineers	Status and trend surveys – 5 year recurrence
Statewide comprehensive mussel survey (2014-2016)	SDGFP and South Dakota State University	Distribution, abundance, and status survey
Western prairie streams and rivers inventory survey	SDGFP and South Dakota State University	Monitor and inventory species assemblage structure
Zebra and quagga mussel surveys	Bureau of Reclamation	Monitoring and detection program at reservoirs
GASTROPODS		
Black Hills land snail surveys	Black Hills National Forest	Monitor species occurrence and trends
INSECTS		
American Burying Beetle population surveys (5-year intervals or as funding allows)	SDGFP, U.S. Fish and Wildlife Service, and volunteers	Periodically monitor species occurrence, trends, and state distribution
Dakota skipper and Poweshiek skipperling population surveys	SDGFP and U.S. Fish and Wildlife Service	Monitor species occurrence, abundance, relationship to management practices, and state distribution
Mosquito surveys	SD Department of Health, South Dakota State University, Northern State University, various communities	Survey and monitor distribution and abundance of mosquito populations, with special emphasis on *Culex tarsalis*, the most common West Nile Virus vector in SD
AQUATIC INVERTEBRATES		
Western prairie streams and rivers inventory and surveys	SDGPF and South Dakota State University	Monitor and inventory species assemblage structure

Appendix E (continued). Summary of aquatic and terrestrial species-level monitoring programs in South Dakota, as of 2013.

FISHES		
Topeka Shiner population monitoring (3-year intervals)	SDGFP	Monitor species occurrence and trends – 3-year recurrence
Lakes and rivers fisheries surveys	SDGFP	Monitor species occurrence and trends
Missouri River reservoir and Fort Pierre National Grassland fisheries surveys	SDGFP	Monitor species occurrence – recurrence manage on water-specific basis and rotation
Western prairie streams and rivers inventory surveys	SDGFP and South Dakota State University	Monitor and inventory species assemblage structure
Lower Missouri River Fish Surveys	U.S. Army Corps of Engineers, SDGFP, U.S. Fish and Wildlife Service	Monitor species occurrence and trends, with emphasis on pallid sturgeon re: success of reintroduction efforts
Fish Management Surveys and Management • fisheries survey • harvest survey • fish stocking • paddlefish harvest	Lower Brule Sioux Tribe	Survey and stock small impoundments, estimate harvest annually through questionnaires
AMPHIBIANS AND REPTILES		
Turtle monitoring, Missouri National Recreational River below Fort Randall and Gavins Point dams	National Park Service, Nebraska Game and Parks Commission	Monitor species occurrence and trends
Wild Turtles Inventory (2002-2003)	SDGFP and cooperators	Statewide inventory of 9 turtle species
Reptile and Amphibian surveys (2003-2005)	SDGFP and cooperators	Species occurrence

Appendix E (continued). Summary of aquatic and terrestrial species-level monitoring programs in South Dakota, as of 2013.

EFFORTS THAT CROSS ANIMAL GROUPS OR APPLY TO MULTIPLE HABITAT TYPES:

- SD Natural Heritage Program Monitored Species: Collections, observations, nests locations, etc., of monitored species to document species occurrences to facilitate species and habitat conservation and to assist with environmental review.
- Aquatic Invasive Species Management Plan Implementation: Detect and address AIS issues in South Dakota.

Appendix F. List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Project title, identifier and status	Objectives	PI or contractor
Survey of animal species of greatest conservation needs at representative public areas in South Dakota T-2-R-1 completed 2004	1. survey animal species of greatest conservation need at three publicly-owned areas in eastern SD 2. draw attention to species of concern and methods used to conduct biological surveys 3. compile set of survey protocols that have application to future taxa surveys in SD	Ken Higgins, SDSU, Coop. Unit
Black-backed and Lewis's woodpeckers responses to fire; can post-burn use be predicted using pre-burn forest structure variables? T-3-R-1 completed 2005	1. determine the validity of a black-backed woodpecker model predicting occurrence in a burned site based on pre-fire forest structure 2. determine the response of other woodpecker species to fire 3. quantify habitat characteristics of nest sites compared to random sites to determine habitat preferences of breeding woodpeckers	Kerri Vierling, SD School of Mines and Technology
Enhance wildlife habitat provided by aspen in Custer State Park T-4-R-1 completed 2004	Protect/enhance essential habitats for wildlife species by treating at least 40 aspen clones	Gary Brundige, CSP, SDGFP

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

An evaluation of nesting success of grassland birds in fragmented and unfragmented areas in the mixed grass prairie region of South Dakota, with emphasis on declining grassland species T-5-R-1 completed 2006	1. to evaluate the relationship between nest density and grassland patch size and landscape composition 2. to evaluate the relationship between nest success and grassland patch size and landscape composition 3. to evaluate the relationship between nest predation and parasitism and grassland patch size and landscape composition 4. to determine the most effective size of grassland patches for bird conservation areas in eastern South Dakota 5. to determine habitat requirements for Le Conte's and Henslow's sparrows, if encountered 6. to record species of concern from all taxa encountered during research	Kristel Bakker, DSU and Ken Higgins, SDSU, Coop. Unit
Development of South Dakota's comprehensive wildlife conservation plan T-6-R-1 completed 2005	Complete the South Dakota wildlife comprehensive plan by September 30, 2005	Jon Haufler, Ecosystem Management Research Institute
Ecology of the Black Hills redbelly snake (*Storeria occipitomaculata pahasapae*) with emphasis on food habits T-7-R-1 completed 2006	1. determine seasonal activity, reproductive characteristics, relative body size, habitat selection, population characteristics, distribution, and food habits of the Black Hills redbelly snake 2. determine if there is an association between prey selection and abundance of prey and whether prey abundance is influencing the Black Hills redbelly snake population	Chuck Dieter, SDSU

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Herpetology surveys for South Dakota Comprehensive Wildlife Conservation Plan T-8-R-1 completed 2005	By January 30, 2005, survey ten priority habitats for all species of reptiles and amphibians; these surveys will focus on species of concern and state listed species of amphibians and reptiles	Many (10 total)
Evaluation of a decision support tool to help support fish species at risk in South Dakota streams T-9-R-1 completed 2006	1. assess the accuracy of models to validate their use as decision support tools 2. increase data on distributions of fish species focusing on 9 species of concern 3. obtain data on the habitat and community associations of 9 fish species of concern	Chuck Berry, SDSU, Coop. Unit
Reintroduction of osprey into suitable sites along the Missouri River in South Dakota T-10-R-1 completed 2010	1. reintroduce 20-30 osprey chicks per year from 2004 through 2007 at selected sites in southeastern South Dakota 2. document timing, distance and routes of migration for juvenile ospreys hacked from selected sites in South Dakota 3. identify wintering areas and arrival and departure dates 4. evaluate characteristics of the migration routes and wintering areas and attempt to identify potential threats to ospreys based on this evaluation	Melissa Horton, Wildlife Experiences, Janie Fink and Wayne Melquist, University of Idaho

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Peregrine falcon (*Falco peregrinus*) reintroduction in South Dakota T-10-R-1 Amendment 4 &5 completed 2013	By September 30, 2013: Reintroduce 15 captive-reared falcons in an urban setting in South Dakota to facilitate the return of adult peregrine falcons to establish breeding territories in the vicinity of the reintroduction area.	Janie Fink, Birds of Prey Northwest
A proposal to examine endemism and population relationships of the Black Hills *Oreohelix* snails T-11-R-1 completed 2006	1. determine if the *Oreohelix* in the Black Hills consist of one or more than one biological entities that can be defined by genetics, morphology, anatomy, and/or environmental conditions 2. determine if *Oreohelix* in the Black Hills represent an endemic group, unique from other *Oreohelix* in the geographical region	Tamara Anderson, University of Colorado
Topeka shiner (*Notropis topeka*) monitoring in eastern South Dakota streams T-12-R-1 completed 2006	Develop and implement a 3-year Topeka shiner survey program in 11 watersheds necessary to evaluate the management goals outlined in the State Plan and provide baseline data for evaluating long-term trends in Topeka shiner populations and habitat	Steve Wall

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Nesting success, brood survival, and movements of long-billed curlews (*Numenius americanus*) in grazed landscapes of western South Dakota T-13-R-1 completed 2006	1. determine the effects of land-use practices (grazing regimes) on nesting habitat selection, nest density, and nesting success by long-billed curlews 2. determine the effects of land-use practices (grazing regimes) on movement rates and brood survival of long-billed curlews 3. assess the importance of early-seasons food availability from different grazing regimes on the resultant nesting success and population recruitment in long-billed curlews	K.C. Jensen, SDSU
Natural history and genetic makeup of the northern flying squirrel (*Glaucomys sabrinus bangsi*) population in the Black Hills and northeastern South Dakota T-14-R-1 completed 2008	1. determine reproductive characteristics, morphological characteristics, habitat selection, seasonal activity patterns, population characteristics, distribution and food habits 2. to develop proper handling, trapping, and radio-collaring techniques 3. determine the genetic variability and genetic distance between the Black Hills, South Dakota and northeastern South Dakota populations of northern flying and red squirrel using microsatellite markers, mitochondrial DNA markers, and Y-chromosome markers 4. study the population and develop parentage testing for the *Glaucomys sabrinus* and *Tamiasciurus hudsonicus* in the Black Hills, South Dakota and northeastern South Dakota using microsatellite markers	Chuck Dieter, SDSU and Hugh Britten, USD

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Bat habitat protection and evaluation: implementing and assessing management techniques T-15-R-1 completed 2007	1. evaluate the management activities undertaken within the Black Hills region to date 2. determine the role of Black Hills habitat in supporting regional bat populations 3. identify ten additional sites providing significant habitat to regional bat species and develop management plans for their protection 4. establish a database of bat survey data based upon active and hibernation seasons 5. compile a call library of bat echolocation calls for all species identified within South Dakota	Joel Tigner, BatWorks
Statewide colonial and semi-colonial waterbird inventory with a plan for long-term monitoring T-16-R-1 completed 2007	Implement a statewide inventory of colonial and semi-colonial waterbird populations in South Dakota and develop a plan for their long-term monitoring	Nancy Drilling, Rocky Mountain Bird Observatory
Monitoring the American burying beetle in South Dakota T-17A-R-1 completed 2009	1. expand monitoring efforts to cover more habitat annually than is currently being surveyed 2. increase sampling time in June and August, when adult ABB are most active 3. tag individuals with numbered bee tags to facilitate tracking movements and estimate population size through recaptures	Doug Backlund, SDGFP and Gary Marrone

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Monitoring butterfly species of concern in South Dakota T-17B-R-1 completed 2009	1. survey suitable habitat throughout the Black Hills and northeastern South Dakota for 4 target species 2. collect information on plant species used as larval food sources and adult nectar sources 3. develop a monitoring plan for 4 target species, if populations are found that warrant monitoring	Doug Backlund, SDGFP
Monitoring American dippers in the Black Hills T-17C-R-1 completed 2008	1. monitor annual production at nest sites for 5 years 2. assess aquatic insect abundance at nest sites 3. monitor winter use of stream habitat by dippers for 5 years 4. track movements and length of survival of color banded dipper for 5 years	Doug Backlund, SDGFP
Comprehensive aquatics survey of the Minnesota River tributaries T-17D-R-1 completed 2007	Provide up-to-date survey information on the relative abundance of fish, unionid mussel, and aquatic insect species to determine populations trends and state heritage ranks	Jeff Shearer and Andy Burgess, SDGFP

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Biology of American three-toed woodpeckers in the Black Hills T-18-R-1 completed 2008	1. survey Black Hills white spruce habitat for resident American three-toed woodpeckers 2. characterize Black Hills white spruce habitats and other habitats used by American three-toed woodpeckers 3. locate nests and monitor production 4. band American three-toed woodpeckers in the Black Hills with standard FWS bands and color bands and use radio transmitters to track movements of a subset of banded birds 5. collect information on foraging behavior and attempt to relate this to habitat 6. record presence and nesting of sympatric avian species inhabiting Black Hills white spruce habitats and evaluate competition 7. collect DNA samples from the Black Hills populations of American three-toed woodpeckers and sequence mitochondrial and microsatellite DNA 8. obtain samples from other populations and determine the genetic uniqueness of Black Hills population	Dave Swanson, USD
Assessing the impacts of tree plantings on grassland birds in South Dakota T-19-R-1 completed 2006	1. compare bird density among transects placed at variable distances from tree plantings 2. evaluate bird density in transects at sites with trees to those from grassland sites without trees (i.e. controls) 3. assess changes in bird density at sites before and after trees are removed as part of an experimental manipulation	Dave Naugle, University of Montana

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Northern cricket frog (*Acris crepitans*) seasonal status and distribution in southeastern South Dakota T-20A-R-1 completed 2007	1. determine cricket frog occurrence and abundance in appropriate habitats within its historic range in South Dakota 2. determine overwintering habitat and habitat conditions in South Dakota 3. determine freezing tolerance capacity for cricket frogs in South Dakota	Dave Swanson, USD
Status and distribution of turtles and turtle nests, particularly species of greatest conservation need, in southeastern South Dakota T-20B-R-1 completed 2008	1. survey waterways in southeastern South Dakota, particularly the Missouri River, to locate and identify turtle nests and locations 2. determine characteristics of the identified areas, including occupied niches 3. compare habitats occupied to habitats available as nest sites to help in making management recommendations	Chuck Dieter, SDSU
Genetic variation in the smooth green snake, *Liochlorophis vernalis*, in South Dakota T-21-R-1 completed 2007	1. analyze the extent of genetic variation in this species within South Dakota. 2. examine genetic distance amongst South Dakota populations relative to those outside of the state	Brian Smith, Black Hills State University

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Distribution and monitoring of bat species along the lower Missouri River with emphasis on resident vs. migratory behavior T-22-R-1 completed 2007	1. determine migratory behaviors/patterns and migratory timing of bats in South Dakota, specifically those that may use the Missouri River drainage as a corridor 2. determine the distribution, seasonal activity pattern and habitat selection of bats using the Missouri River drainage	Scott Pedersen, SDSU
Does prairie dog colony size matter? Implications for the conservation of grassland biota in South Dakota T-23-R-1 completed 2007	1. compare burrowing owl abundance across a range of prairie dog colony sizes 2. compare prairie dog density and productivity across a range of prairie dog colony sizes 3. compare vegetation cover and composition across a range of prairie dog colony sizes as a measure of forage utility to prairie dogs and other herbivores 4. develop a suite of competing models that compare the influence of covariates (i.e. colony size, age, and spatial arrangement, soil type, and annual precipitation) on burrowing owls, prairie dogs, and vegetation	Kristy Bly and Mike Phillips, Turner Endangered Species Fund
Development and application of a habitat assessment tool for juvenile pallid sturgeon in the upper Missouri River T-24-R-1 completed 2008	1. develop and evaluate a juvenile pallid sturgeon bioenergetics model. 2. quantify effects of water temperature, turbidity and water velocity on feeding rate of juvenile pallid sturgeon. 3. model habitat suitability for juvenile pallid sturgeon in the Missouri River. 4. quantify prey selectivity of age-0 pallid sturgeon	Steve Chipps, SDSU, Coop. Unit

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Restoring swift foxes (*Vulpes velox*) to the Bad River Ranches and environs in western South Dakota T-25-R-1 completed 2009	Job 1: 1. establish a self-sustaining population of swift fox in west-central South Dakota (Haakon, Jackson, Jones, Lyman and Stanley counties) that serves as a course for swift fox recovery and expansion in the northern Great Plains, assists in removing this species from the South Dakota threatened species list, restores native biodiversity to the area, and promotes prairie conservation awareness. 2. collect and disseminate scientific information on the ecology of the species, the ecological requirements for successful restoration, and the evaluation of reintroduction and management techniques. Job 2: 1. to evaluate resource selection of swift foxes during the pup-rearing period in the mixedgrass prairie of west-central South Dakota 2. to refine the existing habitat suitability model developed by Kunkel et al. (2003) for the pup-rearing period using updated techniques and area-specific data	Kevin Honness and Mike Phillips, Turner Endangered Species Fund; amended to Dr. Jon Jenks, SDSU
Wildlife habitat inventory on game production areas in eastern South Dakota T-26-R-1 completed 2009	To map, categorize, and make management recommendations for remaining tracts of native grassland and associated native habitats on state Game Production Areas in a 33 county area of eastern South Dakota	Dan Limmer, Sustained Horizons

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Exploration of factors that influence productivity of American white pelicans at Bitter Lake in northeastern South Dakota T-27-R-1 completed 2011	1. determine nest-attendance schedules and chick-feeding rates during the pre-crèche stages of breeding 2. estimate distances to foraging sites 3. determine locations and attributes of foraging sites 4. document sources of disturbance at nesting areas; 5. monitor colony productivity	Marsha Sovada and Pam Pietz, USGS-Northern Prairie Wildlife Research Center
Sage-steppe and prairie conservation planning T-28-R-1 ongoing	By 30 June 2010, develop a cohesive, comprehensive, WAFWA prairie conservation strategy that integrates pertinent components of companion efforts for the white-tailed, Gunnison's, and black-tailed prairie dogs; black-footed ferret; swift and kit foxes; lesser prairie chicken; mountain plover; burrowing owl; ferruginous hawk; Swainson's hawk; loggerhead shrike; and, as appropriate and feasible, other shrub and grassland species in the Western Great Plains.	WAFWA
Mapping big sagebrush vegetation in western South Dakota T-29-R-1 completed 2008	To map remaining stands of big sagebrush vegetation in three western SD counties: Butte, Harding and Fall River	Mike Pucharelli, USBR and Dan Cogan, Cogan Technology Inc.

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Population estimates, habitat relationships, and movement patterns of turtles, with an emphasis on two species of greatest conservation need, the False Map Turtle, *Graptemys pseudogeographica* and the Smooth Softshell, *Apalone mutica*, in southeastern South Dakota T-30-R-1 in progress	1. determine age structure, sex ratios, and abundance of turtles 2. investigate effects of harvest in James River 3. utilize radio telemetry to investigate how patterns of movement relate to seasonal, sexual and age related parameters of Smooth Softshells and False Map Turtles on the Missouri River and associated tributaries 4. monitor radio tagged turtles and environmental variables associated with their hibernacula in order to investigate the occurrence of, and factors related to winter mortality 5. document and determine how habitat characteristics of aquatic and riparian areas relate to the utilization and distribution of turtle assemblages within southeastern South Dakota	David Swanson USD
Testing the ecosystem diversity approach of South Dakota's Wildlife Action Plan T-31-R-1 completed 2009	1. develop a prototype process for focussing the scope of the South Dakota Wildlife Action Plan to address discrete local-level planning areas using a selected portion of the Missouri Coteau Planning Area 2. identify and explore additional opportunities to assess South Dakota's ecosystem diversity at a local level	EMRI
Avian monitoring in the Black Hills T-32-R-1 completed 2010	Monitor aspen and shrubland habitats on Black Hills National Forest using techniques developed by Rocky Mountain Bird Observatory	Glenn Giroir, RMBO

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

An evaluation of habitat use and requirements for grassland bird species of greatest conservation need in central and western South Dakota T-33-R-1 completed 2009	1. describe local vegetational habitat requirements of SoGCN and Level I and Level II priority grassland bird species 2. describe habitat associations for SoGCN and Level I and Level II priority grassland bird species 3. identify patch and landscape level habitat requirements for SoGCN and Level I and Level II priority grassland bird species	Kristel Bakker, DSU and Charles Dieter, SDSU
Estimating conversion of native grassland to cropland in South Dakota: Loss of habitat for grassland-nesting birds T-34-R-1 completed 2007	1. estimate recent rates of conversion of native grassland to cropland in South Dakota 2. use observed recent conversion to validate predictive models of the probability of conversion of grassland to cropland 3. develop predictive models of the cost of protection for native grassland 4. employ probability models to develop a GIS which will enable wildlife managers to assess the conservation priority of grassland habitats and landscapes in South Dakota	Scott Stephens, DU
Understanding the relationship between prairie dog ecology and black-footed ferret resource selection T-35-R-1 completed 2009	1. measure the spatial distribution of prairie dogs at multiple spatial scales through state-of-the-art resource monitoring and GIS techniques 2. measure resource selection by ferrets and relate resource selection to the spatial distribution of prairie dogs 3. measure prey selection by ferrets	Joshua Millspaugh, University of Missouri-Columbia

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

An aquatic invasive species risk assessment for South Dakota T-36-R-1 completed 2008	1. supply information required for effective control and management of aquatic invasive species (AIS) in South Dakota 2. develop an objective ranking of threat from AIS	Dr. Katie Bertrand, South Dakota State University
Assessment, monitoring and protection of bat habitats in western South Dakota T-37-R-1 completed 2010	1. continue to evaluate the management activities undertaken within western South Dakota to date to benefit bat species by surveying protected hibernacula (both abandoned mines and natural caves), surveying active season bat use of protected sites (compared with pre-gating surveys), and annually monitoring protected sites for vandalism 2. identify and install bat-friendly, vandal-resistant gates at up to 20 additional sites that provide significant habitat to regional bat species and develop management plans for their protection	Joel Tigner, Bat Works
What factors affect territoriality and productivity of black-footed ferrets? T-38-R-1 in progress	1. measure space use of black-footed ferrets in small black-tailed prairie dog complexes and relate territory size, colony size, and carrying capacity by December 15, 2010 2. measure space use by female ferrets and compare the degree of overlap with offspring and unrelated ferrets by December 15, 2010 3. measure space use and resource overlap between black-footed ferrets and badgers by December 15, 2010 4. measure and relate ferret productivity, prairie dog productivity, and forage productivity by December 15, 2010	Shaun Grassel, University of Idaho

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Importance of mountain pine beetle infestations and fire as Black-backed Woodpecker habitat in the Black Hills, South Dakota T-39-R-1 completed 2011	Understand the relative importance of fire and MPB infestations on population and habitat selection processes of BBWO: 1. estimate home ranges during the breeding season, fall, and winter in recently burned and MPB habitats 2. document seasonal time budgets in recently burned and MPB habitats 3. compute general and forage resource selection models for BBWO 4. develop a demographic population model that compares BBWO demographics in burned and MPB habitats of the Black Hills, SD 5. write an article for the public (e.g., South Dakota Conservation Digest, etc.) about the role of disturbance in maintaining BBWO habitat	Josh Millspaugh, UMC and Mark Rumble, Forest Service
Nesting success of tree-nesting waterbirds in colonies on selected wetlands in northeast South Dakota T-40-R-1 completed 2010	By June 30, 2010: 1. to determine the nesting success of tree-nesting waterbirds breeding in colonies on selected wetlands in northeast South Dakota as suggested in the SDWCCP and SDABCP 2. to identify important aspects of habitat required for colonial tree-nesting waterbirds on wetlands of northeast South Dakota in order to create management recommendations	Chuck Dieter, SDSU and Kristel Bakker, Dakota State University

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

South Dakota Breeding Bird Atlas 2 T-41-R-1 in progress	By June 30, 2014: 1. document current distribution of all breeding bird species, including under-surveyed species such as owls and secretive marshbirds 2. assess changes in distributions of breeding birds since the first SDBBA (1988-1992) 3. identify habitat associations and requirements for all breeding species 4. produce a report and interactive web site with species distribution maps and analyses	Nancy Drilling, Rocky Mountain Bird Observatory
Faunal survey of the delta habitat of Upper Lewis and Clark Lake T-42-R-1 completed 2012	By June 1, 2012: 1. Survey the delta for marsh birds, amphibians, reptiles, and freshwater invertebrates, specifically targeting Wildlife Action Plan species of greatest conservation need. 2. Examine the potential for trematode infection in amphibian, snail, and bird hosts. 3. Disseminate information concerning the delta fauna to both wildlife biologist and the general public.	Jacob Kerby and David Swanson, USD
Status of the Bear Lodge Meadow Jumping Mouse (*Zapus hudsonius campestris*) T-43-R-1 completed 2012	By December 31, 2012: 1. Determine the present distribution, abundance, and habitat affinity of *Zapus hudsonius campestris* in the Black Hills of South Dakota during June and July of 2010 and 2011. 2. Compare the present distribution and abundance with historical records of this species.	Tim Mullican, Dakota Wesleyan University

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Distribution, abundance, and seasonal habitat use patterns in ornate box turtles in South Dakota T-44-R-1 completed 2012	By May 15, 2012: 1. Estimate the geographic range of ornate box turtles in South Dakota through the use of ecological niche modeling. 2. Document the macro- and microhabitat use throughout the active season (May through September). 3. Describe movements and estimate home range size. 4. Document daily and seasonal activity periods. 5. Estimate population size. 6. Provide training in ecological field research to Oglala Lakota College (OLC) students.	Alessandra Higa and Hugh Quinn, Oglala Lakota College
Survey and mapping of Black Hills montane grasslands T-45-R-1 completed 2012	By December 31, 2012: 1. Digitally map higher quality Black Hills montane grasslands; construct a montane grassland GIS layer in cooperation with public agencies. 2. Provide a set of photos of survey sites from relocatable points. 3. Thoroughly characterize the Black Hills montane grassland vegetation type. 4. Develop a field key to the type. 5. Share information through national databases and publication in an academic journal.	Hollis Marriott, Don Faber-Langendoen, and Jim Drake

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Evaluation of artificial bat roost selection and occupancy in South Dakota ecoregions T-46-R-1 in progress	By May 15, 2014: 1. Determine optimal bat house designs for habitat specific ecoregions in South Dakota. 2. Record and assess occupancy and microclimate of existing artificial roosts for comparison with historical data collected by Joel Tigner and throughout the period of the grant. 3. Develop bat house design recommendation plans for landowners and homeowners; create a pamphlet for the SDSU Extension Service and link to South Dakota Bat Working Group website to make research results available to the public. 4. Evaluate potential for a continued volunteer monitoring program at sites. 5. Assess potential influence of environmental factors on artificial roost selection/occupancy. 6. Perform acoustic surveys at occupied sites for determination of bat species present and DNA fecal analysis to determine species using bat houses.	Scott Pedersen, SDSU

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Mapping and characterization of calcareous fens in eastern South Dakota T-47-R-1 in progress	By December 31, 2014: 1. Delineate favorable fen habitat and identify potential fen locations in South Dakota. 2. Confirm fen locations and characterize plant community composition, peat depth, water chemistry, and surrounding land use of both previously described and newly delineated calcareous fens. 3. Develop indices of calcareous fen condition and develop statistical models to relate condition to site-level management, size and isolate of fen, and landscape and regional land use factors. 4. Develop an ArcGIS geodatabase.	Mark Dixon, USD and Gary Larson, SDSU
Revision of South Dakota comprehensive wildlife conservation plan T-48-R-1 in progress	By December 31, 2013: Revise the South Dakota Wildlife Action Plan by reviewing and updating the 8 required elements and including consideration of climate change as a potential cause of concern for South Dakota’s fish and wildlife species and associated habitats.	Jon Haufler, EMRI, and GFP staff

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Preliminary investigation into migratory movements of bats in South Dakota T49-R-1 initial project completed, but additional data analysis needed	By June 30, 2013: 1. Describe (graphically) and detect (statistically) significant peaks in annual, monthly, and nightly bat activity (as measured by a bat activity index) at 16 selected bat migration stations located throughout South Dakota. 2. Determine if the 15 selected monitoring stations experience peaks in bat activity during spring and fall migration during each calendar year of the study. 3. Determine if a correlation exists between environmental variables (time, temperature, wind speed, etc.) and a bat activity index at each of the 16 selected bat migration stations during spring and fall or throughout the calendar year. 4. Measure annual and seasonal (spring and fall) bat species (or species group) richness at each of 16 selected bat migration stations. 5. Provide recommendations for a long-term bat migration monitoring program.	Joel Tigner, BatWorks, and Silka Kempema, SDGFP

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Classification and mapping of riparian forest along the White River in South Dakota T-50-R-1 in progress	By June 30, 2014: 1. Map vegetation extent, structure, and composition along the riparian corridor of the White River in South Dakota within a GIS framework, using a hierarchical classification system compatible with the National Vegetation Classification. 2. Sample and quantify riparian forest composition and structure within selected study reaches along the White River, with a particular emphasis on the delta where the White River flows into the Missouri River (Lake Francis Case). 3. Quantify historic changes in riparian vegetation extent, recruitment, and channel dynamics via analysis of historic aerial photography using GIS, along selected reaches of the White River.	Mark Dixon, USD and W. Carter Johnson, SDSU
Past and Current Vegetation Conditions of Core Sagebrush Habitat and Leks of the Greater Sage-Grouse (*Centrocercus urophasianus*) at the easternmost extent of its range in Western South Dakota T-51-R-1 completed 2013	By April 30, 2013: 1. Review and analyze data and field check locations of historical data on GRSG occurrences and associated habitat information. 2. Repeat data collection at historical sites described in Carter data, including vegetation data and observations of individual GRSG, GRSG leks and collection of plant voucher specimens, as needed. 3. Compile and summarize existing information on GRSG counts and lek data collected in South Dakota for comparison to the historical Carter data and the results obtained in Objective 2. 4. Compile information on sagebrush habitat restoration methods and evaluate public land sites for potential future restoration work.	Shelly Deisch, SDGFP and Daryl Mergen, Mergen Ecological Delineations, Inc.

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Colonial and semi-colonial waterbird monitoring T-52-R-1 completed 2012	By December 31,2012: 1. Survey major and important colonial and semi-colonial waterbird breeding colonies to document and enumerate breeding species. 2. Document current habitat conditions at each major and important colony site and identify the surrounding land use and management practices within ½ mile of the colony centroid. 3. Conduct aerial surveys in the Prairie Coteau, Lake Thompson watershed, and Northern Pothole regions of South Dakota to document breeding status in known colonial and semi-colonial waterbird colonies and search for new colonies.	Nancy Drilling, RMBO
Status and distribution of Franklin's ground squirrels and Richardson's ground squirrels in eastern South Dakota T-53-R-1 in progress	By June 30,2015: 1. To identify colony sites, determine the current range, and estimate relative abundance of *S. franklinii* and *S. richardsonii* in eastern South Dakota, as suggested in the SDCWCP (SDGFP 2006). 2. To describe land use and habitat characteristics of colony sites of *S. franklinii and S. richardsonii*, and create a georeferenced database of *S. richardsonii* colony locations as suggested in the SDCWCP (SDGFP 2006). 3. To identify important areas of habitat required for *S. franklinii* and *S. richardsonii* in order to create management recommendations.	Charles Dieter, SDSU and Tim Mullican, DWU

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Mapping and characterization of native grassland habitats on South Dakota's prairie Coteau T-54-R-1, Amendment 2 in progress	By May 31, 2015: 1. Delineate all remaining grassland habitat within a 225-square mile study area located on a portion of the Prairie Coteau with the highest number of documented records of Dakota skipper butterflies. This grassland inventory will involve the use of aerial imagery and ground truthing to produce a GIS layer of remaining native grassland. 2. Rank the ecological condition of delineated grassland parcels within the study area based upon the "Condition Ranking Guidelines" developed by the Minnesota County Biological Survey, and other vegetation inventory projects. 3. Quantitatively characterize the native vegetation that predominates at sites inhabited by Dakota Skipper butterflies. This will involve quantitative sampling of representative stands of each native grassland vegetation type within the study area. Vegetation plot data will be collected to enable comparison with previously collected plot data from elsewhere on the Prairie Coteau. 4. Identify sites within the study area likely to support Dakota Skipper butterflies based upon vegetation and habitat characteristics.	Lan Xu and Gary Larson, SDSU

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Determination of river otter distribution and evaluation of potential sites for population expansion in South Dakota T-55-R-1 in progress	By December 31, 2014: 1. Update river otter occupancy status of drainages with evidence more than 5 years old. 2. Determine river otter occupancy status of agreed-upon drainages. 3. Evaluate agreed-upon sites for reintroduction suitability.	Wayne Melquist, CREX Consulting
Development of a long-term grassland songbird monitoring program for South Dakota with an emphasis on species of greatest conservation need T-56-R-1 in progress	By June 30, 2015: 1. Update existing literature review with peer-reviewed publications published after 2003 and synthesis with a focus on grassland passerines to be completed by September 2012 2. Conduct literature review, synthesis, and analysis of bird survey and monitoring methodologies by May 2013. 3. Conduct review and analysis of existing grassland bird monitoring programs and consult with monitoring experts by May 2013 (ongoing). 4. Propose, finalize, and test monitoring program methodologies. 5. Develop long-term (10-15 year) monitoring plan containing specific data collection field methodology and estimated cost. 6. Plan methodology will increasing grassland passerine species detection rates, provide statistically valid data and address bird population monitoring criteria outlined by the U.S. NABCI Monitoring Subcommittee.	Kristel Bakker, DSU and Silka Kempema, SDGFP

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Threats, management, and suggested harvest and collection policy of herpetofauna of South Dakota T-57-R-1 completed 2012	By September 1,2012: 1. Provide recommendations on take allowances. 2. Provide data to justify the amount of take, both commercially and via fishing licenses. 3. Identify best management practices which could be implemented for herpetofauna during construction projects. 4. Identify general threats to reptiles and amphibians in South Dakota. 5. Provide a final report with data supported recommendations to South Dakota Game, Fish, and Parks (SDGFP) which could be implemented in management decisions.	Brian Smith, BHSU and Hugh Quinn, OLC
Breeding ecology of ferruginous hawks and golden eagles in north-central and western South Dakota T-58-R-1 in progress	By June 30, 2016: 1. Using ground and aerial surveys, document locations of all nesting raptor species of interest in the study area. 2. Evaluate reproductive parameters of ferruginous hawk and golden eagle nests. 3. Evaluate food habits of ferruginous hawks and golden eagles in space and time. 4. Document mammalian prey species abundance using line transects, focusing on prey species documented in the literature as major prey items for ferruginous hawks and golden eagles.	Troy Grovenburg, SDSU

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Breeding ecology of ferruginous hawks and golden eagles in north-central and western South Dakota (continued) T-58-R-1 in progress	5. Identify landscape characteristics associated with raptor nests within each study area by examining habitat characteristics within multiple spatial scales around each nest site, and evaluating how local- and landscape-level processes influence nesting patterns and overall reproductive success. 6. Using nest occupancy data gathered during this study and survey data gathered during previous research in Harding, Perkins, and McPherson counties, determine raptor detection probability and nest occupancy through time, and model how future land-use changes could potentially influence population viability and sustainability.	
Evaluation of the James River Conservation Reserve Enhancement Program in South Dakota T-59-R-1 in progress	By December 31, 2016: 1. Assess effects of CREP on water quality, aquatic habitats and fish assemblage structure in the James River, its tributaries, and watershed wetlands. 2. Assess functional and numerical responses of avifauna to the James River Conservation Reserve Enhancement Program.	Joshua Stafford, SD Coop. Unit and Katie Bertrand, SDSU

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Preliminary investigation of the role of small mammals in the maintenance of plague on Lower Brule black-tailed prairie dog colonies T-60-R-1 in progress	By June 30, 2016: 1. Estimate the effect of treatment with deltamethrin on the survival, density, and diversity of small rodents on black-tailed prairie dog colonies. 2. Estimate the prevalence of *Yersinia pestis* in burrow-collected fleas on black-tailed prairie dog colonies pre- and post-treatment with deltamethrin and in fleas from prairie dogs collected in 2010 to obtain an estimate of *Y. pestis* prevalence in the study colonies. 3. Estimate and detect any differences in *Y. pestis* prevalence in fleas on small rodents on treated, untreated, inactive colony, and off-colony plots and compare these prevalence estimates to *Y. pestis* prevalence of fleas collected from prairie dog burrows. 4. Measure the exposure of small rodents to plague on and near black-tailed prairie dog colonies by titers for plague antibodies in blood samples. 5. Detect any change in flea abundance and flea species diversity on small rodents on treated, untreated, inactive colony, and off-colony plots and in black-tailed prairie dog burrows on dusted and undusted plots.	Hugh Britten, USD

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

A population survey of mussels in South Dakota rivers T-61-R-1 in progress	By December 31, 2016: 1. Assess the presence of mussel populations, distribution, abundance, and habitat affinity from wadeable streams across the state of South Dakota. 2. Conduct effort-based survey of mussel species occurrence followed by quantitative species counts and habitat assessment from wadeable tributary and main stem sites of major river basins to determine species composition and habitat preference. 3. Provide recommendations for an effective long-term monitoring plan for mussels across the state of South Dakota.	Nels Troelstrup, SDSU, Chelsey Pasbrig and Mike Smith, SDGFP
Evaluation of timber harvest on nongame bird abundance and diversity in Custer State Park, South Dakota T2-1-R-1 completed 2013	By May 15, 2013: 1. compare nongame bird abundance and diversity before and after timber sale treatments 2. determine the effects of timber harvest on abundance of sensitive or species of greatest conservation need 3. quantify macro- and micro-habitat characteristics used by nongame birds in a ponderosa pine ecosystem	Chad Lehman, SDGFP and Kent Jensen, SDSU
Conservation status of the mountain sucker (*Catostomus platyrhynchus*) in South Dakota T2-2-R-1 completed 2011	By December 31, 2011: 1. document the current distribution and abundance of mountain sucker in South Dakota for comparison with historical data 2. evaluate the potential influence of physical and biological factors on the abundance and distribution of the mountain sucker 3. inform management recommendations related to the conservation of mountain suckers in SD	Katie Bertrand, South Dakota State University

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Prevalence of an emerging disease in South Dakota amphibian populations T2-3-R-1 completed 2011	By June 1, 2011: 1. Survey the prevalence of the chytrid fungus in amphibian populations across South Dakota 2. Use an Amphibian Disease Testing Center to provide timely and cost-efficient evaluations of amphibian disease outbreaks for researchers working in the state of South Dakota 3. Disseminate information concerning the chytrid fungus to both wildlife biologists and the general public	Jake Kerby University of South Dakota
Classification and mapping of riparian vegetation along the Big Sioux River T2-4-R-1 completed 2012	By August 31, 2012: 1. Map vegetation extent, structure, and composition along the riparian corridor of the Big Sioux River from Watertown to Sioux City within a GIS framework, using a hierarchical classification system compatible with the National Vegetation Classification 2. Sample and quantify dominant overstory and understory plant species composition within at least 5 stands of each classified vegetation type in a format compatible with VegBank 3. Quantify historic changes in riparian vegetation extent, adjacent land cover, and channel dynamics along the Big Sioux River in Brookings, County, SD	Mark Dixon University of South Dakota

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Burrowing owl distribution in western South Dakota T2-5-R-1 completed 2012	By June 30, 2012: 1. Determine distribution of burrowing owl occupied black-tailed prairie dog colonies on 50% of known colonies in western South Dakota 2. Construct a database of black-tailed prairie dog colonies containing multiple burrowing owl pairs which includes size, ownership and management of colonies 3. Describe local vegetational habitat factors associated with occurrence and density of burrowing owls in black-tailed prairie dog colonies 4. Describe habitat associations (active/inactive black-tailed prairie dog colonies, poisoning and grazing regimes, ownership of colonies), colony and landscape level factors affecting burrowing owl use of black-tailed prairie dog colonies 5. Compare vegetation, habitat associations, colony- and colony- and landscape-level characteristics of burrowing owl occupied and unoccupied colonies. 6. Determine factors associated with nest site selection by burrowing owls in select colonies.	Kristel Bakker, Dakota State University and Chuck Dieter, SDSU

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Biodiversity inventory of native bees in the Black Hills Ecoregion T2-6-R-1 completed 2012	By December 31, 2012: 1. Provide a biodiversity inventory of the native bee species of the Black Hills 2. Focus the survey and inventory on exemplary forest, meadow, and shrub-steppe habitats in the Black Hills of Lawrence, Pennington, Custer, and Fall River counties in South Dakota 3. Document host flowers and analyze floral visitation patterns through seasonal changes 4. Use data collected on species occurrence and associated habitat characteristics for initial geospatial evaluations in order to seek patterns associated with historical and contemporary land-use	Paul Johnson, SDSU
Distribution and lek locations of Greater Prairie-Chickens and Sharp-tailed Grouse outside of their traditional range in South Dakota T2-7-R-1 completed 2012	By June 30, 2012: 1. To identify and survey areas of eastern South Dakota where populations of Greater Prairie-Chickens and Sharp-tailed Grouse are suspected to reside, and document their distribution and numbers. 2. To characterize the landscape attributes within 3000 m of identified display grounds (leks). 3. To analyze landscape characteristics using Geographic Information System modeling to develop a predictive model to assist natural resource managers in identifying potential prairie-chicken and sharp-tailed grouse habitats.	Charles Dieter and Kent Jensen, SDSU

Appendix F (continued). List of State Wildlife Grant-funded projects conducted in South Dakota, as of 2013.

Glacial relict fishes in spring-fed headwater streams of South Dakota's Sandhills region T2-8-R-1 completed 2013	To assess the occurrence of Finescale Dace, Northern Pearl Dace, Northern Redbelly Dace, Blacknose Shiner, and Plains Topminnow in the Sandhills of South Dakota and to provide recommendations for an effective long-term monitoring plan for glacial relict fishes in spring-fed headwater streams.	Katie Bertrand, SDSU
Topeka shiner (*Notropis topeka*) monitoring in eastern South Dakota streams (round two) T2-9-R-1 completed 2012	Collect standardized biological and physical habitat data from all previously monitored streams by 2012.	Chelsey Pasbrig, SDGFP
Status of salamander species in South Dakota T62-R-1	By April 30, 2016: Investigate the threat of ranavirus to false map turtle (*Graptemys pseudogeographica*), smooth softshell (*Apalone mutica*), Cope's gray treefrog (*Hyla chrysoscelis*), and Blanchard's cricket frog (*Acris blanchardi*) by sampling tiger salamander populations (*Ambystoma tigrinum*) for the presence of ranavirus infection.	Jacob Kerby, USD

Appendix G. Species-level research and survey needs identified during South Dakota Wildlife Action Plan revision to address conservation challenges.

Conservation challenge	Future or ongoing survey needs Future research needs (Initials indicate respondents[a])	Relevant SGCN	Related completed or ongoing projects
Diseases • white-nose syndrome • West Nile Virus • sylvatic plague • ranavirus • chytrid fungus • snake fungal dermatitis	**Survey**: • Establish monitoring program to detect new occurrences of ranavirus by geographic area or watershed • Monitor West Nile virus incidence and mortality (ND) • Monitor white pelicans and associated colonial waterbirds for disease outbreaks (ND)	• Cope's Gray Treefrog • Blanchard's Cricket Frog • Greater Sage-Grouse • American White Pelican • all SGCN terrestrial populations	• Status of salamander species in South Dakota. Jacob Kerby, USD, PI. State Wildlife Grant T-62-R-1.
	Research: • Investigate prevalence of ranavirus in South Dakota amphibian species		
	• Investigate prevalence of West Nile virus and its effects on terrestrial populations, particularly birds (AK)		• USGS research, Marsha Sovada and others
	• Examine bacterial and viral species present in American pelican feces, determining strains of microorganisms that may be detrimental to populations (AK)		

Appendix G (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision to address conservation challenges.

Exotic or introduced species impacts	**Survey**: • Determine whether SDGFP AIS efforts should be expanded to additional areas with high levels of SGCN occurrence.	• all aquatic and multiple terrestrial SGCN	• SDGFP AIS work
Pollution/pesticides • environmental contaminants • lead poisoning	**Survey**: • Establish monitoring program for large white pelican colonies in South Dakota, in association with fish contaminant monitoring in areas near the largest colonies.	• American White Pelican	• USGS research study on large white pelican colonies in the Northern Great Plains
	Research: • Secure and analyze white pelican chick mortalities for analysis of contaminant loads.	• American White Pelican	
	Research: • Analyze contaminant loads in eastern hog-nosed snakes, lined snakes, and greater short-horned lizards (HQ).	• Eastern Hog-nosed Snake • Lined Snake • Greater Short-horned Lizard	• Smith, Brian E., and Hugh Quinn. 2012. Threats, management and suggested harvest and collection policy for herpetofauna of South Dakota. Report to South Dakota Game, Fish and Parks Department, Pierre, South Dakota.
Wetland quality (includes riparian strips)	**Research**: • Analyze contaminant levels in wetlands; assess damage to these areas (particularly grazing) (BS)	• all amphibians • Red-bellied Snake	• Smith, Brian E., and Hugh Quinn. 2012. Threats, management and suggested harvest and collection policy for herpetofauna of South Dakota. Report to South Dakota Game, Fish and Parks Department, Pierre, South Dakota.

Appendix G (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision to address conservation challenges.

Damage to Black Hills meadows	**Research**: • Study effects of grazing on mesic meadows at higher elevations in the Black Hills (>4000 ft.) (BS)	• Black Hills Red-bellied Snake	• Smith, Brian E., and Hugh Quinn. 2012. Threats, management and suggested harvest and collection policy for herpetofauna of South Dakota. Report to South Dakota Game, Fish and Parks Department, Pierre, South Dakota.
Protection of habitats used by Sagebrush Lizards and Greater Short-horned Lizards	**Research**: • Characterization of these habitat types via niche modeling (BS)	• Sagebrush Lizard • Greater Short-horned Lizard • associated species using this habitat type	• Short-horned lizard survey (*Phrynosoma hernandesi*) survey in South Dakota 2008 – 2009. Final Report Submitted to the South Dakota Department of Game, Fish and Parks 31 December 2009. Hugh Quinn, Brian Smith, Holly Quinn and Gwen H. Writer. • Brian E. Smith, Jodi L. Massie, and Ben G. Blake. Distribution of the sagebrush lizards, *Sceloporus graciosus*, in the Black Hills of South Dakota. 2006. Unpublished report submitted to the South Dakota Department of Game, Fish and Parks.
Protection of snake hibernacula	**Research**: • Characterization of habitat features required for snake hibernacula via GIS modeling; surveys of such habitat (BS)	• all snakes	• Smith, Brian E., and Hugh Quinn. 2012. Threats, management and suggested harvest and collection policy for herpetofauna of South Dakota. Report to South Dakota Game, Fish and Parks Department, Pierre, South Dakota. • Massie, J.L., B.E. Smith, and H. Quinn. 2013. Redbelly snake (*Storeria occipitomaculata*) and smooth greensnake (*Opheodrys vernalis*) activity along roadways near a presumed hibernaculum. Report to South Dakota Department of Game, Fish and Parks, Pierre, South Dakota.

Appendix G (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision to address conservation challenges.

Over-collection of reptiles and amphibians	**Policy:** • Enact bag limits for the collection of all amphibians and reptile species in South Dakota (HQ).	• all amphibians and reptiles	• Smith, Brian E., and Hugh Quinn. 2012. Threats, management and suggested harvest and collection policy for herpetofauna of South Dakota. Report to South Dakota Game, Fish and Parks Department, Pierre, South Dakota.
Genetic Structure Data	**Research**: • Inbreeding rates and nesting success of American white pelicans, determining factors that may contribute to poor survival (AK). • Examine subspecies determinations for herpetofauna (AK).	• American White Pelican • all herpetofauna	
Riparian area habitat degradation and loss	**Survey**: • Establish a monitoring program for mussels and other aquatic biodiversity in South Dakota, in association with housing development along riparian areas. (KPaquatics).	• all mussels • all aquatic SGCN	
	Research: • Study effects of housing developments along riparian areas on mussels and other aquatic biodiversity. (KPaquatics).		

[a]Respondents to South Dakota Wildlife Action Plan research and survey needs assessment request.

Respondent	**Code**	**Affiliation**	**Topics**
Katie Bertrand	(KBaquatic)	South Dakota State University	fish
Kerry Burns	(KeB)	Black Hills National Forest	birds and bats, Black Hills

Appendix G (continued). Research and survey needs identified during the South Dakota Wildlife Action Plan revision to address conservation challenges.

Respondent	Code	Affiliation	Topics
Charles Dieter	(CD)	South Dakota State University	birds, mammals
Nancy Drilling	(ND)	Rocky Mountain Bird Observatory	birds, habitats
Randy Griebel	(RG)	Nebraska National Forest	black-footed ferrets and related issues
Mick Hanan	(MH)	US Fish and Wildlife Service, Lake Andes NWR	birds, habitats
Steve Hummel	(SHaquatic)	Odonata Central	aquatic insects-Odonata
Alyssa Kiesow	(AK)	Northern State University	herptiles, mammals
Dave Lucchesi	(DLaquatic)	SDGFP	fish
Keith Perkins	(KPaquatic)	University of Sioux Falls	mussels
Hugh Quinn	(HQ)	Oglala Lakota College/Black Hills State University	reptiles, amphibians
Mark Rumble	(MR)	USFS, Rocky Mountain Forest and Range Experiment Station	birds, habitats
Will Sayler	(WSaquatic)	SDGFP	fish
Brian Smith	(BS)	Black Hills State University	reptiles, amphibians
Steve Spomer	(SS)	University of Nebraska-Lincoln	terrestrial insects
Sam Stukel	(SSaquatic)	SDGFP	fish (i.e. Pallid Sturgeon, Blue Sucker, Sturgeon Chub, Sicklefin Chub)
David Swanson	(DS)	University of South Dakota	birds, amphibians
Joel Tigner	(JT)	BatWorks Consulting	bats

Appendix H. Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision by habitat types or geographical areas.

Habitat or area	Future research needs or ongoing survey needs (Initials indicate respondents[a])	Relevant SGCN	Related completed or ongoing projects
Wetlands	**Research**: • How are wetland migrants distributed among natural and man-made wetlands? (Source: SD All Bird Conservation Plan)	• Blanchard's Cricket Frog • Willet • Wilson's Phalarope • Black Tern • aquatic insects • Whooping Crane • Piping Plover	• Bakker, K.K. 2005. South Dakota All Bird Conservation Plan. South Dakota Department of Game, Fish and Parks, Wildlife Division Report 2005-09.
	Survey: • Tile drainage locations	• Whooping Crane • Willet • Long-billed Curlew • Marbled Godwit • Wilson's Phalarope • Black Tern • LeConte's Sparrow • all aquatic SGCN	
	Research • Impact of narrowleaf cattail and hybrid spp. on wetland birds	• Black Tern • Trumpeter Swan	
	Research: • ID quality stopover habitat for wetland birds	• Piping Plover • Willet • Marbled Godwit • Wilson's Phalarope	

Appendix H (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision by habitat types or geographical areas.

Grassland	**Survey**: • Overlap converted grassland habitat with the habitat needs of monitored species (CD)	• Baird's Sparrow • Swift Fox • Western Box Turtle • Dakota Skipper • Sprague's Pipit • Lark Bunting • Baird's Sparrow • Le Conte's Sparrow • Chestnut-collared Longspur	• Higgins, K.F., V. J. Smith, J.A. Jenks, J. J. Higgins, and G. A. Wolbrink. 2000. A provisional inventory of relict tallgrass prairie tracts remaining in Eastern South Dakota. SD Agricultural Experiment Station Extension Circular EC912. South Dakota State University, Brookings • Ryba, A. 2013. Catalog of map and spatial data products available from the Habitat and Population Evaluation Team (HAPET) Office to support conservation planning and management in the Northern Great Plains Joint Venture. HAPET, Bismarck, ND.
	Research: • Habitat requirements for non-passerine grassland birds	• Burrowing Owl • Marbled Godwit • Long-billed Curlew • Greater Prairie Chicken • Ferruginous Hawk	Relevant species conservation plans (ND) • http://www.whsrn.org/sites/default/files/file/Marbled_Godwit_Conservation_Plan_10_02-28_v1.2.pdf • http://www.whsrn.org/sites/default/files/file/Long-billed_Curlew_Plan_-_USFWS_rev_2009_Sept.pdf
	Research: • Evaluate impacts of CRP loss on wildlife (ND)	• Ferruginous Hawk • Marbled Godwit • Long-billed Curlew • Greater Prairie-Chicken • Willet • Baird's Sparrow • Lark Bunting • Chestnut-collared Longspur • Sprague's Pipit • Dakota skipper	• SD State Wildlife Grant project T-59-R-1 (Evaluation of the James River Conservation Reserve Enhancement Program in South Dakota); duration 1 January 2013 – 31 December 2016

Appendix H (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision by habitat types or geographical areas.

Grasslands (continued)	**Research**: • Nest success between native and "tame" grasslands (ND)	• Marbled Godwit • Long-billed Curlew • Greater Prairie-Chicken • Willet • Baird's Sparrow • Lark Bunting • Chestnut-collared Longspur • Sprague's Pipit	
Aquatic	**Survey**: • Aquatic vegetation layer (produces invertebrates as a food source)	• fish SGCN • mussel SGCN • Wilson's Phalarope	
	Research: • Bioassessment toolkit	• fish SGCN • aquatic insects	• Krause, J.R., K.N. Bertrand, A. Kafle, and N.H. Troelstrup, Jr. In press. A fish index of biotic integrity for South Dakota's Northern Glaciated Plains Ecoregion. Ecological Indicators.
Multiple	**Research**: • Conduct an assessment of grassland and wetland loss in correlation to wetland, wildlife, and overall ecosystem health (including effects that will be detrimental to humans, potentially including water clarity, invertebrate species composition and quantity, vegetation structure, percent full and average depth for existing wetlands) (MH)	• Long-billed Curlew • Swift Fox • Short-horned Lizard • Greater Prairie-Chicken • Willet • Sprague's Pipit (ND) • all SGCN	

Appendix H (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision by habitat types or geographical areas.

Woodlands	**Research**: • Nest success between natural and man-made woodlands • Monitor nesting success and factors effecting nest success of woodland birds using relevant current protocols (DS) • Establish standard methods to evaluate woodland habitat quality and compare natural and planted woodlands		• Followup research needed to evaluate cowbird parasitism in green ash woodlands along the Missouri River. (MR) • Gentry, D.J., D.L. Swanson, and J.D. Carlisle. 2006. Species richness and nesting success of migrant forest birds in natural river corridors and anthropogenic woodlands in southeastern South Dakota. Condor 108:140-153. (DS) • Dan Uresk, U.S. Forest Service, has already completed woodland classifications for cottonwood, green ash, oak, and box elder woodland types (MR). • Liu, M. and D.L. Swanson. 2014. Physiological evidence that anthropogenic woodlots can substitute for native riparian woodlands as stopover habitat for migrant birds. Physiological and Biochemical Zoology 87: *In press* (DS) • Thomas, N.E. and D.L. Swanson. 2013. Plasma metabolites and creatine kinase levels of shorebirds during fall migration in the Prairie Pothole Region. Auk 130:*In press*. http://www.jstor.org.stable/10.1525/auk.2013.12169 (DS)
Black Hills	**Research**: • Effects of development on Black Hills wildlife • Wildlife response to mountain pine bark beetle epidemic (ND and MR) • Relationship between summer prescribed fire and timing of wildfires as they relate to Black-backed Woodpecker habitat (MR) • Genetics research on American Three-toed Woodpecker (MR)	• American Dipper • Northern Goshawk • Black Hills Red Squirrel • Northern flying Squirrel • Mountain Sucker • Townsend's Big-eared Bat • Ruffed Grouse • Black-backed, American Three-toed and Lewis's woodpeckers	

Appendix H (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision by habitat types or geographical areas.

[a]Respondents to South Dakota Wildlife Action Plan research and survey needs assessment request.

Respondent	Code	Affiliation	Topics
Katie Bertrand	(KBaquatic)	South Dakota State University	fish
Kerry Burns	(KeB)	Black Hills National Forest	birds and bats, Black Hills
Charles Dieter	(CD)	South Dakota State University	birds, mammals
Nancy Drilling	(ND)	Rocky Mountain Bird Observatory	birds, habitats
Randy Griebel	(RG)	Nebraska National Forest	black-footed ferrets and related issues
Mick Hanan	(MH)	US Fish and Wildlife Service, Lake Andes NWR	birds, habitats
Steve Hummel	(SHaquatic)	Odonata Central	aquatic insects-Odonata
Alyssa Kiesow	(AK)	Northern State University	herptiles, mammals
Dave Lucchesi	(DLaquatic)	SDGFP	fish
Keith Perkins	(KPaquatic)	University of Sioux Falls	mussels
Hugh Quinn	(HQ)	Oglala Lakota College/Black Hills State University	reptiles, amphibians
Mark Rumble	(MR)	USFS, Rocky Mountain Forest and Range Experiment Station	birds, habitats
Will Sayler	(WSaquatic)	SDGFP	fish
Brian Smith	(BS)	Black Hills State University	reptiles, amphibians
Steve Spomer	(SS)	University of Nebraska-Lincoln	terrestrial insects
Sam Stukel	(SSaquatic)	SDGFP	fish (i.e. Pallid Sturgeon, Blue Sucker, Sturgeon Chub, Sicklefin Chub)
David Swanson	(DS)	University of South Dakota	birds, amphibians
Joel Tigner	(JT)	BatWorks Consulting	bats

Appendix I. Species-level research and survey needs identified during South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Species or species group	**Future or ongoing survey needs** **Future research needs** **Educational needs** **(Initials indicate respondents[a])**	**Relevant SGCN**	**Related completed or ongoing projects**
BIRDS			
Raptors	**Survey:** • Continue to monitor nest site selection, nesting phenology, nest success, and population trends of all raptor species. • Survey small mammal populations in key habitats to assess changes in prey base. • Collate data on human-caused mortality (direct hunting, power lines, wind turbines, etc.) (ND)	• Bald Eagle • Osprey • Burrowing Owl • Ferruginous Hawk • Northern Goshawk • Peregrine Falcon	• South Dakota Breeding Bird Atlas 1 and 2 • Bald Eagle Midwinter Survey • Bald Eagle Nest Surveys • Ft. Pierre National Grasslands winter raptor surveys • Raptor Management Surveys • A raptor survey of the Grand River National Grassland, Perkins County, SD • Aerial survey of Northwestern South Dakota for nesting golden eagles

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Raptors (continued)	**Research:** • Identify critical habitats and prey preferences. • Research the effects of lead and other contaminants in the ecosystem to raptor populations. • Evaluate the potential effects of oil and gas development in northwest South Dakota to raptor nest success. • Assess the impact of wind energy facilities to resident and migratory raptors. • Evaluate the effects of habitat loss due to land conversion and fragmentation to raptor ecology		• Burrowing owl distribution and nest site selection in western South Dakota • Breeding ecology of ferruginous hawks and golden eagles in north central and western South Dakota • Nesting ecology of the northern goshawk in the Black Hills of South Dakota
	Survey: • Continue to solicit sightings of color-banded birds to evaluate success of reintroduction efforts	• Osprey • Peregrine Falcon	
	Survey: • Continue periodic monitoring of Black Hills population, including evaluation of nests that may pose risks to powerlines or other structures	• Osprey	
	Survey: • Investigate reports of nesting pairs or color-banded birds	• Peregrine Falcon	

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Raptors (continued)	**Species Reintroduction:** • Continue the reintroduction of selected species into suitable sites across South Dakota		• Reintroduction of osprey into suitable sites along the Missouri River in South Dakota • Peregrine falcon reintroduction in South Dakota
Colonial Waterbirds	**Survey:** • Continue statewide long-term monitoring of populations, identification of key colonies, and searches for new colony locations. • Determine what and how management actions may positively or negatively impact breeding waterbirds. • Track size and locations of colonies to aid management of waterbird-fisheries conflicts. • Monitor colonies with double-crested cormorants to evaluate how they impact other species in the colonies (CD) • Document all bird species using Bitter Lake complex (CD)	• American White Pelican • Black Tern • Interior Least Tern • Piping Plover	• South Dakota statewide colonial and semi-colonial Waterbird inventory with a plan for long-term monitoring, 2007. • South Dakota 2012 colonial waterbird survey • South Dakota Breeding Bird Atlas 1 and 2 • Colonial waterbird volunteer counts, 2009 and 2010

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Colonial Waterbirds (continued)	**Research:** • Evaluate breeding habitat requirements and the effects of surrounding land use, changes in water levels, and human disturbances. • Identify causes of colony turnover. • Evaluate potential effects of commercial and non-commercial bait collection to food source availability. • Research factors that contribute to and the effects of interspecific competition at colonies.		• Nesting success of tree-nesting waterbirds in colonies on selected wetlands in northeast South Dakota • Exploration of factors that influence productivity of American white pelicans at Bitter Lake in northeastern South Dakota
American Dipper	**Survey:** • Continue monitoring nest site occupancy in Black Hills (KeB) • Identify critical wintering areas (ND) • Continue to document sightings of color-marked birds **Research:** • Factors limiting population size, distribution (ND) • Winter ecology (ND) • Monitor breeding population/success (ND)	• American Dipper	• Forest Service also interested in monitoring. Possible sharing of personnel, etc.

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Ruffed Grouse	**Survey** • Monitor long-term population trends. Possible cost share with FS (KeB) **Research:** • Refine monitoring protocol to be more cost effective (KeB) • Reasons for dramatic decrease in distribution (ND)	• Ruffed Grouse	• Hansen, Christopher P.; Rumble, Mark A.; Millspaugh, Joshua J. 2010. Monitoring ruffed grouse in the Black Hills: Protocol and user's manual for the occupancy spreadsheet program. Gen. Tech. Rep. RMRS-GTR-246WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 36 p. • Integrated Monitoring in Bird Conservation Regions (IMBCR). • Hansen, C.P., J.J. Millspaugh, M.A. Rumble. 2011. Occupancy modeling of ruffed grouse in the Black Hills National Forest. J. Wildl. Manage. 75(1): 71-77. • Hansen, C.P., M.A. Rumble, J.J. Millspaugh. Ruffed grouse selection of drumming sites in the Black Hills National Forest. Am. Midl. Nat. 165:400-411.
Greater Prairie-Chicken	**Research:** (Source: SD Prairie Grouse Management Plan) • Relate weather variables to grouse production on Ft. Pierre National Grasslands	• Greater Prairie-Chicken	• South Dakota Department of Game, Fish and Parks. no date. Prairie Grouse Management Plan for South Dakota 2011-2015. South Dakota Department of Game, Fish and Parks, Pierre, SD.
Greater Sage-Grouse	**Survey:** • Continued surveys of sagebrush habitat (ND **Research:** • Determine effects of livestock grazing (ND)	• Greater Sage-Grouse	

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Woodpeckers	**Survey:** • Monitor long-term population trends. Possible cost share with FS. (KeB) • Develop appropriate survey and monitoring techniques (ND) • Conduct baseline survey to determine distribution, estimate population sizes (ND) • Develop plan for long-term monitoring (ND) **Research:** • Evaluate effectiveness of IMBCR for monitoring trends (KeB) • Evaluate woodpecker responses to tree mortality caused by mountain pine bark beetles and fire (ND) • Identify limiting factors to population growth (ND) • Elucidate wood-boring insect prey population cycles in burns (ND)	• Black-backed Woodpecker • Lewis's Woodpecker • American Three-toed Woodpecker	• Integrated Monitoring in Bird Conservation Regions (IMBCR) • Alternate protocol may be needed for low density birds with irregular distribution such as black-backed woodpecker
Piping Plover and Interior Least Tern	**Research** • Assess health of sandbar habitats with observed success of piping plover and least terns to determine successful habitat characteristics (MH) • Continue evaluation of nesting requirements and responses to annual available habitat	• Piping Plover • Interior Least Tern	• Variety of habitat evaluations conducted by U.S. Army Corps of Engineers, U.S.G.S. and additional research entities
Piping Plover	**Survey:** • Participate in International Piping Plover Census	• Piping Plover	

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Trumpeter Swan	**Survey**: • Winter distribution and limits to that distribution (ND) **Research**: • Investigate why breeding population is not spreading (ND)	• Trumpeter Swan	
Northern Goshawk	**Research**: • Telemetry study – where do pairs go when lose nest tree/stand/ nest- and territory site fidelity (ND) • Prey preferences; prey responses to habitat change and NOGO responses to prey base changes (ND)	• Northern Goshawk	
Ferruginous Hawk	**Research**: • Effects of prairie dog shooting, poisoning (ND)	• Ferruginous Hawk	
Whooping Crane	**Survey:** • Continue monitoring movements and associated habitat use of migrating whooping cranes. **Research**: • Habitat requirements at stopover sites (ND)	• Whooping Crane	
Long-billed Curlew	**Survey**: • Breeding distribution in SD (ND) • Location of core areas for conservation efforts (ND)	• Long-billed Curlew	

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Sprague's Pipit	**Research**: • Reproductive success in native versus nonnative grasslands (ND • Habitat requirements during migration (ND)	• Sprague's Pipit	
Chestnut-collared Longspur	**Research**: • Identify core areas with highest population densities (ND) • Long-term monitoring of all grassland bird species (ND)	• Chestnut-collared Longspur • all grassland bird species	
White-winged Junco	**Survey:** • Monitor general status through existing methods, such as SDBBA2, North American Breeding Bird Survey and SDOU reporting	• White-winged Junco	

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

MAMMALS			
Bats	**Survey:** • Monitor progression of WNS (KeB) • Monitor important hibernacula sites for evidence of WNS (outside cave entrances for excessive winter/spring bat mortality) (KeB) • Evaluate cave conditions to determine if conditions are conducive to WNS (KeB) • Riparian area surveys, intensive monitoring programs along riparian areas (AK) **Agency Coordination**: • Agencies involved with public land and wildlife management should develop formal relationships to maintain monitoring and continue habitat research. (JT) • Continue requiring compliance with South Dakota bat collection and sampling protocol for scientific collector's permit holders. (JT) • Protect specific locational information on significant roosting locations to prevent unnecessary disturbance. (JT)	• Northern Myotis • Townsend's Big-eared Bat • Silver-haired Bat • Red Bat	• Nationwide monitoring of WNS (USFWS) • Forest Service effort to monitor bats, hibernacula and WNS as funding and time permits. • Forest Service temperature/humidity data loggers in several caves in Black Hills. • South Dakota Bat Working Group. 2004. South Dakota Bat Management Plan. Wildlife Division Report 2004-08. 89 pp. • Bales, B.T. 2007. Regional distribution and monitoring of bats, especially species of conservation concern, along the lower Missouri River in South Dakota. M.S. Thesis, South Dakota State University, Brookings. • Swier, V.J. 2003. Distribution, roost site selection and food habits of bats in eastern South Dakota. M.S. Thesis, South Dakota State University, Brookings. • Tigner, J. and E.D. Stukel. 2003. Bats of the Black Hills – A description of status and conservation needs. South Dakota Department of Game, Fish and Parks. Wildlife Division Report 2003-05. • Tigner (BatWorks) contract work for SDGFP, USFWS and BLM.

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Bats	**Survey**: (source: South Dakota Bat Working Group. 2004. South Dakota Bat Management Plan. Wildlife Division Report 2004-08. 89 pp.) • Monitor significant hibernacula and maternity roosts through surveys, especially gated mines and caves. • Evaluate mines (marked for closure on public lands or funded for closure by public monies) through biological survey and monitoring by bat biologists before closure to determine significance of bat habitat. • Design a program for monitoring bats in South Dakota, particularly caves and mines. • Identify hibernacula and maternity roosts of bats, particularly for Townsend's big-eared bats, and identify sites for gate installations. • Census bats along non-urban riparian corridors to understand the value of these habitats for foraging and roosting and as migration routes. • Survey bridges and box culverts along non-urban riparian corridors to determine location and type (e.g., swallow nests or crevices) of bat roosts. • Identify and protect important maternity roosts, nursery roosts, and hibernacula. (JT) **Research**: • Role of abandoned mines in supporting bat populations. (JT) • Conduct future research under framework similar to *Guidelines for the Protection of Bat Roosts*, American Society of Mammalogists, 1992. (JT) **Research:** (source: South Dakota Bat Working Group. 2004. South Dakota Bat Management Plan. Wildlife Division Report 2004-08. 89 pp.) • Determine which bridge and box culvert designs are used most frequently and/or may enhance use by bats in South Dakota • Determine the relative population trend of each bat species in South Dakota. • Continue to gather information on bat reproductive rates, home range, and movement patterns, particularly rare species, in each region of the state. • Determine the effective size of buffer zones needed around occupied caves and/or mines that serve as hibernacula and maternity roosts. • Investigate and determine impact of plant diversity and structure on bat activity at bat foraging habitats. • Determine the diets of each bat species and the relationship between invasive plant species, insect availability, and bat foraging success. • Determine the abundance and diversity of prey and investigate the impacts of pesticides on prey abundance and diversity and the effects on bats. • Analyze the potential threats to bats in areas selected as high priority for wind power generation. • Determine the effects of wind power generation sites on migratory bat populations in South Dakota. • Investigate responses of bats to fire (prescribed or wild) or other disturbance and/or catastrophe. • Continue to gather information on population genetic structure and evolutionary affinities of bat species and/or subspecies throughout the state. • Examine the role bats play in contributing to the control of pest populations in South Dakota. • Determine the effects of selective timber harvest on bat populations in the Black Hills.

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Bats (continued)	**Education**: (South Dakota Bat Working Group. 2004. South Dakota Bat Management Plan. Wildlife Division Report 2004-08. 89 pp.) • Develop Black Hills-wide education process (e.g., newspapers, schools, and radio/TV PSA) for existing and new landowners that may have mine audits. • Share information and management recommendations and procedures on how to maintain and enhance forest stands and riparian areas for tree bat roosts. • Increase public awareness of bat use of bridges and box culverts. • Inform pest control groups about bat friendly exclusion procedures and bat biology. • Provide information regarding regulations and policies associated with bats, bat roosts and habitats to agencies, organizations, and individuals. • Provide information regarding bats and their value, protection status, and (if available) conservation incentives. • Identify and develop informational tools to distribute to different publics.		
Ground Squirrels	**Survey**: • Monitor distribution and abundance to evaluate effects of native grassland alteration. **Research**: • Assess habitat use and requirements • Research factors influencing distributional changes in South Dakota	• Franklin's Ground Squirrel • Richardson's Ground Squirrel	• Status and distribution of Franklin's and Richardson's ground squirrels in eastern South Dakota-T-53-R-1

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Black-footed Ferret	• Determine the influence of predators and prey on black-footed ferret populations • Evaluate and improve reintroduction methods including captive rearing, captive animal release and translocation of wild animals • Further understand the ecology of sylvatic plague • Evaluate and improve current sylvatic plague mitigation methods including vaccination and insecticide application • Evaluate efficacy of sylvatic plague vaccine as a disease management tool and its effect on black-tailed prairie dog ecosystems	• Black-footed ferret	• Research needs identified by the Conservation Subcommittee of the National Black-footed Ferret Recovery Implementation Team, letter to the Executive Committee, 20 February 2013.

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Arboreal squirrels	**Survey:** • Monitor long-term population trends. (KeB) • Conduct surveys and monitor population trends and dynamics (e.g., reproductive success). Do so in intervals (e.g., every other year) rather than annually to gather long-term data (AK) **Research:** • Evaluate effects of timber harvest and mountain pine beetle to population dynamics and movements • Habitat relationships, habitat use, desired habitat characteristics (KeB)	• Northern Flying Squirrel • Red Squirrel	• Hough, M.J. and C.D. Dieter. 2009. Summer nest tree use by northern flying squirrels in the Black Hills, South Dakota. Am. Midl. Nat. 162:98-111. • Hough, M.J. and C.D. Dieter. 2009. Home range and habitat use of northern flying squirrels in the Black Hills, South Dakota. Am. Midl. Nat. 162:112-124. • Kiesow, A.M., L.E. Wallace, and H.B. Britten. 2011. Characterization and isolation of five microsatellite loci in northern flying squirrels, *Glaucomys sabrinus* (Sciuridae, Rodentia). Western North American Naturalist 71: 553-556. • Kiesow, A.M., E.M. Monroe, and H.B. Britten. 2012. Genetic structure of the arboreal squirrels *Glaucomys sabrinus* and *Tamiasciurus hudsonicus* in the North American Black Hills. Canadian Journal of Zoology 90(9): 1191-1200. • Hough, M. and C. Dieter. 2013. Relative abundance of northern flying squirrels and red squirrels in different forest types, Black Hills, South Dakota. Great Plains Research 23:25-31.
River Otter	**Survey:** (source: SD River Otter Management Plan) • Update knowledge of river otter distribution in South Dakota **Research** (source: SD River Otter Management Plan) • Determine survival, mortality and reproductive rates **Education** (source: SD River Otter Management Plan) • Provide information to the public about river otter population and legal status		• South Dakota Department of Game, Fish and Parks. 2012. South Dakota River Otter Management Plan. South Dakota Department of Game, Fish and Parks Wildlife Division Report Number 2012-07, Pierre, South Dakota, USA.

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

REPTILES AND AMPHIBIANS			
Amphibians and reptiles	**Education:** • Conduct state wildlife law and species identification training regarding amphibians and reptiles to wildlife law enforcement and other GF&P Department personnel (HQ).	• all amphibians and reptiles	• Smith, Brian E., and Hugh Quinn. 2012. Threats, management and suggested harvest and collection policy for herpetofauna of South Dakota. Report to South Dakota Game, Fish and Parks Department, Pierre, South Dakota. • Kiesow, Alyssa M. 2006. Field guide to amphibians and reptiles of South Dakota. South Dakota Department of Game, Fish and Parks. Pierre, South Dakota. • Massie, J.L., B.E. Smith, and H. Quinn. 2013. Redbelly snake (*Storeria occipitomaculata*) and smooth greensnake (*Opheodrys vernalis*) activity along roadways near a presumed hibernaculum. Report to South Dakota Department of Game, Fish, and Parks, Pierre, South Dakota. • Brian E. Smith, Jodi L. Massie, and Ben G. Blake. Distribution of the Sagebrush Lizard, *Sceloporus graciosus*, in the Black Hills of South Dakota. 2006. Unpublished report submitted to the South Dakota Department of Game, Fish, and Parks. • Short-horned lizard (*Phrynosoma hernandesi*) survey in South Dakota 2008 – 2009. Final Report Submitted to the South Dakota Department of Game, Fish and Parks 31 December 2009. Hugh Quinn, Brian Smith, Holly Quinn and Gwen H. Writer.
	Research: • Characterization (i.e. niche modeling) of foraging habitat used during active season to predict locations of more populations of these species in South Dakota (BS) • Determine effect of livestock grazing on sagebrush obligates (ND)	• Sagebrush Lizard • Short-horned Lizard • Black Hills Redbelly Snake	
	Survey: • Continue FrogWatch to monitor amphibian and reptile populations. Organize and advertise citizen science program throughout the state (AK)	• all amphibian and reptile species	

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Amphibians and Reptiles (continued)	**Survey:** Create a downloadable smart phone/computer application using the Field Guide to Amphibians and Reptiles of South Dakota to assist with statewide monitoring efforts (AK).	• all herpetofauna	
	Survey: • Habitat surveys in foraging habitat characterization (BS).	• Sagebrush Lizard	
	• Survey potential ornate box turtle sites identified via. GIS technology by Higa et al. 2012 (HQ).	• Ornate Box Turtle	
	Research: • Examine the scope of aquatic turtle mortality as bycatch in fish traps (HQ).	• False Map Turtle • Smooth Softshell	
	• Identify areas where large concentrations of smooth softshells overwinter, and produce plans to manage those areas (HQ). • Survey rivers in northern and western SD (HQ)	• Smooth Softshell	

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Amphibians and Reptiles (continued)	**Survey:** • Survey Missouri River north of Pierre (HQ)	• False Map Turtle	
	Survey: • Continue surveys of greater short-horned lizards to better understand their distribution in the state. Use of predictive ecological niche modeling should further help define appropriate areas to search (HQ).	• Greater Short-horned Lizard	
	Policy/Enforcement: • Encourage enactment of tribal law to provide protection of ornate box turtles on Pine Ridge and Rosebud Reservations (HQ).	• Ornate Box Turtle	• Smith, Brian E., and Hugh Quinn. 2012. Threats, management and suggested harvest and collection policy for herpetofauna of South Dakota. Report to South Dakota Game, Fish and Parks Department, Pierre, South Dakota.
	• Conduct pitfall trap as well as visual surveys for many-lined skinks and common earless lizards in areas of sandy soils in Fall River, Shannon, Custer, Pennington, Jackson, Bennett, Mellette, Todd, Tripp and potentially Gregory Counties (HQ).	• Many-lined Skink • Common Earless Lizard	• Smith, Brian E., and Hugh Quinn. 2012. Threats, management and suggested harvest and collection policy for herpetofauna of South Dakota. Report to South Dakota Game, Fish and Parks Department, Pierre, South Dakota.
	Research: • Collect and analyze molecular genetic population data of greater short-horned lizards and sagebrush lizards to examine population differentiation, gene flow, and populations potentially at risk due to low genetic variation (HQ & BS).	• Greater Short-horned Lizard • Sagebrush Lizard	

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Amphibians and Reptiles (continued)	• Examine micro- and macro-habitat use of greater short-horned lizards and sagebrush lizards to better understand the requirements of this species in South Dakota (HQ & BS).	• Greater Short-horned Lizard • Sagebrush Lizard	• Quinn, Hugh, Brian Smith, and Gwen H. Writer. 2009. Short-horned lizard (*Phrynosoma hernandesi*) in South Dakota 1008 – 2009. Report to South Dakota Game, Fish and Parks Department, Pierre, South Dakota.
Lizards	• Conduct genetic analyses of many-lined skink and common earless lizard populations to determine the distinctiveness of South Dakota populations from those in other parts of their ranges (HQ).	• Many-lined Skink	
Snakes	**Research:** • Define patterns of genetic variation and differentiation among South Dakota eastern hog-nosed snake populations, and compare these to populations outside the state (HQ).	Eastern Hognose Snake	• Quinn, Hugh, Brian Smith, and Gwen H. Writer. 2009. Short-horned lizard (*Phrynosoma hernandesi*) in South Dakota 2008 – 2009. Report to South Dakota Game, Fish and Parks Department, Pierre, South Dakota. • Smith, Brian E., and Hugh Quinn. 2012. Threats, management and suggested harvest and collection policy for herpetofauna of South Dakota. Report to South Dakota Game, Fish and Parks Department, Pierre, South Dakota. • Brian E. Smith, Jodi L. Massie, and Ben G. Blake. Distribution of the Sagebrush Lizard, *Sceloporus graciosus*, in the Black Hills of South Dakota. 2006. Unpublished report submitted to the South Dakota Department of Game, Fish, and Parks.
	• Identify specific areas of high lined snake road mortality, and design methods to ameliorate such losses (HQ).	• Lined Snake	
	• Conduct genetic analyses to determine the distinctiveness of South Dakota lined snake populations from those in other parts of their range (HQ).	• Lined Snake	

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Snakes	• Long-term mark-recapture studies to track population densities through time (BS)	• snake species	• Smith, Brian E., and Hugh Quinn. 2012. Threats, management and suggested harvest and collection policy for herpetofauna of South Dakota. Report to South Dakota Game, Fish and Parks Department, Pierre, South Dakota. • Massie, J.L., B.E. Smith, and H. Quinn. 2013. Redbelly snake (*Storeria occipitomaculata*) and smooth greensnake (*Opheodrys vernalis*) activity along roadways near a presumed hibernaculum. Report to South Dakota Department of Game, Fish, and Parks, Pierre, South Dakota. • http://www.parcplace.org/publications/parcas-priority-amphibian-and-reptile-conservation-areas.html
	Policy: • Participate in identification of Priority Amphibian and Reptile Conservation Areas (PARCAs) through regional Partners in Amphibian and Reptile Conservation (PARC) chapters	• all species	
	• Conduct genetic analyses to determine the distinctiveness of South Dakota lined snake populations from those in other parts of their range (HQ).	• Lined Snake	
	Survey: • Survey dunes in the Hecla area to see if this is still present. Identify threats (intensive grazing). Spomer's recent habitat evaluation indicated some areas that were heavily grazes and dunes trampled. Continued presence at this site may depend on remaining undisturbed or lightly disturbed dunes (SS). • Clean (undisturbed) blowouts need to be identified inland or on shores of lakes or river. (SS)	• Little White Tiger Beetle	

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

TERRESTRIAL INSECTS			
Indian Creek Tiger Beetle	**Survey:** • Continual monitoring of these species. Due to continued loss of prairie habitats in NE SD it is important to locate larval and adult populations of insects dependent on prairie habitats (AK).	• Indian Creek Tiger Beetle	
Little White Tiger Beetle	**Survey:** • Continued monitoring of these species	• Dakota Skippers, other prairie butterflies	
Northern Sandy Tiger Beetle	**Research:** • Continued participation in captive propagation and reintroduction efforts	• Northern Sandy Tiger Beetle	
Indian Creek Tiger Beetle	**Survey:** • Periodically survey occupied area to monitor population status and trends	• Indian Creek Tiger Beetle	
Dakota Skipper and other prairie butterflies	**Survey:** • Periodically survey occupied area to monitor population status and trends	• Dakota Skippers, other prairie butterflies	• Dennis Skadsen contract work • Dennis Skadsen contract work in association with Minnesota Zoo

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Dakota Skipper and other prairie butterflies (continued)	**Research:** Continued participation in captive propagation and reintroduction efforts	• Dakota Skippers, other prairie butterflies	
American Burying Beetle	**Survey:** • Periodically survey occupied area to monitor population status and trends		• Backlund, D. C., G. M. Marrone, C. K. Williams, and K. Tillman. 2008. Population Estimate of the Endangered American Burying Beetle, *Nicrophorus americanus*, Olivier (Coleoptera: Silphidae) in South Dakota. The Coleopterists Bulletin 62(1): 9-15.

[a]Respondents to South Dakota Wildlife Action Plan research and survey needs assessment request.

Respondent	**Code**	**Affiliation**	**Topics**
Katie Bertrand	(KBaquatic)	South Dakota State University	fish
Kerry Burns	(KeB)	Black Hills National Forest	birds and bats, Black Hills
Charles Dieter	(CD)	South Dakota State University	birds, mammals
Nancy Drilling	(ND)	Rocky Mountain Bird Observatory	birds, habitats
Randy Griebel	(RG)	Nebraska National Forest	black-footed ferrets and related issues
Mick Hanan	(MH)	US Fish and Wildlife Service, Lake Andes NWR	birds, habitats
Steve Hummel	(SHaquatic)	Odonata Central	aquatic insects-Odonata
Alyssa Kiesow	(AK)	Northern State University	herptiles, mammals
Dave Lucchesi	(DLaquatic)	SDGFP	fish
Keith Perkins	(KPaquatic)	University of Sioux Falls	mussels
Hugh Quinn	(HQ)	Oglala Lakota College/Black Hills State University	reptiles, amphibians

Appendix I (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for terrestrial animal species groups.

Mark Rumble	(MR)	USFS, Rocky Mountain Forest and Range Experiment Station	birds, habitats
Will Sayler	(WSaquatic)	SDGFP	fish
Brian Smith	(BS)	Black Hills State University	reptiles, amphibians
Steve Spomer	(SS)	University of Nebraska-Lincoln	terrestrial insects
Sam Stukel	(SSaquatic)	SDGFP	fish (i.e. Pallid Sturgeon, Blue Sucker, Sturgeon Chub, Sicklefin Chub)
David Swanson	(DS)	University of South Dakota	birds, amphibians
Joel Tigner	(JT)	BatWorks Consulting	bats

Appendix J. Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

Species or species group	Future or ongoing survey needs Future research needs Educational or coordination needs (Initials indicate respondents[a])	Relevant SGCN	Related completed or ongoing projects
All SGCN			
Educational or coordination: • Improve and increase collaboration and communication • Promote and improve conservation programs and incentives • Increase environmental efforts about the ecological, economic, and social values of aquatic SGCN • Establish standardized surveys and status assessments for native species, especially SGCN • Continue to build voucher, reference collections for all aquatic biodiversity • Follow up on recommendations from completed research projects • Focus conservation on the best opportunities • Promote management that focuses on conserving aquatic biodiversity			
FRESHWATER MUSSELS			
all mussels	**Survey:** • Establish baseline status & distribution information. • Facilitate a state-wide comprehensive survey, (particularly eastriver KPaquatic). • Facilitate a long-term monitoring program.	• Elktoe • Rock Pocketbook • Higgins Eye • Yellow Sandshell • Creek Heelsplitter • Scaleshell • Hickorynut • Pimpleback • Mapleleaf	**Survey:** • Backlund, D. 1996. Freshwater Mussel Survey of the Medicine Knoll Creek Area, Hughes County, South Dakota. Unpublished Report, South Dakota Game, Fish and Parks. • Ecological Specialists, Inc. 1998. Final Report: Unionid Survey in Lake Sharpe, South Dakota and Possible Effects of Drawdown. Prepared for U.S. Army Corps of Engineers Omaha District, Omaha, NE.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

all mussels (continued)			**Survey:** • Ecological Specialists, Inc. 2005. Characterization of Unionid Communities at three sites in the Missouri River at river miles 810.0, 769.8, and 761.5. Prepared for U.S. Army Corps of Engineers Omaha District, Omaha, NE. • Hoke, E. 1983. Unionid Mollusks of the Missouri River on the Nebraska Border. American Malacological Bulletin 1:71-74. • Hoke, E. 2003. Investigations on the distributions of freshwater mussels in the Missouri River reservoirs of South Dakota. Final Report to South Dakota Game, Fish and Parks, Pierre, South Dakota. Perkins, K. III. 1975. Distribution and Relative Abundance of the Unionid Mussels in the Vermillion River, S.D. MS Thesis, University of South Dakota, Vermillion. • Perkins, K. III., D. Skadsen, and D.C. Backlund. 1995. A survey for unionid mussels in Day, Deuel, Grant, and Roberts Counties, South Dakota. South Dakota Game, Fish and Parks, Pierre, South Dakota. • Perkins, K. III., and D.C. Backlund. 2000. Freshwater mussels of the Missouri National Recreational River below Gavin's Point Dam, South Dakota and Nebraska. South Dakota Game, Fish and Parks Report 2000-1. • Perkins, K. III., and D.C. Backlund. 2003. A survey for winged mapleleaf (*Quadrula fragosa*) and scaleshell (*Leptodea leptodon*) in the James River, South Dakota. South Dakota Game, Fish and Parks Report 2003-17. • Skadsen, D. 1998. A report on the results of a survey for Unionid mussels on the Upper and Middle Big Sioux River and tributaries: Grant, Codington, Hamlin, Brookings, and Moody Counties, South Dakota. South Dakota Game, Fish and Parks Report 1998-02.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

all mussels (continued)			• Shearer, J., D. Backlund, and S.K. Wilson. 2005. Freshwater mussel survey of the 39-mile district-Missouri National Recreational River, South Dakota and Nebraska. South Dakota Game, Fish and Parks Report 2005-08.
	Research: • Identify suitable & critical habitats. • Conduct research on life history requirements. • Examine reproductive behaviors: identify hosts, seasonal timing, & environmental variables. • Identify if & where recruitment is occurring. • Research genetic variation. • Identify limiting factors in current populations, such as host fish presence & distributions, & critical densities to maintain recruitment.		
	Education: • Increase awareness of mussels & their link to healthy ecosystems thru education & outreach. • Develop a Field Guide to the Freshwater Mussels of South Dakota.		**Education:** • South Dakota Game, Fish, and Parks. (In preparation). Rare species field guide. CyberTracker. South Dakota Game, Fish, and Parks. • South Dakota Game, Fish and Parks. (In preparation). Wildlife Action Plan Interactive website. South Dakota Game, Fish, and Parks.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

GASTROPODS			
Gastropods	**Survey**: • Periodic surveys to monitor population status and trends	• Dakota Vertigo • Mystery Vertigo • Frigid Ambersnail • Cooper's Rocky Mountainsnail	• Anderson, T., R. Guralnick, and K. Weaver. 2006. Endemism and population relationships of the Black Hills Oreohelix snails – Final Report. • Anderson, T. K., K. F. Weaver, and R. P. Guralnick. 2007. Variation in adult shell morphology and life-history traits in the land snail *Oreohelix cooperi* in relation to biotic and abiotic factors. Journal of Molluscan Studies 73: 129-137. • Weaver, K., T. K. Anderson, and R. P. Guralnick. 2006. Combining phylogenetic and ecological niche modeling approaches to determine distribution and historical biogeography of the Black Hills Mountain Snails (Oreohelicidae). Diversity and Distributions 12:756-766. • Anderson, T. K and C. Schmidt. 2007. Population dynamics of a land snail species of conservation concern in the Black Hills. Intermountain Journal of Sciences 13:13-31. • Anderson, T. K. 2004. Field Guide to Black Hills Land Snails. Natural History Inventory Publication No. 22. University of Colorado Museum. • Anderson, T. K. 2004. A Review of the U.S. distribution of *Melanoides tuberculatus* (Muller, 1774), an exotic freshwater snail. Ellipsar 6(2): 15-18.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

FISHES			
Statewide Cyprinidae (Minnows)	**Survey:** • Determine baseline surveys and status assessments (completed for Topeka Shiner). • Facilitate a management plan (completed for Topeka Shiner). • Develop & implement a monitoring program to evaluate management goals and provide baseline data in 11 watersheds (33 sites) once every three years (Ongoing for Topeka Shiner). • Implement Topeka Shiner monitoring at a minimum of 3 sites per watershed (88 sites) for the remaining watersheds not included within the ongoing monitoring program (10 streams in the James, 5 streams in the Vermillion, and 14 streams in the Big Sioux River basins.	• Blacknose Shiner • Carmine Shiner • Finescale Dace • Hornyhead Chub • Lake Chub • Northern Pearl Dace • Northern Redbelly Dace • Sicklefin Chub • Southern Redbelly Dace • Sturgeon Chub • Topeka Shiner	**Survey:** • Glacial relict fishes in spring-fed headwater streams of South Dakota's Sandhills region (T2-8-R-1). (Completion Date: December 2013). • Keya Paha Watershed Project with Nebraska (U-4-HM-1). (Completion Date: September 2016). • Topeka shiner (*Notropis topeka*) monitoring in eastern South Dakota streams (T-12-R). Completed 2007. • Topeka shiner (*Notropis topeka*) monitoring in eastern South Dakota streams (Round Two) (T2-9-R-1). Completed 2012. • Bailey, R.M., and Allum, M.O. 1962. Fishes of South Dakota (No. 119). Ann Arbor: Museum of Zoology, University of Michigan. • Bertrand, K. 2010. South Dakota Scientific Collector's Permit. South Dakota Game, Fish, and Parks. • Bertrand, K. 2011. South Dakota Scientific Collector's Permit. South Dakota Game, Fish, and Parks. • Blausey, C.M. 2001. The status and distribution of the Topeka shiner *Notropis topeka* in eastern South Dakota. MS. Thesis. South Dakota State University, Brookings. • Cunningham, G.R. and R.D. Olson. 1994. Fish species collected in streams in West River South Dakota-1994. • Cunningham, G.R., R.D. Olson, and S.M. Hickey. 1995. Fish surveys of the streams and rivers of south central South Dakota west of the Missouri River. Proceedings of the South Dakota Academy of Sciences 74:55-64.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

Statewide Cyprinidae (Minnows)	**Survey:** (continued)	• Cunningham, G.R., and S.M. Hickey. 1997. Topeka shiner (*Notropis topeka*) survey at selected sites within the James and Big Sioux river drainages in South Dakota. Eco-Centrics, Omaha, NE. 39 pp. • Cunningham, G.R. 1999. A survey for the Topeka shiner (*Notropis topeka*) within the Big Sioux, Vermillion, and James river basins in South Dakota. Eco-Centrics, Omaha, NE. 73 pp. • Cunningham, G.R. 1999. Rare fish surveys in selected streams of eastern South Dakota. 1999 Survey. Wildlife Diversity Small Grant Report. • Cunningham, G.R. 2002. Topeka shiner surveys and population estimates in eastern South Dakota survey year 1999. Eco-Centrics, Omaha, NE. • Cunningham, G.R. 2006. Pearl dace (*Margariscus margarita*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. • Dieterman, D.J. and C.R. Berry, Jr. 1994. Fishes in seven streams of the Minnesota River drainage in north eastern South Dakota. Proceedings of the South Dakota Academy of Sciences 73:23-30. • Heakin, A., N. Morey, and C. Berry, Jr. 2003.Environmental monitoring and assessment program activities in South Dakota. Annual progress report. South Dakota Game, Fish, and Parks by U.S. Geological Survey. • Isaak, D.J., W.A. Hubert, and C.R. Berry, Jr. 2002. Conservation assessment for lake chub, mountain sucker, and finescale dace in the Black Hills National Forest, South Dakota and Wyoming. USDA Forest Service, Rocky Mountain Region. • McCoy, R.W. and D.C. Hales. 1974. A survey of eight streams in eastern South Dakota: Physical and chemical characteristics, vascular plants, insects and fishes. Proceedings of the South Dakota Academy of Sciences 53:202-219. • Morey, N.M. and C.R. Berry, Jr. 2004. New distributional records of the northern redbelly dace in the northern Great Plains. The Prairie Naturalist 36(4):257-260. • Morey, N. 2005. A survey of fishes from Snake Creek in the upper James River watershed. South Dakota Department of Transportation. • Moyle, J.B. and W.D. Clothier. 1959. Effects of management and winter oxygen levels on the fish populations of a prairie lake. Transactions of the American Fisheries Society 88:178-185. • Pasbrig, C.A. and D.O. Lucchesi. 2012. Topeka shiner (*Notropis topeka*) monitoring in eastern South Dakota streams (2010-2012. Unpublished report #T2-9-R-1. South Dakota Game, Fish and Parks. • Schultz, L. D., S. J. Lewis, and K. N. Bertrand. 2012. Fish assemblage structure in Black Hills, South Dakota streams. Prairie Naturalist 44:98-104.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

Statewide Cyprinidae (Minnows)	**Survey:** (continued)	• Shearer, J.S. 2003. Topeka shiner (*Notropis topeka*) management plan for the state of South Dakota. Wildlife Division Report 2003-10. South Dakota Game, Fish, and Parks. • Shuman, D. A. and R. A. Klumb. 2012. 2011 annual report. Pallid sturgeon population assessment and associated fish community monitoring for the Missouri River: Segments 5 and 6. U.S. Fish and Wildlife Service, Great Plains Fish and Wildlife Conservation Office, Pierre, South Dakota. Prepared for the U.S. Army Corps of Engineers – Missouri River Recovery Program. April 2012. (SSaquatic) • Shuman, D. A. and R. A. Klumb. 2012. 2011 annual report. Pallid sturgeon population assessment and associated fish community monitoring for the Missouri River: Segments 5 and 6. U.S. Fish and Wildlife Service, Great Plains Fish and Wildlife Conservation Office, Pierre, South Dakota. Prepared for the U.S. Army Corps of Engineers – Missouri River Recovery Program. April 2012. • Stasiak, R. 2006. Lake Chub (*Couesius plumbeus*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. • Stasiak, R. 2006. Northern redbelly dace (*Chrosomus eos*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. • Stasiak, R. and G.R. Cunningham. 2006. Finescale dace (*Chrosomus neogaeus*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. • Stukel, S., J. Kral, and N. Loecher. 2011. Pallid Sturgeon population assessment and associated fish community monitoring for the Missouri River: Segment 7. Prepared for the U.S Army Corps of Engineers-Missouri River Recovery Program. South Dakota Game, Fish and Parks. (SSaquatic) • Wall, S.S., C.M. Blausey, J.A. Jenks, and C.R. Berry, Jr. 2001. Topeka shiner (*Notropis topeka*) population status and habitat conditions in South Dakota. South Dakota Cooperative Fish and Wildlife Research Unit, Completion Report, Research Work Order 73, Brookings. • Wall, S.S. 2002. Dawson Creek Survey (2002). Unpublished report. South Dakota Game, Fish, and Parks. • Wall, S.S. 2005. Topeka Shiner (*Notropis topeka*) Monitoring in Eastern South Dakota Streams. Unpublished report. South Dakota Game, Fish, and Parks. • Wall, S.S. 2006. Topeka Shiner (*Notropis topeka*) Monitoring in Eastern South Dakota Streams. Unpublished report. South Dakota Game, Fish, and Parks. • Wall, S.S. and S.K. Thomson. 2007. Topeka shiner (*Notropis topeka*) monitoring in eastern South Dakota streams (2004-2006). Unpublished report. South Dakota Game, Fish and Parks.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

Statewide Cyprinidae (Minnows)	**Survey:** (continued)	• Wall, S.S. and S.K. Thomson. 2009. Population estimate of Topeka shiners within a watershed in eastern South Dakota. Unpublished report. South Dakota, Game, Fish, and Parks. • Wall, S.S. and S.K. Wall. 2010. Variations and trends in population estimates of Topeka shiners in eastern South Dakota. Unpublished report. South Dakota Game, Fish, and Parks.
Statewide Cyprinidae (Minnows) (continued)	**Research:** • Identify critical habitats. • Assess population dynamics. • Research life history characteristics and feeding habitats in South Dakota. • Research genetic variation. • Research seasonal movements & re-colonization capabilities after periods of intermittency. • Identify limiting factors in current populations, such as presence of AIS or game fish species, land-use practices, & critical densities to maintain recruitment.	**Research:** • Anderson, C.M. and S.K. Sarver. 2008. Development of polymorphic microsatellite loci for the endangered Topeka shiner, *Notropis topeka*. Molecular Ecology Resources 8:311-313. • Blank, M., R. Bramblett, J. Cahoon, T. McMahon, O. Stein, S. Kalinowski. 2006. Impacts of Barriers on Topeka shiner populations SD2006-07. Western Transportation Institute. South Dakota Department of Transportation. • Cunningham, G.R. 2002. Road and bridge construction best management practices for stream sites inhabited by *Notropis topeka* (Topeka shiner). Report to the South Dakota Department of Transportation, Pierre. • Cunningham, G.R. 2006. Pearl dace (*Margariscus margarita*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. • Isaak, D.J., W.A. Hubert, and C.R. Berry, Jr. 2002. Conservation assessment for lake chub, mountain sucker, and finescale dace in the Black Hills National Forest, South Dakota and Wyoming. USDA Forest Service, Rocky Mountain Region. • Sarver, S.K. 2001. Development of DNA fingerprinting markers in Topeka shiner. Final Report to South Dakota Game, Fish & Parks, Pierre, South Dakota. • Stasiak, R.H. 1978. Reproduction, Age, and Growth of the Finescale Dace, Chrosomus neogaeus, in Minnesota. Transactions of the American Fisheries Society 107(5):720-723. • Stasiak, R. 2006. Northern redbelly dace (*Chrosomus eos*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. • Stasiak, R. and G.R. Cunningham. 2006. Finescale dace (*Chrosomus neogaeus*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

<table>
<tr><td>Statewide Cyprinidae (Minnows) (continued)</td><td>Research: (continued)</td><td colspan="2">• Thompson, S.K. 2008. The influence of livestock watering ponds (dugouts) on native stream fishes, especially the endangered Topeka shiner (Notropis topeka). Master’s thesis. South Dakota State University. Brookings, SD.
• Toline, C.A. and A.J. Baker. 1995. Mitochondrial DNA variation and population genetic structure of the northern redbelly dace (Phoxinus eos). Molecular ecology, 4(6):745-754.
• Wall, S.S. and C.R. Berry, Jr. 2002. Inventory and mitigation of culverts crossing streams inhabited by Topeka shiners (Notropis topeka) in South Dakota – Draft. South Dakota Department of Transportation, Pierre, South Dakota.
• Wall, S.S. and C.R. Berry, Jr. 2004. Road culverts across streams with the endangered topeka shiner, Notropis topeka, in the James, Vermillion, and Big Sioux River basins. Proceedings of the South Dakota Academy of Science 83: 125-135.
• Wall, S.S. and C.R. Berry, Jr. 2006. The importance of multiscale habitat relations and biotic associations to the conservation of an endangered fish species, the Topeka shiner. American Fisheries Society Symposium 48: 305-322.</td></tr>
<tr><td></td><td>Education:
• Increase awareness of Cyprinids & their link to healthy ecosystems through education & outreach.
• Create a Field Guide to the nongame fishes of South Dakota.</td><td colspan="2">Education:
• Ashton, D.E. and E.M. Dowd. 2006. Fragile Legacy: Rare Animals of South Dakota. South Dakota Game, Fish, and Parks. 2nd Edition. Report No. 91-04.
• South Dakota Game, Fish, and Parks. (In preparation). Rare species field guide. CyberTracker. South Dakota Game, Fish, and Parks.
• South Dakota Game, Fish, and Parks. (In preparation). Wildlife Action Plan Interactive website. South Dakota Game, Fish, and Parks.</td></tr>
<tr><td>Pallid Sturgeon</td><td>Survey:
• Facilitate a management plan (completed).
• Develop & implement a monitoring program to evaluate management goals and provide baseline data (Ongoing).
• Develop standardized protocols for monitoring all life history stages.</td><td>• False Map Turtle
• Pallid Sturgeon
• Shovelnose Sturgeon
• Sicklefin Chub
• Smooth Softshell Turtle
• Sturgeon Chub</td><td>Survey:
• Klumb, R. A., D. A. Shuman, D. A. James, and K. L. Grohs. 2012. Movement Patterns of Age-1 and Age-7 Pallid Sturgeon Within the Missouri River During Record 2011 Discharges Downstream of Fort Randall Dam. Progress Report Prepared for WAPA, Billings, Montana and the Upper Basin Pallid Sturgeon Workgroup USFWS, Great Plains Fish and Wildlife Conservation Office, Pierre, South Dakota.</td></tr>
</table>

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

Pallid Sturgeon (continued)	**Survey:** (continued)	• Missouri River Recovery Program. Pallid Sturgeon and Associated Fish Community Population Assessment website: http://moriverrecovery.usace.army.mil/mrrp/f?p=136:155:12288912760890::NO::PIS_ID:44. • Shuman, D. A. and R. A. Klumb. 2012. 2011 annual report. Pallid sturgeon population assessment and associated fish community monitoring for the Missouri River: Segments 5 and 6. U.S. Fish and Wildlife Service, Great Plains Fish and Wildlife Conservation Office, Pierre, South Dakota. Prepared for the U.S. Army Corps of Engineers – Missouri River Recovery Program. April 2012. • Stukel, S., J. Kral, and N. Loecher. 2011. Pallid Sturgeon population assessment and associated fish community monitoring for the Missouri River: Segment 7. Prepared for the U.S. Army Corps of Engineers-Missouri River Recovery Program. South Dakota Game, Fish, and Parks. • U.S. Fish and Wildlife Service. 1993. Pallid Sturgeon Recovery Plan. USFWS, Bismarck, North Dakota. 55 pp.
	Research: • Evaluate the role of sediment transport & discharge on the creation & maintenance of habitats for all life stages. • Identify limiting factors associated with natural recruitment including environmental factors, microhabitat features, predation, and pollution. • Research spawning & potential natural recruitment below Gavins Point Dam. What are the factors influencing egg and age-0 juvenile survival? • Investigate seasonal movements, use, and potential spawning on the James River for all life stages.	**Research:** • Development and application of a habitat assessment tool for juvenile Pallid Sturgeon in the upper Missouri River (T-24-R). Completed 2008. • Chipps, S.R., R.A. Klumb and E.B. Wright. 2008. Development and Application of Juvenile Pallid Sturgeon Bioenergetics Model. Final Report, State Wildlife Grant Program, Study T-24-R Study No. 2424. Submitted to South Dakota Department of Game, Fish and Parks, Pierre, SD. • French, W.E., B.D.S. Graeb, S.R. Chipps, K.N. Bertrand, and R.A. Klumb. In Press. Size-Dependent trophic patterns of Pallid Sturgeon and Shovelnose Sturgeon in a large river system. Journal of Fish and Wildlife Management. • French, W. E., B. D. S. Graeb, S. R. Chipps, K. N. Bertrand, T. M. Selch and R. A. Klumb. 2010. Vulnerability of age-0 pallid sturgeon Scaphirhynchus albus to fish predation, J. Appl. Ichthyol. 26: 6-10.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

Pallid Sturgeon (continued)	**Research:** (continued)	• Grohs, K.L. 2008. Macroinvertebrate composition and patterns of prey use by juvenile pallid sturgeon (*Scaphirhynchus albus*) in the Missouri River, South Dakota and Nebraska. M.S. Thesis, South Dakota State University, Brookings. • Grohs, K. L., R. A. Klumb, S. R. Chipps and G. A. Wanner. 2009. Ontogenetic patterns in prey use by pallid sturgeon in the Missouri River, South Dakota and Nebraska. J. Appl. Ichthyol. 25: 48-53. • Missouri River Recovery Program. Pallid Sturgeon and Associated Fish Community Population Assessment website: http://moriverrecovery.usace.army.mil/mrrp/f?p=136:155:12288912760890::NO::PIS_ID:44. • Shuman, D. A., D. W. Willis, and S. C. Krentz. 2006. Application of a length-categorization system for pallid sturgeon (*Scaphirhynchus albus*). Journal of Freshwater Ecology 21:71-78. • Shuman, D. A., R. A. Klumb, R. Wilson, M. Jaeger, T. Haddix, B. Gardner, W. Doyle, P. Horner, M. Ruggles, K. Steffensen, S. Stukel, and G. A. Wanner. 2011. Pallid sturgeon growth, condition, and size structure within the Missouri River basin. Journal of Applied Ichthyology 27:269-281. • Sloss, B. L., R. A. Klumb, and E. J. Heist. 2009. Genetic conservation and paddlefish propagation. American Fisheries Society Symposium 66:307-327. Spindler, B.D. 2008. Modeling spatial distribution and habitat associations for juvenile pallid sturgeon (*Scaphirhynchus albus*) in the Missouri River. M.S Thesis, South Dakota State University, Brookings. • Spindler, B.D. 2008. Modeling spatial distribution and habitat associations for juvenile pallid sturgeon (Scaphirhynchus albus) in the Missouri River. M.S Thesis, South Dakota State University, Brookings. • Spindler, B. D., S. R. Chipps, R. A. Klumb and M. C. Wimberly. 2009. Spatial analysis of pallid sturgeon Scaphirhynchus albus distribution in the Missouri River, South Dakota. J. Appl. Ichthyol. 25: 8-13. • Spindler, B.D., S.R. Chipps, R.A. Klumb, B.D.S. Graeb, and M.C. Wimberly. 2012. Habitat and prey availability attributes associated with juvenile and early adult pallid sturgeon occurrence in the Missouri River, USA. Endangered Species Research Vol. 16: 225-234.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

Pallid Sturgeon (continued)	**Research:** (continued)	• Wanner, G. A., R. A. Klumb, G. R. Jordan, and W. J. Stancill. 2007. Habitat use and movements of adult pallid sturgeon in the Missouri River downstream of Fort Randall Dam, South Dakota and Nebraska. Proceedings of the South Dakota Academy of Science 86:21-33. • Wanner, G. A., D. A. Shuman, M. L. Brown, and D. W. Willis. 2007. An initial assessment of sampling procedures for juvenile pallid sturgeon in the Missouri River downstream of Fort Randall Dam, South Dakota and Nebraska. Journal of Applied Ichthyology 23:529-538. • Wanner, G. A., D. A. Shuman, and D. W. Willis. 2006. Food habits of juvenile pallid sturgeon and adult shovelnose sturgeon in the Missouri River below Fort Randall Dam, South Dakota. Journal of Freshwater Ecology 22:81-92. • Wanner, G. A. 2006. Evaluation of a gastric lavage method on juvenile pallid sturgeon. North American Journal of Fisheries Management 26:587-591.
	Education: • Increase awareness of Pallid Sturgeon monitoring and recovery efforts thru education & outreach.	• Ashton, D.E. and E.M. Dowd. 2006. Fragile Legacy: Rare Animals of South Dakota. South Dakota Game, Fish, and Parks. 2nd Edition. Report No. 91-04. • South Dakota Game, Fish, and Parks. (In preparation). Rare species field guide. CyberTracker. South Dakota Game, Fish, and Parks. • South Dakota Game, Fish, and Parks. (In preparation). Wildlife Action Plan Interactive website. South Dakota Game, Fish, and Parks.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

Statewide Catostomidae (Suckers)	**Survey:** • Conduct baseline surveys and status assessments.	• Longnose Sucker • Mountain Sucker • Blue Sucker	**Survey:** • Conservation status of the mountain sucker (*Catostomus platyrhynchus*) in South Dakota (T2-2-R-1). Completed 2011. • Schultz, L. D. and K. N. Bertrand. 2012. Long term trends and outlook for mountain sucker in the Black Hills of South Dakota. Am. Midl. Nat. 167:96-110. • Schultz, L. D., S. J. Lewis, and K. N. Bertrand. 2012. Fish assemblage structure in Black Hills, South Dakota streams. Prairie Naturalist 44:98-104. • Shuman, D. A. and R. A. Klumb. 2012. 2011 annual report. Pallid sturgeon population assessment and associated fish community monitoring for the Missouri River: Segments 5 and 6. U.S. Fish and Wildlife Service, Great Plains Fish and Wildlife Conservation Office, Pierre, South Dakota. Prepared for the U.S. Army Corps of Engineers – Missouri River Recovery Program. April 2012. • Stukel, S., J. Kral, and N. Loecher. 2011. Pallid Sturgeon population assessment and associated fish community monitoring for the Missouri River: Segment 7. Prepared for the U.S. Army Corps of Engineers-Missouri River Recovery Program. South Dakota Game, Fish, and Parks.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

Statewide Catostomidae (Suckers) (continued)	**Research:** • Identify critical habitats. • Assess population dynamics. • Research life history characteristics and feeding habitats in South Dakota. • Research genetic variation. • Research seasonal movements & re-colonization capabilities after periods of intermittency. • Identify limiting factors in current populations, such as presence of AIS or game fish species, land-use practices, & critical densities to maintain recruitment.	• Longnose Sucker • Mountain Sucker • Blue Sucker	**Research:** • Belica, L.T. and N.P. Nibbelink. 2006. Mountain Sucker (*Catostomus platyrhynchus*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. • Dauwalter, D.C., F.J. Rahel, S.R. Hirtzel, K.G. Gerow, and G.D. Hayward. 2008. MIS Monitoring Protocol for Mountain Sucker. Black Hills National Forest, USDA Forest Service, Region 2. • Isaak, D.J., W.A. Hubert, and C.R. Berry, Jr. 2002. Conservation assessment for lake chub, mountain sucker, and finescale dace in the Black Hills National Forest, South Dakota and Wyoming. USDA Forest Service, Rocky Mountain Region. • Morey, N.M. and C.R. Berry Jr. 2003. Biological characteristics of Blue Sucker in the James River and Big Sioux River, South Dakota. Journal of Freshwater Ecology 18(1): 33-41. • Schultz, L. D. 2011. Environmental factors associated with long-term trends of mountain sucker populations in the Black Hills, and an assessment of their thermal tolerance. M.S. Thesis, South Dakota State University, Brookings. 102 pp. • Schultz, L. D. and K. N. Bertrand. 2011. An assessment of the lethal thermal maxima for mountain sucker. Western North American Naturalist 71(3):404-411.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

Statewide Catostomidae (Suckers) (continued)	**Education:** • Increase awareness of Catostomids & their link to healthy ecosystems through education & outreach. • Create a Field Guide to the nongame fishes of South Dakota.	• Longnose Sucker • Mountain Sucker • Blue Sucker	**Education:** • Ashton, D.E. and E.M. Dowd. 2006. Fragile Legacy: Rare Animals of South Dakota. South Dakota Game, Fish, and Parks. 2nd Edition. Report No. 91-04. • South Dakota Game, Fish, and Parks. (In preparation). Rare species field guide. CyberTracker. South Dakota Game, Fish, and Parks. • South Dakota Game, Fish, and Parks. (In preparation). Wildlife Action Plan Interactive website. South Dakota Game, Fish, and Parks.
Statewide Fundulidae (Killifishes & Topminnows)	**Survey:** • Determine baseline surveys and status assessments.	• Banded Killifish • Plains Topminnow**	**Survey:** • Glacial relict fishes in spring-fed headwater streams of South Dakota's Sandhills region (T2-8-R-1). (Completion Date: December 2013). • Keya Paha Watershed Project with Nebraska (U-4-HM-1). (Completion Date: September 2016). • Pasbrig, C.A., K.D. Koupal, S. Schainost, and W.W. Hoback. 2012. Changes in range-wide distribution of plains topminnow, *Fundulus sciadicus*. Endangered Species Research 16: 235-247.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

Statewide Fundulidae (Killifishes & Topminnows)	**Research:** • Identify critical habitats. • Determine population dynamics. • Research life history characteristics and feeding habitats. • Research seasonal movements & re-colonization capabilities after periods of intermittency. • Research genetic variation. • Identify limiting factors in current populations, such as presence of AIS or game fish species, land-use practices, & critical densities to maintain recruitment.	• Banded Killifish • Plains Topminnow**	**Research:** • Schumann, D.A., C.A. Pasbrig, K.D. Koupal, and W.W. Hoback. 2012. Culture of Plains Topminnow in a pond constructed for species conservation. North American Journal of Aquaculture 74(3): 360-364.
	Education: • Increase awareness & interest of nongame fishes & their link to healthy ecosystems thru education & outreach. • Create a Field Guide of the nongame fishes of South Dakota.		**Education:** • South Dakota Game, Fish, and Parks. (In preparation). Rare species field guide. CyberTracker. South Dakota Game, Fish, and Parks. • South Dakota Game, Fish, and Parks. (In preparation). Wildlife Action Plan Interactive website. South Dakota Game, Fish, and Parks.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

Statewide Percidae (Darters & Logperch)	**Survey:** • Determine baseline surveys and status assessments.	• Blackside Darter • Logperch	
	Research: • Identify critical habitats. • Determine population dynamics. • Research life history characteristics and feeding habitats. • Research seasonal movements & re-colonization capabilities after periods of intermittency. • Research genetic variation. • Identify limiting factors in current populations, such as presence of AIS or game fish species, land-use practices, & critical densities to maintain recruitment.		
	Education: • Increase awareness & interest of nongame fishes & their link to healthy ecosystems thru education & outreach. • Create a Field Guide of the nongame fishes of South Dakota.		**Education:** • South Dakota Game, Fish, and Parks. (In preparation). Rare species field guide. CyberTracker. South Dakota Game, Fish, and Parks. • South Dakota Game, Fish, and Parks. (In preparation). Wildlife Action Plan Interactive website. South Dakota Game, Fish, and Parks.

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

Statewide Umbridae (Mudminnows)	**Survey:** • Determine baseline surveys and status assessments.	• Central Mudminnow	
	Research: • Identify critical habitats. • Determine population dynamics. • Research life history characteristics and feeding habitats. • Research seasonal movements & re-colonization capabilities after periods of intermittency. • Research genetic variation. • Identify limiting factors in current populations, such as presence of AIS or game fish species, land-use practices, & critical densities to maintain recruitment.		
	Education: • Increase awareness & interest of nongame fishes & their link to healthy ecosystems thru education & outreach. • Create a Field Guide of the nongame fishes of South Dakota.		
Statewide Percopsidae (Trout-Perch)	**Survey:** • Determine baseline surveys and status assessments.	• Trout-Perch	

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

Statewide Percopsidae (Trout-Perch) (continued)	**Research:** • Identify critical habitats. • Determine population dynamics. • Research life history characteristics and feeding habitats. • Research seasonal movements & re-colonization capabilities after periods of intermittency. • Research genetic variation. • Identify limiting factors in current populations, such as presence of AIS or game fish species, land-use practices, & critical densities to maintain recruitment.	• Trout-Perch	
	Education: • Increase awareness & interest of nongame fishes & their link to healthy ecosystems thru education & outreach. • Create a Field Guide of the nongame fishes of South Dakota.		

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

AQUATIC INSECTS			
all aquatic insects	**Survey:** • Establish baseline status & distribution information.	• *Analetris eximia*-A Mayfly • *Epitheca petechialis*-Dot-winged Baskettail • *Stylurus notatus*-Elusive Clubtail • *Perlesta dakota*-A Stonefly • *Libellula saturate*-Flame Skimmer** • *Brechmorhoga mendax*- Pale-faced Clubskimmer** • *Argia lugens*-Sooty Dancer** • *Erpetogomphus designates*-Eastern Ringtail (SHaquatic)**	**Survey:** • Huntsman, B. O., Baumann, R. W., & Kondratieff, B. C. (2001). The stoneflies (Plecoptera) of South Dakota. *Entomological News*, *112*(2), 104-111.
	Research: • Identify suitable & critical habitats. • Conduct research on life history requirements. • Determine limiting factors.		
	Education: • Increase awareness & interest of aquatic invertebrates & their link to healthy ecosystems thru education & outreach.		

**Topic is of research and/or monitoring importance, but species is not listed as a species of greatest conservation need

Appendix J (continued). Species-level research and survey needs identified during the South Dakota Wildlife Action Plan revision for aquatic animal species groups.

[a]Respondents to South Dakota Wildlife Action Plan research and survey needs assessment request.

Respondent	Code	Affiliation	Topics
Katie Bertrand	(KBaquatic)	South Dakota State University	fish
Kerry Burns	(KeB)	Black Hills National Forest	birds and bats, Black Hills
Charles Dieter	(CD)	South Dakota State University	birds, mammals
Nancy Drilling	(ND)	Rocky Mountain Bird Observatory	birds, habitats
Randy Griebel	(RG)	Nebraska National Forest	black-footed ferrets and related issues
Mick Hanan	(MH)	US Fish and Wildlife Service, Lake Andes NWR	birds, habitats
Steve Hummel	(SHaquatic)	Odonata Central	aquatic insects-Odonata
Alyssa Kiesow	(AK)	Northern State University	herptiles, mammals
Dave Lucchesi	(DLaquatic)	SDGFP	fish
Keith Perkins	(KPaquatic)	University of Sioux Falls	mussels
Hugh Quinn	(HQ)	Oglala Lakota College/Black Hills State University	reptiles, amphibians
Mark Rumble	(MR)	USFS, Rocky Mountain Forest and Range Experiment Station	birds, habitats
Will Sayler	(WSaquatic)	SDGFP	fish
Brian Smith	(BS)	Black Hills State University	reptiles, amphibians
Steve Spomer	(SS)	University of Nebraska-Lincoln	terrestrial insects
Sam Stukel	(SSaquatic)	SDGFP	fish (i.e. Pallid Sturgeon, Blue Sucker, Sturgeon Chub, Sicklefin Chub)
David Swanson	(DS)	University of South Dakota	birds, amphibians
Joel Tigner	(JT)	BatWorks Consulting	bats

Appendix K. Species-level species- or habitat-specific restoration needs.

Species, species group or habitat	Restoration needs (Initials indicate respondents[a])	Relevant SGCN	Related completed or ongoing projects
reptiles, birds	• Restore (either artificially or through natural flooding) open beaches below dams along the Missouri river (HQ).	• For needed nesting habitat: False Map Turtle, Smooth Softshell, Least Tern, Piping Plover • For needed required habitat for all life stages: Eastern Hog-nosed Snake	• Smith, Brian E., and Hugh Quinn. 2012. Threats, management and suggested harvest and collection policy for herpetofauna of South Dakota. Report to South Dakota Game, Fish and Parks Department, Pierre, South Dakota.
migratory birds	• Characterization and protection of migration and wintering habitats in Central and South America	• American White Pelican • Osprey • Ferruginous Hawk • Peregrine Falcon • Willet • Long-billed Curlew • Marbled Godwit • Wilson's Phalarope • Black Tern • Burrowing Owl • Sprague's Pipit • Lark Bunting • Baird's Sparrow • Le Conte's Sparrow • Chestnut-collared Longspur	• Southern Wings Program is an international effort to link bird needs across breeding, migration and wintering habitats. SDGFP has contributed to a project in the Saltillo Grasslands in Mexico to help protect important wintering habitat for Ferruginous Hawk, Western Meadowlark, Chestnut-collared Longspur, and Grasshopper Sparrow.

Appendix K (continued). Species-level species- or habitat-specific restoration needs.

lizards	• Create areas of open sand (discouraging stabilization of sand dune habitats) in areas of Lacreek National Wildlife Refuge where common earless lizards are known to occur (HQ).	• Common Earless Lizard	• Smith, Brian E., and Hugh Quinn. 2012. Threats, management and suggested harvest and collection policy for herpetofauna of South Dakota. Report to South Dakota Game, Fish and Parks Department, Pierre, South Dakota.
Greater Sage-Grouse	• Identify sites in Fall River County with suitable lek, nesting, brood-rearing, and winter habitat (ND) • Reintroduce disease-free birds into Fall River County (ND)	• Greater Sage-Grouse	
sagebrush	• Investigate best propagation and planting methods for big sagebrush (ND) • Identify sites for big sagebrush restoration (ND)	• Greater Sage-Grouse • Sagebrush Lizard	
mussel SGCN	• Identify high priority sites & landowners for potential conservation & recovery (Locate within COAs). • Controlled propagation of mussels to discover methods & techniques best suited to recover declined &/or extirpated populations.	• Elktoe • Rock Pocketbook • Higgins Eye • Yellow Sandshell • Creek Heelsplitter • Scaleshell • Hickorynut • Pimpleback • Mapleleaf	
Topeka Shiner	• Identify high priority sites & landowners for potential conservation & recovery (Locate within COAs).	• Topeka Shiner	

Appendix K (continued). Species-level species- or habitat-specific restoration needs.

Pallid Sturgeon	• Continued supplemental stockings needed (Ongoing). • River corridor habitat protection through easements or purchase. (SSaquatic)	• Pallid Sturgeon	• Jordan, G. R., R. A. Klumb, G. A. Wanner, and W. J. Stancill. 2006. Post-stocking movements of hatchery- reared juvenile pallid sturgeon in the Missouri River below Fort Randall Dam, South Dakota and Nebraska. Transactions of the American Fisheries Society 135:1499-1511.

[a]Respondents to South Dakota Wildlife Action Plan research and survey needs assessment request.

Respondent	Code	Affiliation	Topics
Katie Bertrand	(KBaquatic)	South Dakota State University	fish
Kerry Burns	(KeB)	Black Hills National Forest	birds and bats, Black Hills
Charles Dieter	(CD)	South Dakota State University	birds, mammals
Nancy Drilling	(ND)	Rocky Mountain Bird Observatory	birds, habitats
Randy Griebel	(RG)	Nebraska National Forest	black-footed ferrets and related issues
Mick Hanan	(MH)	US Fish and Wildlife Service, Lake Andes NWR	birds, habitats
Steve Hummel	(SHaquatic)	Odonata Central	aquatic insects-Odonata
Alyssa Kiesow	(AK)	Northern State University	herptiles, mammals
Dave Lucchesi	(DLaquatic)	SDGFP	fish
Keith Perkins	(KPaquatic)	University of Sioux Falls	mussels
Hugh Quinn	(HQ)	Oglala Lakota College/Black Hills State University	reptiles, amphibians
Mark Rumble	(MR)	USFS, Rocky Mountain Forest and Range Experiment Station	birds, habitats
Will Sayler	(WSaquatic)	SDGFP	fish
Brian Smith	(BS)	Black Hills State University	reptiles, amphibians

Appendix K (continued). Species-level species- or habitat-specific restoration needs.

Steve Spomer	(SS)	University of Nebraska-Lincoln	terrestrial insects
Sam Stukel	(SSaquatic)	SDGFP	fish (i.e. Pallid Sturgeon, Blue Sucker, Sturgeon Chub, Sicklefin Chub)
David Swanson	(DS)	University of South Dakota	birds, amphibians
Joel Tigner	(JT)	BatWorks Consulting	bats

Appendix L. Assessment methods, data sources, and products for terrestrial, riparian, and wetland systems

Terrestrial Systems

Mapping Ecological Sites

SD WAP Product: ALL MLRAs TERRESTRIAL SDWAP.shp

Source GIS and tabular data:

1. U.S. Department of Agriculture National Resource Conservation Service. Soil survey geographic (SSURGO) database for all available counties in South Dakota

   (http://SoilDataMart.nrcs.usda.gov/)

2. U.S. Fish and Wildlife Service, National Wetlands Inventory (http://www.wetlands.fws.gov) – South Dakota data.

3. U.S. Department of Agriculture National Resource Conservation Service. Major Land Resource Area (MLRA) GIS layer (http://soils.usda.gov/survey/geography/mlra/)

Methods: Steps used to develop the GIS layer for mapping the terrestrial (grass/shrub and forested) ecological sites for the state of South Dakota.

1. Acquire NRCS SSURGO GIS and associated ecological site and soils data for the state of South Dakota.
2. Acquire NRCS Major Land Resource Area (MLRA) GIS layer.
3. Union SSURGO and MLRA GIS layers
4. Identify and remove riparian and wetland ecological sites.
5. Identify and fill blanks in the data where ecological site has not been identified for a polygon by using best available information such as adjacent county/MLRA data or soils information to associate an ecological site to blank polygons, where possible.
6. Develop a standardized state-wide naming protocol for ecological site as some MLRAs used different names for the same ecological site.
7. Remove additional mapped riparian and wetland sites using the National Wetlands Inventory GIS layer.
8. Table L-1 identifies and describes the fields associated with the resulting GIS layer and the original data source for the field. Those fields added to facilitate additional application to the SD WAP are noted as “Developed for the SD WAP” in the data source column.

Table L-1. Field names, descriptions and data sources used in the development of the South Dakota Wildlife Action Plan ecological site layer for terrestrial ecosystems (ALL MLRAs TERRESTRIAL SDWAP.shp).

FIELD NAME	*DESCRIPTION*	*GIS/DATA SOURCE*
ECOSITEID	Same as "ecoclassid" found in SSURGO table "coecoclass"; refers to a particular ecological site – represents the concatenated form of ecological site type, ecological site MLRA, ecological site LRU, ecological site number, and ecological site state FIPS code	NRCS SSURGO; some blanks may have been filled for SD WAP
ECOSITENAM	Ecological site name that also includes the precipitation zone, where applicable; may or may not be the same name provided by NRCS SSURGO data; in a few instances a blank field may have been populated with an ecological site name based on interpretation of best available information (see number 4 in method description above)	NRCS SSURGO; some blanks may have been filled for SD WAP
MLRA	Corresponds to Major Land Resource Areas (MLRA) identified within state of South Dakota	NRCS MLRA
ECOSITE	Same as ECOSITEID but ecological site name only	NRCS SSURGO
PRECZONE	Same as ECOSITEID but precipitation zone only, where applicable	NRCS SSURGO
SYSTEM	Broad vegetation system category (i.e. grass-shrub, forested, etc.)	Developed by SDWAP

Identifying Land Use Impacts

Source GIS and tabular data:

1. SD WAP Terrestrial Ecological Site Layer (ALL MLRAs TERRESTRIAL SDWAP.shp) – see previous section for a description of this layer
2. 2006 National Land Cover Database (Landsat-based, 30 meter resolution, landcover GIS file and database); http://www.mrlc.gov/index.php

Methods: Steps used to identify and quantify current land use impacts by ecological site and MLRA.

1. Evaluate options for quantifying land use impacts across South Dakota.
2. Acquire 2006 NLCD GIS layer and associated database.
3. Overlay NLCD GIS layer with SD WAP developed Terrestrial Ecological site Layer.
4. Group land use codes into broader categories needed to meet objectives of SD WAP - see table L-2 below.

Table L-2. Groupings of National Land Cover Data (NLCD) Code/Classification used to meet the objectives of the South Dakota Wildlife Action Plan for assessing and quantifying land use impacts.

SD WAP Grouped Category	*NLCD Code/Classification*
Urban/Residential Development	21/Developed, Open Space 22/Developed, Low Intensity 23/Developed, Medium Intensity 24/Developed, High Intensity
Agriculture	81/Pasture-Hay 82/Cultivated Crops
Unconverted	41/Deciduous Forest 42/Evergreen Forest 43/Mixed Forest 52/Scrub-Shrub 71,64,65,66/Grassland-Herbaceous 90/Woody Wetlands 95/Emergent Herbaceous Wetland 31/Barron Land

Native Ecosystem Plant Community Descriptions

SD WAP Product: SD WAP Database.accdb

Source Data:

1. Ecological Site Description Plant Community tables (provided by Stan Bolts, NRCS)

Methods:

1. Acquire all available and approved ecological site description plant community tables for the state of South Dakota.
2. Review all plant community descriptions relative to the state and transition model developed for the SD WAP and assign one of six disturbance states to each plant community where possible (see Section 3.3 for more information on disturbance states) based on understanding plant community characteristics in response to fire and grazing regimes.
3. Add information on expected historical fire and grazing regimes.
4. Check species common and scientific names, as well as codes, for consistency and update if necessary using NRCS PLANTS database.
5. Remove all non-native species included in the plant community descriptions to meet the objectives for identifying historical disturbance states/conditions described in the SD WAP.

6. Table L-3 identifies and describes the fields associated with the resulting database and the original data source for the field. Those fields added to facilitate additional application to the SD WAP are noted as “Developed for the SD WAP” in the data source column.

Table L-3. Field names, descriptions and data sources used in the development of South Dakota Wildlife Action Plan Database for native ecosystem plant communities.

FIELD NAME	DESCRIPTION	DATA SOURCE
MLRA	Major Land Resource Area (MLRA)	NRCS Plant Community Table
ECOSITEID	NRCS code for ecological site – represents the concatenated form of ecological site type, ecological site MLRA, ecological site LRU, ecological site number, and ecological site state FIPS code	NRCS Plant Community Table
ECOSITENAME	Ecological site name	NRCS Plant Community Table
DISTSTATE	Corresponds to the disturbance state codes described in Section 2.5.1	Developed for the SD WAP
PLANTCOMMUNITY	Common name for co-dominant species identified in the plant community	NRCS Plant Community Table
SYMBOL	NRCS PLANTS code that corresponds to the listed plant species	NRCS Plant Community Table
GROWTHFORM	General growth form for a plant species	NRCS Plant Community Table
MINCOMP	Minimum % composition (annual production) of a plant species	NRCS Plant Community Table
MAXCOMP	Maximum % composition (annual production) of a plant species	NRCS Plant Community Table
CCEXPCHANGE	The expected change in annual production based on climate change; described in Section 2.7.1.2.3	Developed for SD WAP
FIREREGIME	Frequency of historical fire disturbance influencing plant community; described in Section 2.5.1	Developed for SD WAP
GRAZINGREGIME	Intensity of historical bison grazing influencing plant community; described in Section 2.5.1	Developed for SD WAP
UNIQID	Unique identifier for each plant species occurring in a plant community	Developed for SD WAP
RV	The Representative Value (average value) expressed as lbs. per acre of annual production for a plant community	NRCS Plant Community Table
ECOSITEID_STATE	Code that represents concatenated ECOSITEID and DISTSTATE fields described above	Developed for SD WAP
COMMONNAME	Common name for a plant species (may have been updated using PLANTS database)	NRCS Plant Community Table
SCIENTIFICNAME	Scientific name for a plant species (may have been updated using PLANTS database)	NRCS Plant Community Table
PHOTOSYNTHETIC PATHWAY	Type of photosynthetic pathway used by a grass species (i.e. C_3, C4, or CAM)	Developed for SD WAP

Riparian and Wetland Systems

Mapping Ecological Sites

SD WAP Product: All MLRAs RIPWET SDWAP.shp

Source GIS and tabular data:

1. U.S. Department of Agriculture National Resource Conservation Service. Soil survey geographic (SSURGO) database for all available counties in South Dakota (http://SoilDataMart.nrcs.usda.gov/)
2. U.S. Fish and Wildlife Service, National Wetlands Inventory (http://www.wetlands.fws.gov) – South Dakota data only.
3. U.S. Department of Agriculture National Resource Conservation Service. Major Land Resource Area (MLRA) GIS layer (http://soils.usda.gov/survey/geography/mlra/)

Methods: Steps used to develop the GIS layer for mapping the riparian and wetland ecological sites for the state of South Dakota.

1. Acquire SSURGO GIS and associated ecological site and soils data for the state of South Dakota.
2. Acquire NRCS Major Land Resource Area (MLRA) GIS layer.
3. Union SSURGO and MLRA GIS layers
4. Identify and remove terrestrial ecological sites.
5. Identify and fill blanks in the data where ecological site has not been identified for a polygon by using best available information such as adjacent county data or soils information to associate an ecological site to blank polygons, where possible.
6. Develop a standardized state-wide naming protocol for ecological site, as some MLRAs used different names for the same ecological site.
7. Acquire USFS National Wetlands Inventory (NWI) GIS and associated data for the state of South Dakota.
8. Merge SSURGO and NWI GIS layers and associated data.
9. Use existing SSURGO information to extrapolate ecological site classification where possible and appropriate. Also, where SSURGO information is unavailable, such as for NWI polygons, use NWI polygon information to interpret ecological site classification where possible and appropriate.
10. Table L-4 identifies and describes the fields associated with the resulting database and the original data source for the field. Those fields added to facilitate additional application to the SD WAP are noted as “Developed for the SD WAP” in the data source column.

Table L-4. Field names, descriptions and data sources used in the development of the South Dakota Wildlife Action Plan ecological site layer for riparian and wetland ecosystems (ALL MLRAs RIPWET SDWAP.shp).

FIELD NAME	DESCRIPTION	GIS/DATA SOURCE
MLRA	Corresponds to NRCS mapped Major Land Resource Areas (MLRA)	NRCS MLRA
ECOSITE_ID	For NRCS SSURGO polygons, same as "ecoclassid" found in SSURGO table "coecoclass" that represents the concatenated form of ecological site type, ecological site MLRA, ecological site LRU, ecological site number, and ecological site state FIPS code. For USFWS NWI polygons only, represents a concatenated code for VEGZONE, HGMCLASS, and HYDROSUBCL developed using available polygon information to identify an ecological site as described in the SDWAP.	NRCS SSURGO; USFWS NWI
ECOSITENAME	Name of ecological site for purposes of the SD WAP; name represents a concatenation of HGMCLASS and HYDROSUBCL	Developed for SD WAP
HGMCLASS	Hydrogeomorphic class as defined in Section 2.4.2	Developed for SD WAP using NRCS or USFWS polygon information
HYDROSUBCL	Hydrological subclasses as defined in Section 2.4.2	Developed for SD WAP using NRCS or USFWS polygon information
VEGZONE	Vegetation zone as defined in Section 2.4.2	Developed for SD WAP using NRCS or USFWS polygon information
WATREGZONE	Hydrology influencing a vegetation zone within an ecological site	Developed for SD WAP using NRCS or USFWS polygon information
SPECMODIFI	Indicates special modifications to a wetland (DIKE/IMP= diked or impounded, EXCAVATED, PART DRAIN/DITCH=partially drained/ditched, BEAVER, and FARMED).	USFWS NWI
UNIQ_POLY_	Identifies the number of polygons associated with a mapped ecological site by MLRA; first value represents MLRA and second represents a unique number applied to all polygons associated with an ecological site.	Developed by SD WAP
NWI_ATTRIB	Original USFWS NWI "ATTRIBUTE"	USFWS NWI

Identifying Land Use Impacts

Source GIS and tabular data:

1. SD WAP Riparian and Wetland Ecological Site Layer (ALL MLRAs RIPWET SDWAP.shp) – see previous section for a description of this layer

2. 2006 National Land Cover Database (Landsat-based, 30 meter resolution, landcover GIS file and database); http://www.mrlc.gov/index.php

Methods: Steps used to identify and quantify current land use impacts by ecological site and MLRA.

1. Evaluate options for quantifying land use impacts across South Dakota.
2. Acquire 2006 NLCD GIS layer and associated database.
3. Overlay NLCD GIS layer with SD WAP developed Riparian and Wetland Ecological site Layer.
4. Group land use codes into broader categories needed to meet objectives of SD WAP - see table C-2.

Native Ecosystem Plant Community

The same source information and methods as described for terrestrial systems.

Aquatic Systems

SD

Species of Greatest Conservation Need

Species Profiles

SD WAP Product: SGCN Profiles.xlxs and SGCN Citation List.xlxs

Source GIS and data:

1. SD Game, Fish and Parks species distribution GIS database

Methods: Steps used to develop profiles for species of greatest conservation needed

1. Current distribution maps developed by SD Game, Fish and Parks
2. All other species information gathered from published and online resources and listed in SGCN Citation List.xlxs.
3. Tables L-5 and L-6 identify and describe the fields associated with the resulting SGCN Profiles.xlxs and SGCN Citation List.xlxs tables.

Table L-5. Field name, description, and data sources used in the development of SGCN Profiles.xlxs.

FIELD NAME	DESCRIPTION	DATA SOURCE
SPP NUM	Unique number assigned to each species of greatest conservation need	Developed for SD WAP
Common Name	Common name generally associated with species in SD	SD Game, Fish and Parks
Scientific Name	Scientific name associated with species	SD Game, Fish and Parks
SPP Code	4 letter code associated with a species; derived from common name	SD Game, Fish and Parks
SPP GROUP	General	SD Game, Fish and Parks
FS	Federal protection status for a species	US Fish and Wildlife Service
SS	State protection status for a species	SD Game, Fish and Parks
2006 SGCN	Species included in 2006 WAP as a SGCN – yes or no	SD Game, Fish and Parks
2006 SC		SD Game, Fish and Parks
2012 SGCN	Species included in 2013 WAP as SGCN – yes or no	SD Game, Fish and Parks
2012 SC		SD Game, Fish and Parks
PHYS DESC	Physical description of species	Many sources by species
SD USE DESC	General habitat use of species in South Dakota	Developed from various information sources such as included in literature cited file for each species
Distribution	Distribution of species in South Dakota; historical and current	Historical information from best available source; current distribution based on South Dakota database of known recent sightings or evidence
KEY HAB DESC	Key habitat used by a species in South Dakota	Developed from various information sources such as included in literature cited file for each species
ECOSYSDIV LINK	Habitat distribution for a species as it relates to native ecosystem diversity of South Dakota	Developed based on best information available for preferred historical habitat of a species
Concerns - Hab	Habitat related conservation challenges facing a species in South Dakota	Developed from various information sources such as included in literature cited file for each species
Concerns – non-hab	Non-habitat related conservation challenges facing a species in South Dakota	Developed from various information sources such as included in literature cited file for each species
ACTIONS_hab	Habitat related conservation actions proposed for a species	Developed from various information sources such as included in literature cited file for each species
Action non-hab	Non-habitat related actions proposed for a species	Developed from various information sources such as included in literature cited file for each species
RECOV PLAN	Existing recovery plan or conservation plan? Yes or No	Citations are provided in species citation file

Table L-6. Field name, description, and data source associated with SGCN Citation List.xlxs.

FIELD NAME	DESCRIPTION	DATA SOURCE
SPP Code	4 letter code associated with a species; usually derived from the common name	SD Game, Fish and Parks
YR Reviewed	The year a publication was reviewed and added to WAP	Developed for SD WAP
CITATION	Citation for a publication	Various sources depending on species
Comments	Comments provided for a citation	Developed for SD WAP

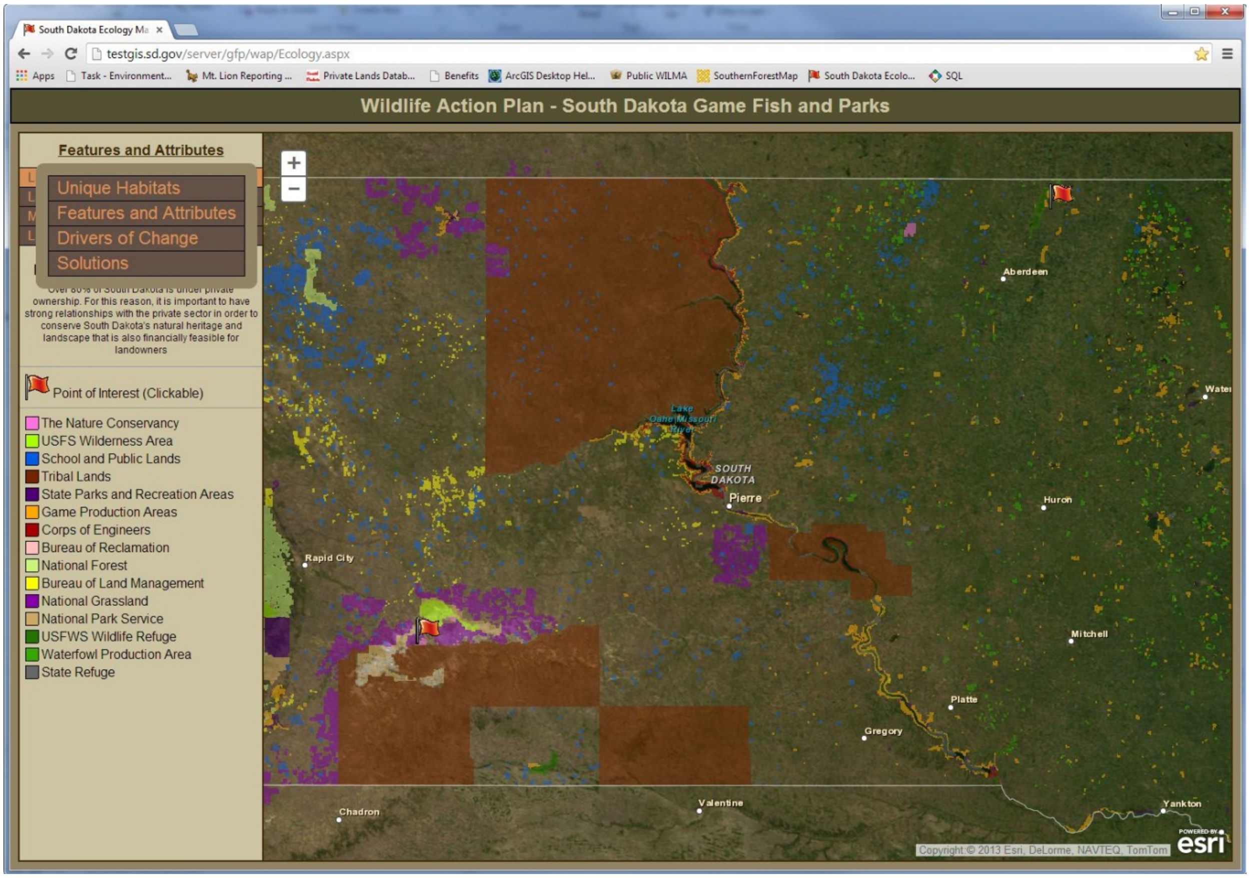
Appendix M. Descriptions of Wildlife Action Plan web tools.

SDGFP has designed an easy-to-use interactive website that displays information from the Wildlife Action Plan and guides the user through various aspects of South Dakota landscapes, conservation challenges, and wildlife. The website was created during the Wildlife Action Plan Revision process, but the content will be dynamic as new information is created or found.

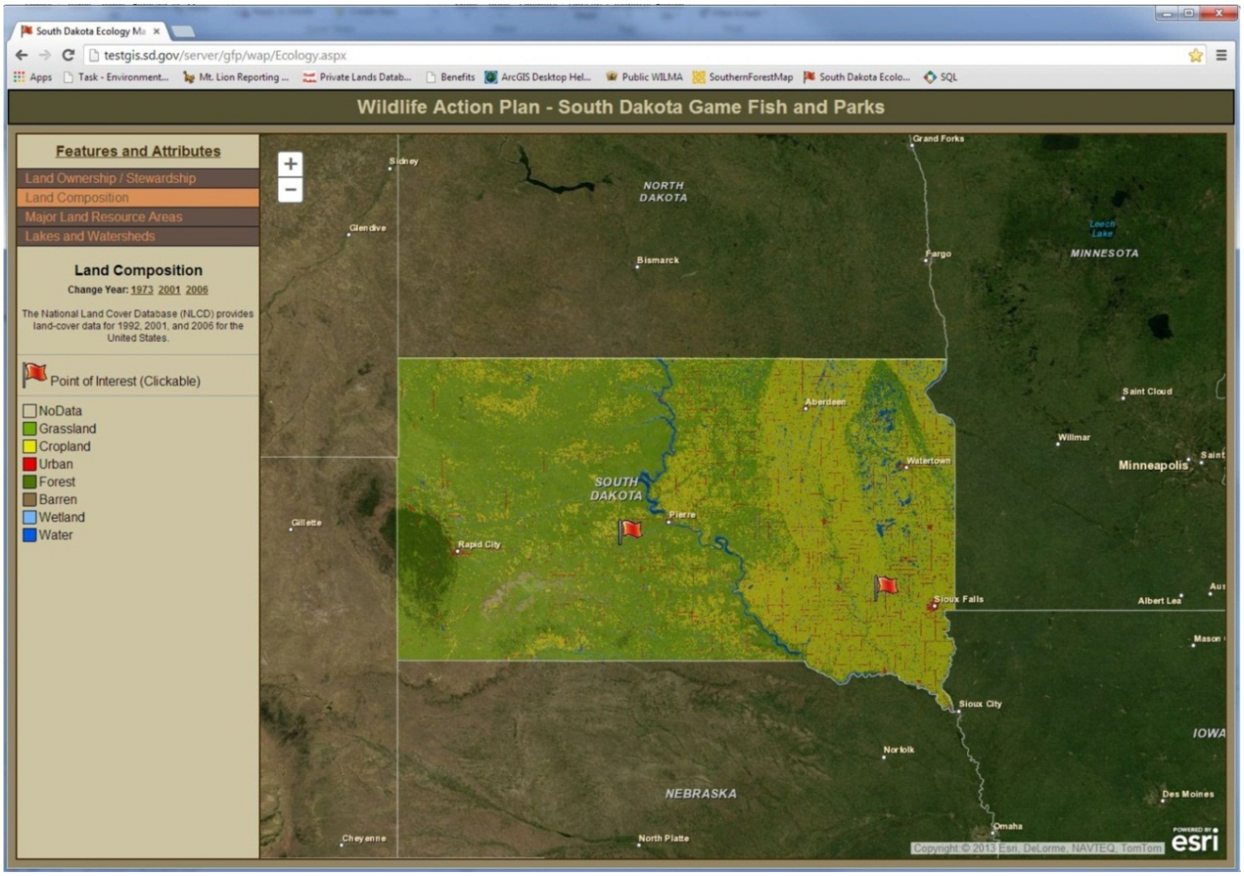
The first web tool is tentatively called South Dakota Lands and Waters. The four main themes are Unique Habitats, Features and Attributes, Drivers of Change, and Solutions. These themes are further divided into relevant topics that help tell the story of each theme. Points of interest are included with each topic to highlight interesting facts about South Dakota and provide more information about that particular topic.

The following screen shots illustrate various components of the South Dakota Wildlife, Land and Water tool, including land ownership, land composition, and a sample feature - grazing practices.

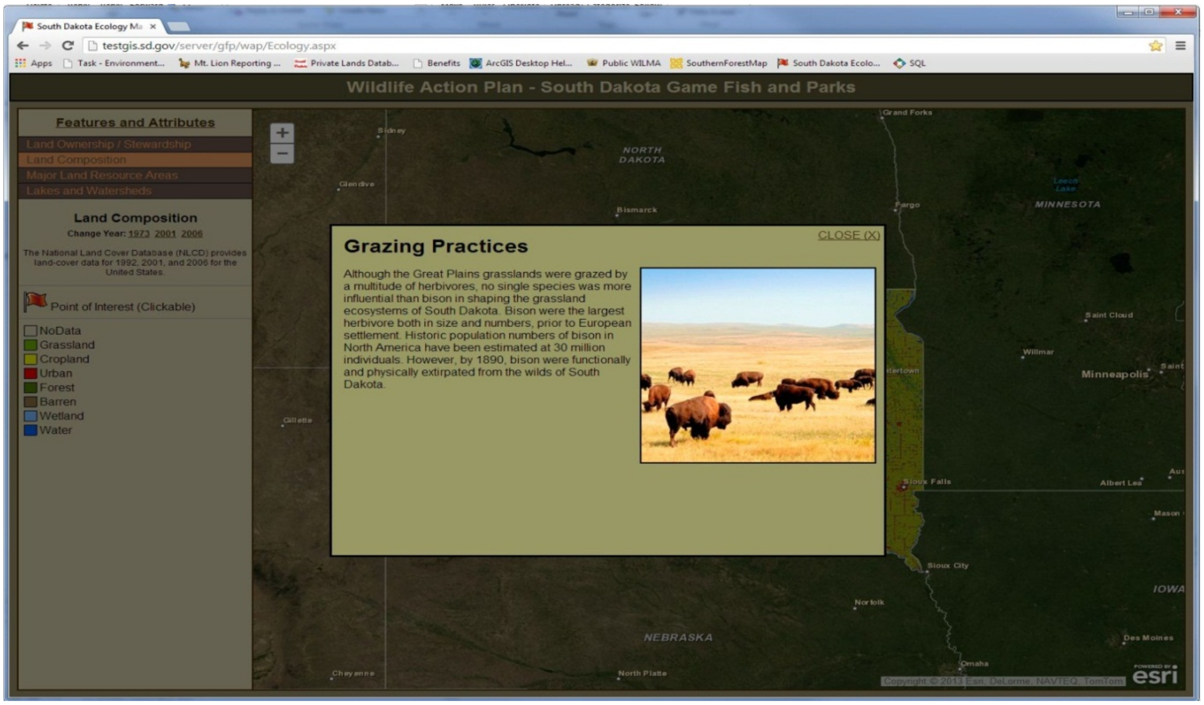
Appendix M (continued). Descriptions of Wildlife Action Plan web tools.



Appendix M (continued). Descriptions of Wildlife Action Plan web tools.

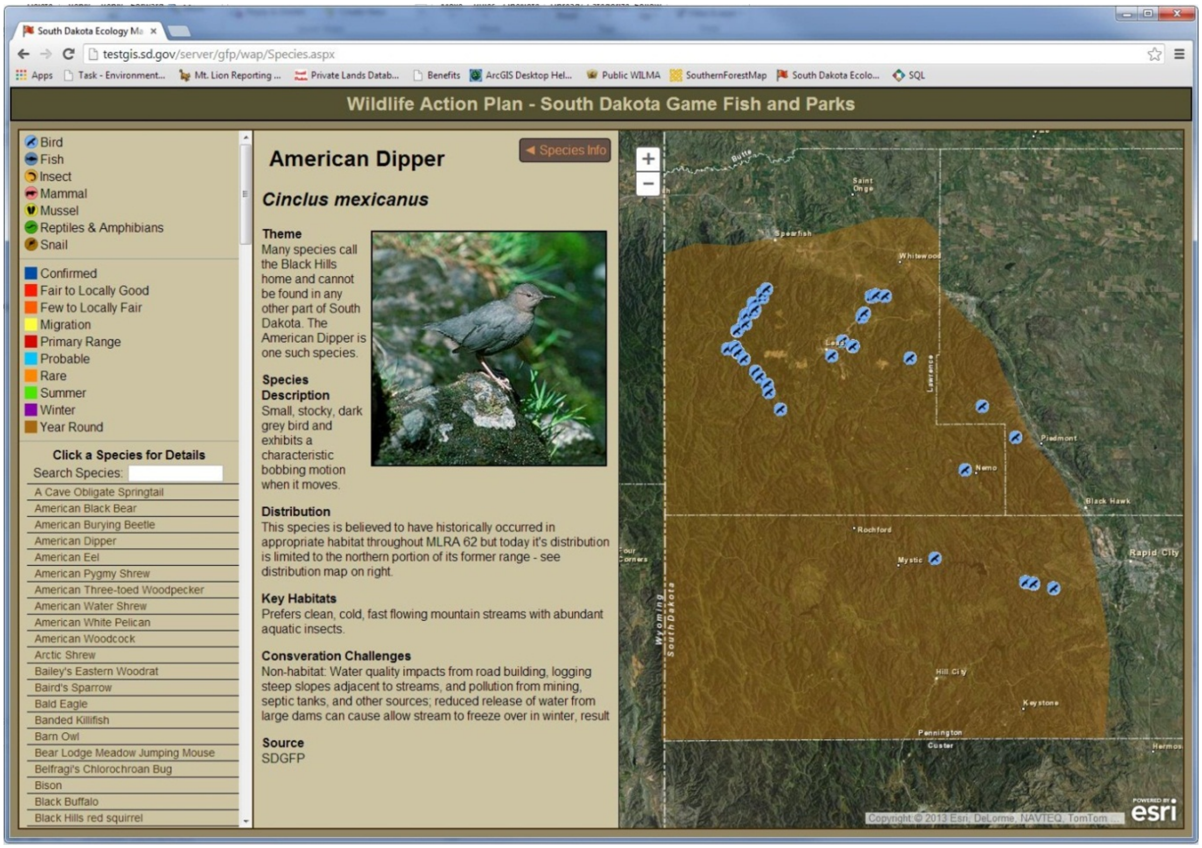


Appendix M (continued). Descriptions of Wildlife Action Plan web tools.



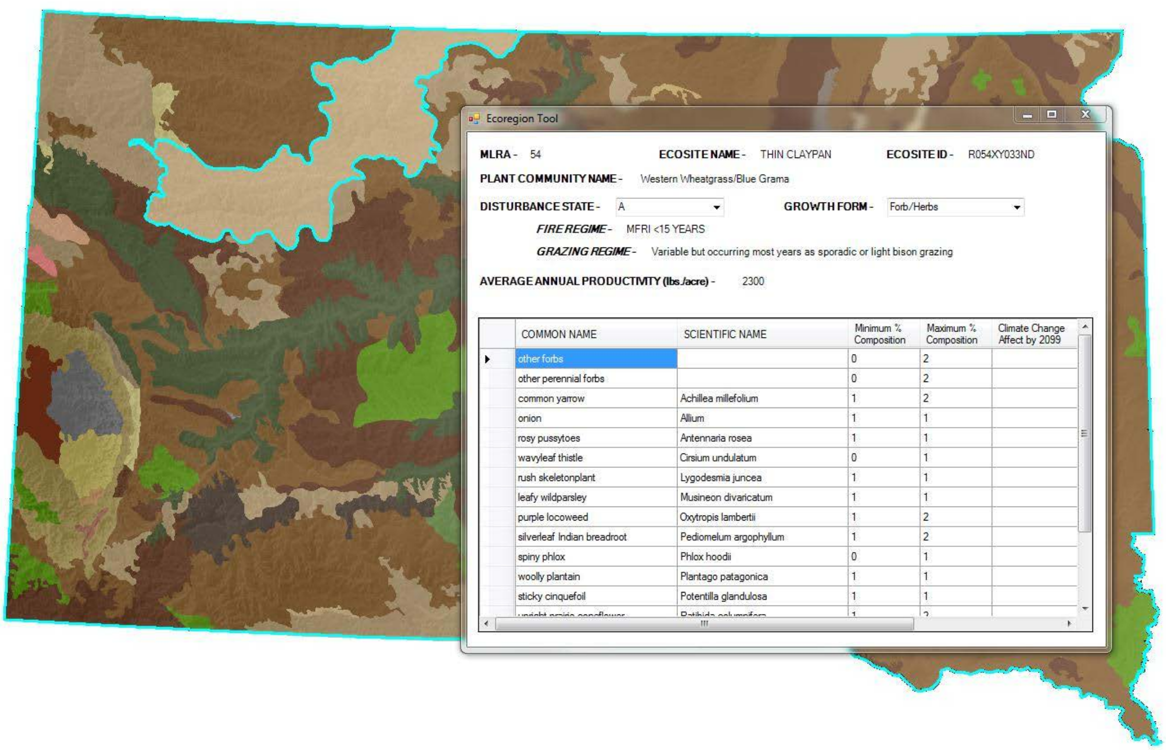
Appendix M (continued). Descriptions of Wildlife Action Plan web tools.

The Species web tool initially displays all animal species in South Dakota by common name. The user can click on the name for more information, which includes a brief species description, distribution, key habitats, and conservation challenges. A search function allows the user to find a particular species by filtering the list accordingly (e.g. Eagle). The screen shot below illustrates current content for the American dipper.



Appendix M (continued). Descriptions of Wildlife Action Plan web tools.

The Ecosite web tool allows the user to select an ecosite to determine the plant communities that could potentially exist within those boundaries. When the user selects a particular ecosite, the tool provides the Major Land Resource Area (MLRA) unit, the Ecosite name, and the Ecosite ID. Also listed are the dominant plant community for that ecosite, fire and grazing regime, and the average annual productivity in pounds per acre. The user can filter the results based on the disturbance state (i.e. A, B, C, or D) and the growth form (i.e. Forb/Herbs, Grasses & Grass-likes, and Shrubs). After the user selects an ecosite, the tool displays the common and scientific names of the plant community, minimum/maximum percent composition, and the climate change effect by 2099 (Grasses & Grass-likes only). The screen shot below provides an example of the ecosite web tool.



Appendix N. Past, Present, and Future Climates for South Dakota – Observed climatic variation from 1895-2010 and projected climate change to 2099. Authors Dr. Mark A. Cochrane and Christopher J. Moran (Executive Summary).

Planet Earth is warming, as shown by rising sea levels, falling levels of glacial and sea ice, and increasing temperatures within the lower atmosphere and surface waters of the world's oceans. In the last 30 years, global temperatures have risen by roughly 0.6°C (1.0°F) concurrently with increases in the atmospheric concentrations of several known greenhouse gases (GHGs). Changes in average weather patterns that are maintained over long periods are what define climate change. Global climate changes do not proceed equally in all regions or at an average rate through time. Local climate changes will play a large role in shaping ecosystems by providing selection pressure for species or geno- and phenotypes that can thrive under a region's new conditions. We present here an analysis based upon observed climate changes since 1895 and a 16 Global Climate Model-ensemble depicting projected climate changes for low and high GHG emission scenarios between now and the end of this century, for each of the 19 Major Land Resource Areas (MLRAs) in the state of South Dakota.

Since the climate normals (1961-1990) were established for the existing Major Land Resource Areas (MLRAs), average temperatures have increased between 0.1°C and 0.5°C, and average precipitation has varied from a 0.5% decrease to a 14.9% increase in individual MRLAs for the most recent climate normals (1981-2010).

Downscaled global climate models project a continuation of observed trajectories with increases in both average temperature and precipitation. However, average precipitation is, for the most part, projected to stay within the range of variability observed since 1895, while average temperatures will push beyond historical ranges.

For individual MRLAs in the 2021-2050 climatic period, an increase in average temperature of between 1.6 – 1.8°C and 1.5 – 1.6°C is expected for the A2 and B1 greenhouse gas emission scenarios, respectively, with disproportionate warming in the summer (June, July, August) months of up to 2°C. Average precipitation will increase from 3.9 – 7.8% and 4.5 – 7.2% for the A2 and B1 greenhouse gas emission scenarios, respectively, with the greatest increases predicted in the spring (March, April, May) months of up to 12.9%.

For individual MRLAs in the 2070-2099 climatic period, an increase in average temperature of between 4.3 – 4.6°C and 2.7 – 2.9°C is expected for the A2 and B1 greenhouse gas emission scenarios, respectively, with disproportionate warming in the summer months of up to 5.2°C. Average precipitation will increase from 10.3 – 17.7% and 7.5 – 9.3% for the A2 and B1 greenhouse gas emission scenarios, respectively, with the greatest increases predicted in the spring months of up to 31.2%.

Appendix O. Climate Change Vulnerability Assessment of Aquatic Species of Greatest Conservation Need in South Dakota. Author Dr. Andrew Burgess (Executive Summary).

As part of the revision of the South Dakota Comprehensive Wildlife Conservation Plan, also known as the South Dakota Wildlife Action Plan, the South Dakota Department of Game, Fish and Parks chose to consider the impacts of projected climate change on aquatic species of greatest conservation need. This analysis was contracted to a former aquatic biologist with the agency. The primary tool used in this analysis was NatureServe's Climate Change Vulnerability Index (CCVI), which measures vulnerability to climate change based on exposure to projected future changes in temperature, precipitation, and moisture across a species' range and the species' sensitivity to potential changes based on certain physiological, genetic, and life history variables. The tool does not consider species status rankings, which should be evaluated in combination with the CCVI tool.

Twenty fish species of greatest conservation need were assessed; 14 were found vulnerable to the impacts of future climate change. Eight species were found highly or extremely vulnerable. Six of these species are considered disjunct species in the state because they depend on restricted habitat conditions in isolated areas (Longnose Sucker, Mountain Sucker, and Lake Chub) or because they are glacial relicts (Northern Redbelly Dace, Northern Pearl Dace, and Finescale Dace). Missouri River endemic species, such as Pallid Sturgeon, Sicklefin Chub, and Sturgeon Chub, are also vulnerable to future climate change.

Nine freshwater mussel species were assessed; 4 were found vulnerable to the impacts of future climate change. Two species, Higgins eye and elktoe, were found highly vulnerable. Four aquatic insects that are included on the species of greatest conservation need list were not analyzed due to a lack of necessary specific information.

This analysis is considered a starting point for the assessment of climate change impacts on aquatic species of greatest conservation need in South Dakota, representing only one potential limiting factor to aquatic species. The tool's predictive capability is expected to improve with consideration of additional data. Resource managers will also benefit from a better understanding of climate change impacts at a broader habitat scale, which is beyond the scope of this initial analysis.

Appendix P. List of conservation initiatives in South Dakota, as of 2013.

Lead Entity	Initiative title	Purpose/target	Key cooperators	Geographic level	Website address
Multispecies, habitat- or landscape-based efforts					
USFWS	Northern Great Plains Joint Venture	Maintaining and protecting existing wetlands and grasslands and creating and enhancing wetlands		Southeastern MT, southwestern ND, western SD, and northeastern WY	
USFWS	Prairie Potholes Joint Venture	"The mission of the Prairie Pothole Joint Venture is to implement conservation programs that sustain populations of waterfowl, shorebirds, other waterbirds and prairie landbirds at objective levels through targeted wetland and grassland protection, restoration and enhancement programs. These activities will be based on science and implemented in collaboration with multiple stakeholders."	Hierarchy includes cooperator, management board, HAPET offices, and standing committees composed of agencies and NGOs	Northern MT, northern and southeastern ND, eastern SD, western MN, northwestern IA	http://www.ppjv.org/
USFWS	Plains and Prairie Potholes Landscape Conservation Cooperative			Prairie Pothole Region, Northern Great Plains and the riparian corridors of several major river systems including the Missouri, the Yellowstone and the Red River	http://www.plainsandprairiepotholeslcc.org/ http://www.plainsandprairiepotholeslcc.org/wp-content/uploads/2012/04/PrairiePotholesLCC_water_noframe.pdf
USFWS	Dakota Grassland	"to accelerate the conservation of wetland and grassland	USFWS, state wildlife agencies with	Prairie Pothole Region	http://www.fws.gov/audubon/grasslan

	Conservation Area	habitat, within the Prairie Pothole Region in the eastern portions of North Dakota, South Dakota, and Montana.”	complementary goals		ds/dgca_lpp_fact_sheet_web.pdf
USFWS	NAWCA grants	“The North American Wetlands Conservation Act (Act, or NAWCA) of 1989 provides matching grants to organizations and individuals who have developed partnerships to carry out wetlands conservation projects in the United States, Canada, and Mexico for the benefit of wetlands-associated migratory birds and other wildlife.”		continentwide	http://www.fws.gov/birdhabitat/Grants/NAWCA/index.shtm
USFWS	National Fish Habitat Partnership/ National Fish Habitat Action Plan Great Plains Fish Habitat Partnership	“The mission of the National Fish Habitat Action Plan is to protect, restore and enhance the nation's fish and aquatic communities through partnerships that foster fish habitat conservation and improve the quality of life for the American people.”		U.S. states and territories	http://fishhabitat.org/ http://www.prairiefish.org/ http://fishhabitat.org/content/national-fish-habitat-action-plan-2nd-edition-2012 (Action plan, 2nd edition)
USFWS	100th Meridian Initiative	“ a cooperative effort between local, state, provincial, regional and federal agencies to prevent the westward spread of zebra/quagga mussels and other aquatic nuisance species in North America"		Missouri River Basin	http://www.100thmeridian.org/

SDGFP	Coordinated restoration of native grasslands using innovative practices	restore native grasslands in SD and Nebraska	Nebraska Game and Parks Commission; EMRI	South Dakota and Nebraska	
SDGFP	Multistate conservation of species of greatest conservation need in the Keya Paha Watershed	enhance populations of SGCN identified in Wildlife Action Plans of SD and Nebraska	Nebraska Game and Parks Commission	Keya Paha watershed of SD and Nebraska	
SDGFP	South Dakota All Bird Conservation Plan	identify the priority species of concern in South Dakota, present their habitat requirements, and identify possible habitat management options.	tribes, other agencies, birding community, and the general public	South Dakota	http://gfp.sd.gov/wildlife/docs/bird-plan.pdf
SDGFP	South Dakota Bat Management Plan	protect bats and bat habitat through action, education, and cooperation with federal, state, and private landowners	South Dakota Bat Working Group, tribes, other agencies, and the general public	South Dakota	http://gfp.sd.gov/wildlife/management/plans/bat-management-plan.aspx
NRCS	Wetland Reserve Program Grassland Reserve Program	Wetlands Reserve Program was a voluntary program that offered landowners the opportunity to protect, restore, and enhance wetlands on their property. Grassland Reserve Program was a voluntary conservation program that emphasized support for working grazing operations, enhancement of plant and animal biodiversity, and protection of grassland			http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/

		under threat of conversion to other uses			
SD Dept. of Environment and Natural Resources	319 Non–point Source Pollution Projects	restore water bodies		South Dakota	http://water.epa.gov/polwaste/nps/success319/ only 3 SD examples are featured http://denr.sd.gov/dfta/wp/maps/319projectmap.pdf 319 project status map as of Feb. 2012
SD Dept. of Transportation	Scenic Byways	5 designated in SD: • Native American Scenic Byway • Peter Norbeck Scenic Byway • Badlands Loop Scenic Byway • Spearfish Canyon Scenic Byway • Wildlife Loop Road Scenic Byway			http://byways.org/explore/states/SD
SD Dept. of Agriculture	Coordinated Natural Resources Conservation Grants	Limited competitive funding for projects that show a natural resource conservation benefit to the state.	Conservation districts eligible		http://sdda.sd.gov/grants/
Bureau of Land Management	National Landscape Conservation System				none in South Dakota
National Park Service	Badlands Wilderness Area	"…to secure for the American people of present and future generations the benefits of an enduring resource of			http://www.wilderness.net/map.cfm

		wilderness"			
U.S. Forest Service	Black Elk Wilderness Areas				
U.S. Forest Service	Forest Legacy Program				http://www.fs.fed.us/spf/coop/programs/loa/flp_projects.shtml No acreage listed for SD
U.S. Forest Service, Nebraska National Forest	Land and Resource Management Plan, Nebraska National Forest			Nebraska National Forest	http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsm9_027883.pdf (LRMP plan, including map link)
U.S. Forest Service, Dakota Prairie Grassland	Final EIS Dakota Prairie Plan			Grand River National Grassland (Perkins and Corson counties)	http://www.fs.usda.gov/detailfull/dpg/landmanagement/?cid=stelprdb5340280&width=full
U.S. Forest Service, Custer National Forest				Harding County; in addition to North and South Cave Hills and Short Pines, there are 2 National Natural Landmarks - Castles and Capitol Rock	http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5346049.pdf (link to Sioux Ranger District map) http://www.fs.usda.gov/resources/custer/landmanagement/resourcemanagement http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5353157.pdf (motor vehicle use map)

North American Grouse Partnership	Prairie Grouse Partners	Restore 20% of North America's native grasslands	Pheasants Forever, Quail Forever, Theodore Roosevelt Conservation Partnership, and Mule Deer Foundation	North America	http://grousepartners.org/
Ducks Unlimited	Grasslands for Tomorrow	Perpetual protection of 2,000,000 acres of native prairie		Prairie Pothole Region	http://www.ducks.org/conservation/where-we-work/prairie-pothole-region/grasslands-for-tomorrow
National Wild Turkey Federation	Northern Great Plains Riparian Initiative	Enhance Riparian Habitat	BASF, Miller Brewing Co., OK DOWC	MT, SD, ND, WY	http://www.nwtf.org/conservation/regional_habitat_programs.html
National Audubon Society	Important Bird Areas	"identify and conserve areas that are vital to birds and other biodiversity"	Audubon chapters		http://web4.audubon.org/bird/iba/ None identified in SD; project recently begun.
American Bird Conservancy	Top 20 Most Threatened Bird Habitats in the U.S.			U.S.	http://www.abcbirds.org/newsandreports/special_reports/habitatreport.pdf
The Nature Conservancy	"The Status of Biodiversity in the Great Plains: Great Plains Landscapes of Biological Significance" Aldrich, J.M., W.R. Ostlie, and T.M. Faust. 1997. The Nature Conservancy,	ecoregional planning document that does not contain maps			http://conserveonline.org/library/greatplains_landscapes_97.pdf/view.html Identified areas: • Black Hills (SD, WY) • Keya Paha River (NE, SD) • Little Missouri River (MT, ND, SD, WY) • Middle Missouri River (ND, SD, NE) • Nebraska Sandhills (NE, SD)

	Minneapolis, MN.				• Pine Ridge (NE, SD) • Prairie Coteau (MN, SD) • Sisseton Escarpment (MN, SD) • South Dakota Badlands (SD) • Southern Missouri Coteau (ND, SD) • Upper Minnesota River (MN, SD)
The Nature Conservancy	"Ecoregional Planning in the Northern Tallgrass Prairie" Northern Tallgrass Prairie Ecoregional Planning Team. 1998.			northern tallgrass prairie ecoregion (portions of Manitoba, ND, SD, MN and IA)	http://east.tnc.org/east-file/35/ntp-final-plan.pdf Figure 8 (Portfolio Design), p. 37 Figure 15 (Conservation Priorities), p. 55 Appendix 2 (Primary Target Species), p. 85
The Nature Conservancy	"Ecoregional Planning in the Northern Great Plains Steppe" Northern Great Plains Steppe Ecoregional Conservation Team. 1999.				http://east.tnc.org/east-file/26/ngps_final_feb99.pdf Black Hills excluded from this plan Appendix 1 (Primary Target Species), p. 58
The Nature Conservancy	"Ecoregional Conservation in the Black Hills" Hall, J.S., H.J. Marriott, and J.K. Perot. 2002. The Nature Conservancy,				http://conserveonline.org/library/bhills_final_apr02pdf.pdf/view.html Figure 5 (Portfolio sites), p. 27 Appendix 3 (Animal Target Information), p. 77

	Minneapolis, MN.				
Western Governors Association	Critical Habitat Assessment Tool	"…to bring greater certainty and predictability to planning efforts by establishing a common starting point for discussing the intersection of development and wildlife"			http://www.westgovchat.org/
Partners in Flight	Bird Conservation Regions 11 and 17 Physiographic Areas 37 and 38 • Partners in Flight Bird Conservation Plan for The Northern Mixed-grass Prairie (Physiographic Area 37) • West River (Physiographic Area 38) – plan not completed				http://www.partnersinflight.org/ http://www.partnersinflight.org/bcps/plan/pl_37_10.pdf http://www.partnersinflight.org/bcps/pl_38sum.htm
Association of Fish and Wildlife Agencies	Southern Wings	international effort to conserve state-priority migratory bird species on wintering grounds	participating state agencies (including SDGFP), American Bird Conservancy, National Audubon Society, Ducks Unlimited, The Nature Conservancy, Pronatura	Latin America	http://www.fishwildlife.org/index.php?section=southern-wings-program&activator=62
PARC (Partners in Amphibian and Reptile	PARCA (Priority Amphibian and Reptile	identify and designate PARCAs in each state using a system informed by scientific criteria	PARC, regional PARC chapters, state wildlife agencies and other	U.S.	http://www.parcplace.org/publications/parcas-priority-amphibian-and-reptile-

Conservation)	Conservation Area) System	and expert review	cooperators		conservation-areas.html (South Dakota's participation will depend on acquisition and analysis of suitable habitat data.)
25 organizations	Northern Plains Conservation Network (NPCN)	"Ours is a vision for the future of the heartland of North America, a vision of a sea of grass supporting healthy wildlife populations and vibrant communities of people."	Alberta Wilderness Association, American Bison Society, Badlands Conservation Alliance, Biodiversity Conservation Alliance, Defenders of Wildlife, Environmental Defense Fund, FaunaWest Wildlife Consultants, Great Plains Restoration Council, Lower Brule Sioux Tribe Department of Wildlife, Fish and Recreation, Montana Big Open, Montana Wilderness Association, National Audubon Society, National Wildlife Federation, Nature Canada, Oglala Sioux Parks and Recreation Authority, Prairie Hills Audubon Society of Western South Dakota Inc., Prairie Wildlife Research, Sacred Ground International, Sierra Club, Society of Grasslands Naturalists,	Northern Great Plains of U.S. and Canada	http://www.npcn.net/ http://www.protectedareas.info/upload/document/ecoregionplan-northerngreatplainconservationassessmentsummary.pdf (Second link is for Ocean of Grass Assessment by Forrest et al. 2004)

			Southern Plains Land Trust, Temperate Grasslands Conservation Initiative, Wildlife Conservation Society, World Wildlife Fund, Yellowstone Buffalo Foundation		

Appendix P (continued). List of conservation initiatives in South Dakota, as of 2013.

Lead Entity	Initiative title	Purpose/target	Key cooperators	Geographic level	Website address
Species-specific efforts					
USFWS	Pallid Sturgeon Recovery Plan	promote recovery of pallid sturgeon	state and tribal wildlife agencies within the Missouri River basin	Missouri River (2 recovery priority management areas in SD)	http://www.fws.gov/yellowstoneriverc oordinator/pallid%20recovery%20plan. pdf
USFWS	Piping Plover critical habitat	identify areas that provide important habitats for piping plover		Missouri River (2 units in SD)	http://www.fws.gov/mountain-prairie/species/birds/pipingplover/
USFWS	Greater Sage-Grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report	"The U.S. Fish and Wildlife Service (Service) is making available a final report that is designed to help guide the efforts of the States and other partners to conserve the greater sage-grouse with a landscape level strategy. The report, prepared by state and federal scientists and sage-grouse experts, identifies the conservation status of the sage-grouse, the nature of the threats facing the species, and objectives to ensure its long-term conservation."		range of the greater sage-grouse	http://www.fws.gov/mountain-prairie/species/birds/sagegrouse/COT/COT-Report-with-Dear-Interested-Reader-Letter.pdf
USFWS	Black-footed Ferret Draft Recovery Plan – Second Revisions,	to recover the black-footed ferret such that it no longer meets the ESA's definition of endangered or threatened and	participating state, federal and tribal agencies, private landowners, private	range of the black-footed ferret	http://www.fws.gov/mountain-prairie/species/mammals/blackfootedf erret/2013DraftRevisedRecoveryPlan.p df

	February 2013	can be removed from the Federal List of Endangered and Threatened Wildlife (i.e., delisted).	organizations, the general public		
USFWS	American Burying Beetle (*Nicrophorus americanus*) Recovery Plan	interim objective is to reduce the immediacy of the threat of extinction to the American burying beetle, and the longer range objective is to improve its status so that it can be reclassified from endangered to threatened	participating state, federal and tribal agencies, private landowners, private organizations, the general public	range of the American burying beetle	http://www.fws.gov/southdakotafieldoffice/abbrecoveryplan.pdf
USFWS	Higgins Eye Pearlymussel (*Lampsilis higginsii*) Recovery Plan: First Revision	• recovery of Higgins eye to levels where its protection under the Act is no longer necessary and it may be removed from the Federal list of Endangered and Threatened Wildlife (50 CFR 17.11) • plan also contains an intermediate goal of reclassifying the species from Endangered to Threatened.	USACE, Minnesota Dept. of Natural Resources, Wisconsin Dept. of Natural Resources, Macalester College, University of Minnesota, Western Wisconsin Technical College	range of the Higgins eye	http://www.fws.gov/midwest/mussel/documents/higgins_eye_recovery_plan_first_revision.pdf
USFWS	Topeka shiner (*Notropis Topeka*) 5-Year Review: Summary and Evaluation	summarize state of knowledge on research, population trends, present and future threats, and conservation actions	cooperating state, federal and tribal agencies, the general public	range of the Topeka shiner	http://www.fws.gov/mountain-prairie/species/fish/shiner/TopekaShiner5YearReview01222010Final.pdf
USFWS and Canadian Wildlife Service	International Recovery Plan Whooping Crane (*Grus americana*) –	establish multiple self-sustaining populations of whooping cranes in the wild in North America, allowing initially for reclassification to	participating state, federal and tribal agencies, private landowners, private organizations, the	range of the whooping crane	http://www.fws.gov/southwest/es/Documents/R2ES/Whooping_Crane_Recovery_Plan_FINAL_21-July-2006.pdf

	Third Revision	threatened status and, ultimately, removal from the List of Threatened and Endangered Species (delisting)	general public		
Natural Resources Conservation Service	Sage Grouse Initiative	Enhance Sage Grouse Habitat		Western U.S.	http://www.sd.nrcs.usda.gov/programs/EQIP_SGI_2012.html
U.S. Army Corps of Engineers	Missouri River Recovery Management Plan	develop conceptual ecological models and species objectives for piping plover, least tern, and pallid sturgeon and	U.S. Fish and Wildlife Service; state and tribal wildlife agencies along the Missouri River	Missouri River Basin	http://moriverrecovery.usace.army.mil/mrrp/f?p=136:70:0
Interstate Black-tailed Prairie Dog Conservation Team	A Multi-State Conservation Plan for the Black-tailed Prairie Dog, *Cynomys ludovicianus*, in the United States	to provide guidelines under which management plans will by developed by individual states and their respective working groups	USFWS, state and tribal wildlife agencies, private organizations, and the general public	range of the black-tailed prairie dog	http://www.azgfd.gov/w_c/nongameandendangeredwildlifeprogram/documents/080623_BTPD_Multi-StateConservationPlan_Final.pdf
SDGFP	South Dakota River Otter Management Plan	provide general, strategic guidance for 5 years to the South Dakota Game, Fish and Parks Department (SDGFP) and potential partners for the recovery and sustained management of the river otter in South Dakota	tribes, other agencies, trappers, and the general public	South Dakota	http://gfp.sd.gov/wildlife/management/plans/docs/OtterPlan2012.pdf
SDGFP	Prairie Grouse Management Plan for South Dakota (2011 – 2015)	maintain prairie grouse populations and habitat consistent with the ecological, social, and aesthetic values of SD citizens while addressing the concerns and issues of	tribes, other agencies, hunters, and the general public	South Dakota	http://gfp.sd.gov/wildlife/management/plans/docs/PrairieGrouseManagementPlan.pdf

		residents and visitors of SD			
SDGFP	South Dakota Aquatic Nuisance Species Management Plan	• Prevent new introductions of ANS to South Dakota. • Educate all aquatic users of ANS risks and how to reduce the harmful impacts. • Prevent dispersal of established populations of ANS into uninfested waters in South Dakota. • Eradicate or control ANS to minimize the adverse ecological, economic, social, and public health effects of ANS in an environmentally sound manner. • Support research on ANS in South Dakota, and develop systems to disseminate information.	tribes, other agencies, anglers and river recreationists, and the general public	South Dakota	http://gfp.sd.gov/wildlife/docs/SDANS-final-draft-management-plan.pdf
SDGFP	Topeka Shiner State Management Plan	• Maintain habitat integrity in Topeka shiner streams • Establish a point-based management goal for the State of South Dakota in contribution towards national recovery efforts	USFWS, NRCS, USACE, SD DENR , SD DOT, SD Dept. of Agriculture, conservation districts, state universities, and private organizations (SD Cattlemen's Assoc., SD Farm Bureau)	eastern South Dakota	http://gfp.sd.gov/wildlife/management/plans/topeka-shiner-plan.aspx
SDGFP	South Dakota Black-tailed Prairie Dog Conservation and Management Plan	manage for long-term, self-sustaining prairie dog populations in South Dakota while addressing landowner concerns and maintaining the viability of this unique	SD Dept. of Agriculture	South Dakota	http://gfp.sd.gov/wildlife/docs/Prairiedog-management-plan.pdf

		grassland ecosystem			
SDGFP	South Dakota Pallid Sturgeon (*Scaphirhynchus albus*) Management Plan	to ensure that South Dakota's activities on lands transferred from federal government to SDGFP have an overall net benefit on the pallid sturgeon and to promote management of the Missouri River system so that conditions are suitable for pallid spawning, fry survival and recruitment	USFWS, NPS, USACE, Nebraska Game and Parks Commission, SDSU, SD DENR, Yankton Sioux Tribe	Missouri River in South Dakota	http://gfp.sd.gov/wildlife/management/plans/docs/FinalPallidPlan.pdf
SDGFP	South Dakota Interior Least Tern (*Sterna antillarum athalassos*) and Piping Plover (*Charadrius melodus*) Management Plan	identify goals for interior least tern and piping plover to assist in meeting rangewide recovery	USFWS, NPS, USACE, Nebraska Game and Parks Commission, Standing Rock Sioux Tribe, Rosebud Sioux Tribe, Lower Brule Tribe, Cheyenne River Sioux Tribe, Yankton Sioux Tribe	South Dakota	http://gfp.sd.gov/wildlife/docs/least-tern-piping-plover-plan.pdf
SDGFP	South Dakota Bald Eagle (*Haliaeetus leucocephalus*) Management Plan	identify long-term goals for bald eagles in South Dakota to ensure their long-term survival	USFWS, NPS, USACE, Nebraska Game and Parks Commission, Standing Rock Sioux Tribe, Rosebud Sioux Tribe, Sisseton-Wahpeton Sioux Tribe, Oglala Sioux Tribe, Cheyenne River Sioux Tribe, Yankton Sioux Tribe	South Dakota	http://gfp.sd.gov/wildlife/docs/bald-eagle-plan.pdf
SDGFP	Greater Sage-Grouse Management Plan,	manage greater sage- grouse and associated habitats in South Dakota for their	tribes, other agencies, and the general public	South Dakota	http://gfp.sd.gov/wildlife/docs/sage-grouse-management-plan.pdf

	South Dakota, 2008 – 2017	sustained and equitable use, and for the benefit, welfare, and enjoyment of the citizens of this stat and its visitors			

Appendix Q. Separation distances used in developing terrestrial conservation opportunity area species richness data layer.

Species Common Name	Scientific Name	Separation Distance (km)
Amphibians		
American Toad	*Anaxyrus americanus*	5
Blanchard's Cricket Frog	*Acris blanchardi*	5
Boreal Chorus Frog	*Pseudacris maculata*	5
Bull Frog	*Lithobates catesbeianus*	5
Canadian Toad	*Anaxyrus hemiophrys*	5
Cope's Gray Treefrog	*Hyla chrysoscelis*	5
Eastern Gray Treefrog	*Hyla versicolor*	5
Great Plains Toad	*Anaxyrus cognatus*	5
Mudpuppy	*Necturus maculosus*	10
Northern Cricket Frog	*Acris crepitans*	5
Northern Leopard Frog	*Lithobates pipiens*	5
Plains Leopard Frog	*Lithobates blairi*	5
Plains Spadefoot	*Spea bombifrons*	5
Tiger Salamander	*Ambystoma tigrinum*	3
Wood Frog	*Lithobates sylvaticus*	5
Woodhouse's Toad	*Anaxyrus woodhousii*	5
Birds		
American Avocet	*Recurvirostra americana*	5
American Bittern	*Botaurus lentiginosus*	10
American Black Duck	*Anas rubripes*	10
American Coot	*Fulica americana*	10
American Crow	*Corvus brachyrhynchos*	5
American Dipper	*Cinclus mexicanus*	5
American Goldfinch	*Spinus tristis*	5
American Kestrel	*Falco sparverius*	10
American Redstart	*Setophaga ruticilla*	5
American Robin	*Turdus migratorius*	5
American Three-toed Woodpecker	*Picoides dorsalis*	5
American White Pelican	*Pelecanus erythrorhynchos*	10
American Wigeon	*Anas americana*	10
American Woodcock	*Scolopax minor*	5
Baird's Sparrow	*Ammodramus bairdii*	5
Bald Eagle	*Haliaeetus leucocephalus*	10
Baltimore Oriole	*Icterus galbula*	5
Bank Swallow	*Riparia riparia*	5
Barn Owl	*Tyto alba*	10
Barn Swallow	*Hirundo rustica*	5
Barred Owl	*Strix varia*	10

Bell's Vireo	*Vireo bellii*	5
Belted Kingfisher	*Megaceryle alcyon*	10
Black Tern	*Chlidonias niger*	5
Black-and-white Warbler	*Mniotilta varia*	5
Black-backed Woodpecker	*Picoides arcticus*	5
Black-billed Cuckoo	*Coccyzus erythropthalmus*	5
Black-billed Magpie	*Pica hudsonia*	5
Black-capped Chickadee	*Poecile atricapillus*	5
Black-crowned Night-Heron	*Nycticorax nycticorax*	10
Black-headed Grosbeak	*Pheucticus melanocephalus*	5
Black-necked Stilt	*Himantopus mexicanus*	5
Blue Grosbeak	*Passerina caerulea*	5
Blue Jay	*Cyanocitta cristata*	5
Blue-gray Gnatcatcher	*Polioptila caerulea*	5
Blue-winged Teal	*Anas discors*	10
Blue-winged Warbler	*Vermivora cyanoptera*	5
Bobolink	*Dolichonyx oryzivorus*	5
Brewer's Blackbird	*Euphagus cyanocephalus*	5
Brewer's Sparrow	*Spizella breweri*	5
Broad-tailed Hummingbird	*Selasphorus platycercus*	5
Broad-winged Hawk	*Buteo platypterus*	10
Brown Creeper	*Certhia americana*	5
Brown Thrasher	*Toxostoma rufum*	5
Brown-headed Cowbird	*Molothrus ater*	5
Bufflehead	*Bucephala albeola*	10
Bullock's Oriole	*Icterus bullockii*	5
Burrowing Owl	*Athene cunicularia*	5
California Gull	*Larus californicus*	5
Canada Goose	*Branta canadensis*	10
Canvasback	*Aythya valisineria*	10
Canyon Wren	*Catherpes mexicanus*	5
Caspian Tern	*Hydroprogne caspia*	5
Cassin's Finch	*Haemorhous cassinii*	5
Cassin's Kingbird	*Tyrannus vociferans*	5
Cassin's Sparrow	*Peucaea cassinii*	5
Cattle Egret	*Bubulcus ibis*	10
Cedar Waxwing	*Bombycilla cedrorum*	5
Cerulean Warbler	*Setophaga cerulea*	5
Chestnut-collared Longspur	*Calcarius ornatus*	5
Chimney Swift	*Chaetura pelagica*	5
Chipping Sparrow	*Spizella passerina*	5
Chuck-will's-widow	*Antrostomus carolinensis*	5
Cinnamon Teal	*Anas cyanoptera*	10
Clark's Grebe	*Aechmophorus clarkii*	10
Clark's Nutcracker	*Nucifraga columbiana*	5

Clay-colored Sparrow	*Spizella pallida*	5
Cliff Swallow	*Petrochelidon pyrrhonota*	5
Common Grackle	*Quiscalus quiscula*	5
Common Loon	*Gavia immer*	10
Common Merganser	*Mergus merganser*	10
Common Nighthawk	*Chordeiles minor*	5
Common Poorwill	*Phalaenoptilus nuttallii*	5
Common Tern	*Sterna hirundo*	5
Common Yellowthroat	*Geothlypis trichas*	5
Cooper's Hawk	*Accipiter cooperii*	10
Cordilleran Flycatcher	*Empidonax occidentalis*	5
Dickcissel	*Spiza americana*	5
Double-crested Cormorant	*Phalacrocorax auritus*	10
Downy Woodpecker	*Picoides pubescens*	5
Dusky Flycatcher	*Empidonax oberholseri*	5
Eared Grebe	*Podiceps nigricollis*	10
Eastern Bluebird	*Sialia sialis*	5
Eastern Kingbird	*Tyrannus tyrannus*	5
Eastern Meadowlark	*Sturnella magna*	5
Eastern Phoebe	*Sayornis phoebe*	5
Eastern Screech-owl	*Megascops asio*	5
Eastern Towhee	*Pipilo erythrophthalmus*	5
Eastern Wood-pewee	*Contopus virens*	5
Eurasian Collared-Dove	*Streptopelia decaocto*	10
European Starling	*Sturnus vulgaris*	5
Evening Grosbeak	*Coccothraustes vespertinus*	5
Ferruginous Hawk	*Buteo regalis*	10
Field Sparrow	*Spizella pusilla*	5
Flammulated Owl	*Otus flammeolus*	5
Forster's Tern	*Sterna forsteri*	5
Franklin's Gull	*Leucophaeus pipixcan*	5
Gadwall	*Anas strepera*	10
Glossy Ibis	*Plegadis falcinellus*	10
Golden Eagle	*Aquila chrysaetos*	20
Golden-crowned Kinglet	*Regulus satrapa*	5
Grasshopper Sparrow	*Ammodramus savannarum*	5
Gray Catbird	*Dumetella carolinensis*	5
Gray Jay	*Perisoreus canadensis*	5
Gray Partridge	*Perdix perdix*	5
Great Blue Heron	*Ardea herodias*	10
Great Crested Flycatcher	*Myiarchus crinitus*	5
Great Egret	*Ardea alba*	10
Great Horned Owl	*Bubo virginianus*	10
Greater Prairie Chicken	*Tympanuchus cupido*	10
Greater Sage Grouse	*Centrocercus urophasianus*	15

Great-tailed Grackle	*Quiscalus mexicanus*	5
Green Heron	*Butorides virescens*	5
Green-tailed Towhee	*Pipilo chlorurus*	5
Green-winged Teal	*Anas crecca*	10
Gyrfalcon	*Falco rusticolus*	20
Hairy Woodpecker	*Picoides villosus*	5
Henslow's Sparrow	*Ammodramus henslowii*	5
Herring Gull	*Larus argentatus*	5
Hooded Merganser	*Lophodytes cucullatus*	10
Horned Grebe	*Podiceps auritus*	5
Horned Lark	*Eremophila alpestris*	5
House Finch	*Haemorhous mexicanus*	5
House Sparrow	*Passer domesticus*	5
House Wren	*Troglodytes aedon*	5
Indigo Bunting	*Passerina cyanea*	5
Interior Least Tern	*Sternula antillarum athalassos*	5
Killdeer	*Charadrius vociferus*	5
King Rail	*Rallus elegans*	5
Lark Bunting	*Calamospiza melanocorys*	5
Lark Sparrow	*Chondestes grammacus*	5
Lazuli Bunting	*Passerina amoena*	5
Le Conte's Sparrow	*Ammodramus leconteii*	5
Least Bittern	*Ixobrychus exilis*	5
Least Flycatcher	*Empidonax minimus*	5
Lesser Scaup	*Aythya affinis*	10
Lewis's Woodpecker	*Melanerpes lewis*	5
Little Blue Heron	*Egretta caerulea*	10
Loggerhead Shrike	*Lanius ludovicianus*	5
Long-billed Curlew	*Numenius americanus*	5
Long-eared Owl	*Asio otus*	5
MacGillivray's Warbler	*Geothlypis tolmiei*	5
Mallard	*Anas platyrhynchos*	10
Marbled Godwit	*Limosa fedoa*	5
Marsh Wren	*Cistothorus palustris*	5
McCown's Longspur	*Rhynchophanes mccownii*	5
Merlin	*Falco columbarius*	10
Mountain Bluebird	*Sialia currucoides*	5
Mountain Plover	*Charadrius montanus*	5
Mourning Dove	*Zenaida macroura*	10
Nelson's Sparrow	*Ammodramus nelsoni*	5
Neotropric Cormorant	*Phalacrocorax brasilianus*	10
Northern Bobwhite	*Colinus virginianus*	5
Northern Cardinal	*Cardinalis cardinalis*	5
Northern Flicker	*Colaptes auratus*	5
Northern Goshawk	*Accipiter gentilis*	15

Northern Harrier	*Circus cyaneus*	10
Northern Mockingbird	*Mimus polyglottos*	5
Northern Pintail	*Anas acuta*	10
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	5
Northern Saw-whet Owl	*Aegolius acadicus*	5
Northern Shoveler	*Anas clypeata*	10
Olive-sided Flycatcher	*Contopus cooperi*	5
Orchard Oriole	*Icterus spurius*	5
Osprey	*Pandion haliaetus*	20
Ovenbird	*Seiurus aurocapilla*	5
Peregrine Falcon	*Falco peregrinus*	20
Pied-billed Grebe	*Podilymbus podiceps*	10
Pileated Woodpecker	*Dryocopus pileatus*	5
Pine Siskin	*Spinus pinus*	5
Pinyon Jay	*Gymnorhinus cyanocephalus*	5
Piping Plover	*Charadrius melodus*	5
Plumbeous Vireo	*Vireo plumbeus*	5
Prairie Falcon	*Falco mexicanus*	20
Purple Martin	*Progne subis*	5
Pygmy Nuthatch	*Sitta pygmaea*	5
Red Crossbill	*Loxia curvirostra*	5
Red-bellied Woodpecker	*Melanerpes carolinus*	5
Red-breasted Nuthatch	*Sitta canadensis*	5
Red-eyed Vireo	*Vireo olivaceus*	5
Redhead	*Aythya americana*	10
Red-headed Woodpecker	*Melanerpes erythrocephalus*	5
Red-naped Sapsucker	*Sphyrapicus nuchalis*	5
Red-necked Grebe	*Podiceps grisegena*	5
Red-tailed Hawk	*Buteo jamaicensis*	10
Red-winged Blackbird	*Agelaius phoeniceus*	5
Ring-billed Gull	*Larus delawarensis*	5
Ring-necked Duck	*Aythya collaris*	10
Ring-necked Pheasant	*Phasianus colchicus*	10
Rock Pigeon	*Columba livia*	10
Rock Wren	*Salpinctes obsoletus*	5
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	5
Rough-legged Hawk	*Buteo lagopus*	10
Ruby-crowned Kinglet	*Regulus calendula*	5
Ruby-throated Hummingbird	*Archilochus colubris*	5
Ruddy Duck	*Oxyura jamaicensis*	10
Ruffed Grouse	*Bonasa umbellus*	15
Sage Thrasher	*Oreoscoptes montanus*	5
Savannah Sparrow	*Passerculus sandwichensis*	5
Say's Phoebe	*Sayornis saya*	5
Scarlet Tanager	*Piranga olivacea*	5

Sedge Wren	*Cistothorus platensis*	5
Sharp-shinned Hawk	*Accipiter striatus*	10
Sharp-tailed Grouse	*Tympanuchus phasianellus*	15
Short-eared Owl	*Asio flammeus*	5
Snowy Egret	*Egretta thula*	10
Song Sparrow	*Melospiza melodia*	5
Sora	*Porzana carolina*	5
Spotted Sandpiper	*Actitis macularius*	5
Spotted Towhee	*Pipilo maculatus*	5
Sprague's Pipit	*Anthus spragueii*	5
Swainson's Hawk	*Buteo swainsoni*	10
Swainson's Thrush	*Catharus ustulatus*	5
Swamp Sparrow	*Melospiza georgiana*	5
Townsend's Solitaire	*Myadestes townsendi*	5
Tree Swallow	*Tachycineta bicolor*	5
Tricolored Heron	*Egretta tricolor*	10
Trumpeter Swan	*Cygnus buccinator*	10
Turkey Vulture	*Cathartes aura*	10
Upland Sandpiper	*Bartramia longicauda*	5
Veery	*Catharus fuscescens*	5
Vesper Sparrow	*Pooecetes gramineus*	5
Violet-green Swallow	*Tachycineta thalassina*	5
Virginia Rail	*Rallus limicola*	5
Virginia's Warbler	*Oreothlypis virginiae*	5
Warbling Vireo	*Vireo gilvus*	5
Western Grebe	*Aechmophorus occidentalis*	10
Western Kingbird	*Tyrannus verticalis*	5
Western Meadowlark	*Sturnella neglecta*	5
Western Tanager	*Piranga ludoviciana*	5
Western Wood-pewee	*Contopus sordidulus*	5
Whip-poor-will	*Antrostomus vociferus*	5
White-breasted Nuthatch	*Sitta carolinensis*	5
White-faced Ibis	*Plegadis chihi*	10
White-throated Swift	*Aeronautes saxatalis*	5
White-winge Junco	*Junco hyemalis aikeni*	5
White-winged Crossbill	*Loxia leucoptera*	5
Whooping Crane	*Grus americana*	15
Wild Turkey	*Meleagris gallopavo*	15
Willet	*Tringa semipalmata*	5
Williamson's Sapsucker	*Sphyrapicus thyroideus*	5
Willow Flycatcher	*Empidonax traillii*	5
Wilson's Phalarope	*Phalaropus tricolor*	5
Wilson's Snipe	*Gallinago delicata*	5
Wood Duck	*Aix sponsa*	10
Wood Thrush	*Hylocichla mustelina*	5

Yellow Rail	*Coturnicops noveboracensis*	5
Yellow Warbler	*Setophaga petechia*	5
Yellow-bellied Sapsucker	*Sphyrapicus varius*	5
Yellow-billed Cuckoo	*Coccyzus americanus*	5
Yellow-breasted Chat	*Icteria virens*	5
Yellow-crowned Night-Heron	*Nyctanassa violacea*	10
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	5
Yellow-rumped Warbler	*Setophaga coronata*	5
Yellow-throated Vireo	*Vireo flavifrons*	5
Terrestrial Insects		
Acadian Hairstreak	*Satyrium acadicum*	5
Afranius Duskywing	*Erynnis afranius*	10
Alcestis Fritillary	*Speyeria aphrodite alcestis*	10
American Burying Beetle	*Nicrophorus americanus*	1
American Lady	*Vanessa virginiensis*	2
American Snout	*Libytheana carinenta bachmanii*	2
Anise Swallowtail	*Papilio zelicaon nitra*	20
Arctic Blue	*Agriades glandon rusticus*	10
Arogos Skipper	*Atrytone arogos iowa*	10
Arrowhead Blue	*Glaucopsyche piasus daunia*	10
Atlantis Fritillary	*Speyeria atlantis*	10
Banded Hairstreak	*Satyrium calanus falacer*	10
Barred Yellow	*Eurema daira*	10
Bees		1
Belfragi's Chlorochroan Bug	*Chlorochroa belfragii*	1
Black Swallowtail	*Papilio polyxenes asterius*	20
Boisduval'S Blue	*Icaricia iacrioides pembina*	10
Broad-Winged Skipper	*Poanes viator*	5
Bronze Copper	*Lycaena hyllus*	4
Brown Elfin	*Callophrys augustinus*	10
Cabbage White	*Pieris rapae*	10
California Tortoiseshell	*Nymphalis californica*	20
Callippe Fritillary	*Speyeria callippe calgariana*	10
Canadian Tiger Swallowtail	*Papilio canadensis*	20
Checkered White	*Pontia protodice*	10
Christina Sulphur	*Colias christina krauthii*	10
Clouded Sulphur	*Colias philodice*	10
Cloudless Sulphur	*Phoebis sennae eubele*	10
Common Buckeye	*Junonia coenia*	2
Common Checkered Skipper	*Pyrgus communis*	10
Common Roadside Skipper	*Amblyscirtes vialis*	10
Common Sootywing	*Pholisora catullus*	10
Common Wood-Nymph	*Cercyonis pegala nephele*	5
Compton'S Tortoiseshell	*Nymphalis vaualbum j-album*	20
Coral Hairstreak	*Satyrium titus*	10

Coronis Fritillary	*Speyeria coronis*	10
Crossline Skipper	*Polites origenes rhena*	10
Dainty Sulphur	*Nathalis iole*	20
Dakota Skipper	*Hesperia dacotae*	10
Dark Wood-Nymph	*Cercyonis oetus charon*	5
Delaware Skipper	*Anatrytone logan lagus*	10
Dion Skipper	*Euphyes dion*	5
Dog Face	*Zerene cesonia*	10
Dreamy Duskywing	*Erynnis icelus*	10
Dusted Skipper	*Atrytonopsis hianna*	10
Eastern Comma	*Polygonia comma*	20
Eastern Dun Skipper	*Euphyes vestris metacomet*	10
Eastern Tailed-Blue	*Everes comyntas*	10
Eastern Tiger Swallowtail	*Papilio glaucus*	20
Edwards' Fritillary	*Speyeria edwardsii*	10
Edwards' Hairstreak	*Satyrium edwardsii*	10
Eufala Skipper	*Lerodea eufala*	10
Eyed Brown	*Satyrodes eurydice*	5
Field Crescent	*Phyciodes pratensis camillus*	10
Fiery Skipper	*Hylephila phyleus*	10
Garita Skipperling	*Oarisma garita*	10
Ghost Tiger Beetle	*Cicindela lepida*	5
Giant Swallowtail	*Papilio cresphontes*	20
Goatweed Butterfly	*Anaea andria*	20
Gorgone Checkerspot	*Chlosyne gorgone carlota*	10
Gray Comma	*Polygonia progne*	20
Gray Copper	*Lycaena dione*	4
Gray Hairstreak	*Strymon melinus franki*	10
Great Plains Giant Tiger Beetle	*Amblycheila cylindriformis*	10
Great Southern White	*Ascia monuste*	10
Great Spangled Fritillary	*Speyeria cybele*	10
Green Comma	*Polygonia faunus hylas*	20
Greenish Blue	*Plebejus saepiolus amica*	10
Gulf Fritillary	*Agraulis vanillae*	2
Hackberry Emperor	*Asterocampa celtis celtis*	10
Harvester	*Feniseca tarquinius*	5
Hayhurst'S Scallopwing	*Staphylus hayhurstii*	10
Hoary Comma	*Polygonia gracilis zephyrus*	20
Hoary Elfin	*Callophrys polia obscura*	10
Hobomok Skipper	*Poanes hobomok*	10
Horace'S Duskywing	*Erynnis horatius*	10
Indian Creek Tiger Beetle	*Cicindela nevadica makosika*	10
Indra Swallowtail	*Papilio indra*	20
Iowa Skipper	*Atrytone arogos iowa*	10
Juba Skipper	*Hesperia juba*	10

Juniper Hairstreak	*Callophrys gryneus siva*	10
Juvenal'S Duskywing	*Erynnis juvenalis*	10
Kiowah Skipper	*Euphyes vestris kiowah*	10
Kohler'S Fritillary	*Boloria selene sabulocollis*	10
Large Marble	*Euchloe ausonides palaeoreios*	10
Large Orange Sulphur	*Phoebis agarithe*	10
Least Skipper	*Ancyloxypha numitor*	10
Leonard'S Skipper	*Hesperia leonardus pawnee*	10
Little Glassywing	*Pompeius verna*	10
Little Wood-Satyr	*Megisto cymela*	5
Little Yellow	*Eurema lisa*	2
Long Dash	*Polites mystic dacotah*	10
Lupine Blue	*Icaricia lupini*	10
Manitoba Fritillary	*Speyeria aphrodite manitoba*	10
Marine Blue	*Leptotes marina*	10
Meadow Fritillary	*Boloria bellona*	10
Mead'S Wood-Nymph	*Cercyonis meadii*	5
Melissa Blue	*Lycaeides melissa*	10
Mexican Yellow	*Eurema mexicanum*	10
Milbert'S Tortoiseshell	*Nymphalis milberti*	20
Monarch	*Danaus plexippus*	20
Mormon Fritillary	*Speyeria mormonia*	10
Mormon Metalmark	*Apodemia mormo*	5
Mottled Duskywing	*Erynnis martialis*	10
Mountain Emperor	*Asterocampa celtis antonia*	10
Mourning Cloak	*Nymphalis antiopa*	20
Mulberry Wing	*Poanes massasoit*	5
Mustard White	*Pieris oleracea*	10
Myrina Fritillary	*Boloria selene myrina*	10
Nevada Skipper	*Hesperia nevada*	10
Nevada Tiger Beetle	*Cicindela nevadica*	10
Northern Broken Dash	*Wallengrenia egeremet*	10
Northern Cloudywing	*Thorybes pylades*	10
Northern Crescent	*Phyciodes cocyta*	10
Northern Pearly-Eye	*Enodia anthedon*	5
Northwestern Fritillary	*Speyeria hesperis lurana*	10
Ochre Ringlet	*Coenonympha tullia ochracea*	5
Old World Swallowtail	*Papilio machaon bairdii*	20
Olive Hairstreak	*Callophrys gryneus gryneus*	10
Olympia Marble	*Euchloe olympia*	10
Orange Sulphur	*Colias eurytheme*	10
Oslar'S Roadside Skipper	*Amblyscirtes oslari*	10
Ottoe Skipper	*Hesperia ottoe*	10
Pahaska Skipper	*Hesperia pahaska*	10
Painted Lady	*Vanessa cardui*	2

Pale Crescent	*Phyciodes pallidus barnesi*	10
Pale Swallowtail	*Papilio eurymedon*	20
Pearl Crescent	*Phyciodes tharos*	10
Peck'S Skipper	*Polites peckius*	10
Persius Duskywing	*Erynnis persius fredericki*	5
Pine White	*Neophasia menapia*	10
Pipevine Swallowtail	*Battus philenor*	20
Plains Skipper	*Hesperia assiniboia*	10
Powesheik Skipperling	*Oarisma poweshiek*	10
Prairie Ringlet	*Coenonympha tullia benjamini*	5
Purplish Copper	*Lycaena helloides*	4
Queen Alexandra'S Sulphur	*Colias alexandra*	10
Question Mark	*Polygonia interrogationis*	20
Reakirt'S Blue	*Hemiargus isola*	10
Red Admiral	*Vanessa atalanta rubria*	2
Red-Spotted Purple	*Limenitis arthemis astyanax*	20
Regal Fritillary	*Speyeria idalia*	10
Rhesus Skipper	*Polites rhesus*	10
Ridings' Satyr	*Neominois ridingsii*	5
Rocky Mountain Parnassian	*Parnassiis smintheus sayii*	10
Ruddy Copper	*Lycaena rubidus longi*	4
Sachem	*Atalopedes campestris*	20
Sagebrush Checkerspot	*Chlosyne acastus*	10
Satyr Comma	*Polygonia satyrus*	20
Shasta Blue	*Icaricia shasta minnehaha*	10
Silver-Spotted Skipper	*Epargyreus clarus*	10
Silvery Blue	*Glaucopsyche lygdamus oro*	10
Silvery Checkerspot	*Chlosyne nycteis*	10
Simius Roadside Skipper	*Amblyscirtes simius*	10
Sleepy Duskywing	*Erynnis brizo*	10
Sleepy Orange	*Eurema nicippe*	2
Small Checkered Skipper	*Pyrgus scriptura*	10
Spicebush Swallowtail	*Papilio troilus*	20
Spring Azure	*Celastrina ladon sidara*	10
Spring White	*Pontia sisymbrii nordini*	10
Stella Orangetip	*Anthocharis stella*	10
Strecker'S Giant Skipper	*Megathymus streckeri leussleri*	10
Striped Hairstreak	*Satyrium liparops aliparops*	10
Summer Azure	*Celastrina neglecta*	10
Tawny Crescent	*Phyciodes batesii*	10
Tawny Emperor	*Asterocampa clyton*	10
Tawny-Edged Skipper	*Polites themistocles*	10
Taxiles Skipper	*Poanes taxiles*	10
Texan Crescent	*Phyciodes texana*	10
Two-Spotted Skipper	*Euphyes bimacula illinois*	5

Two-Tailed Swallowtail	*Papilio multicaudatus*	20
Uhler'S Arctic	*Oeneis uhleri varuna*	10
Uncas Skipper	*Hesperia uncas*	10
Variable Checkerspot	*Euphydryas chalcedona bernadetta*	10
Variegated Fritillary	*Euptoieta claudia*	2
Viceroy	*Limenitis archippus*	20
Weidemeyer'S Admiral	*Limenitis weidemeyerii oberfoelli*	20
West Coast Lady	*Vanessa annabella*	2
Western Branded Skipper	*Hesperia colorado idaho*	10
Western Pine Elfin	*Callophrys eryphon*	10
Western Tailed-Blue	*Everes amyntula valeriae*	10
Western Tiger Swallowtail	*Pterourus rutulus*	20
Western White	*Pontia occidentalis*	10
White Admiral	*Limenitis arthemis arthemis*	20
Woodland Skipper	*Ochlodes sylvanoides napa*	10
Zabulon Skipper	*Poanes zabulon*	10
Zerene Fritillary	*Speyeria zerene sinope*	10
Mammals		
American Pygmy Shrew	*Sorex hoyi*	5
American Water Shrew	*Sorex palustris*	5
Arctic Shrew	*Sorex arcticus*	5
Badger	*Taxidea taxus*	5
Bailey's Eastern Woodrat	*Neotoma floridana baileyi*	5
Bear Lodge Meadow Jumping Mouse	*Zapus hudsonius campestris*	5
Big Brown Bat	*Eptesicus fuscus*	5
Bighorn Sheep	*Ovis canadensis*	50
Black-footed Ferret	*Mustela nigripes*	10
Black-tailed Jackrabbit	*Lepus californicus*	10
Black-tailed Prairie Dog	*Cynomys ludovicianus*	5
Canadian Lynx	*Lynx canadensis*	100
Cougar	*Puma concolor*	40
Deer	*Odocoileus virginianus*	5
Deer Mouse	*Peromyscus maniculatus*	5
Dwarf Shrew	*Sorex nanus*	5
Eastern Chipmunk	*Tamias striatus*	5
Eastern Cottontail	*Sylvilagus floridanus*	10
Eastern Fox Squirrel	*Sciurus niger*	5
Eastern Gray Squirrel	*Sciurus carolinensis*	5
Eastern Red Bat	*Lasiurus borealis*	5
Elk	*Cervus elaphus*	50
Evening Bat	*Nycticeius humeralis*	5
Franklin's Ground Squirrel	*Poliocitellus franklinii*	5
Fringe-tailed Myotis	*Myotis thysanodes pahasapensis*	5
Harvest Mouse	*Reithrodontomys megalotis*	5
Hayden's Shrew	*Sorex haydeni*	5

Hispid Pocket Mouse	*Chaetodipus hispidus*	5
Hoary Bat	*Lasiurus cinereus*	5
House Mouse	*Mus musculus*	5
Least Weasel	*Mustela nivalis*	5
Long-eared Myotis	*Myotis evotis*	5
Long-tailed Vole	*Microtus longicaudus*	5
Meadow Jumping Mouse	*Zapus hudsonius*	5
Meadow Vole	*Microtus pennsylvanicus*	5
Merriam's Shrew	*Sorex merriami*	5
Mink	*Neovison vison*	100
Mule Deer	*Odocoileus hemionus*	5
Muskrat	*Ondatra zibethicus*	5
North American Least Shrew	*Cryptotis parva*	5
Northern Flying Squirrel	*Glaucomys sabrinus*	5
Northern Grasshopper Mouse	*Onychomys leucogaster*	5
Northern Myotis	*Myotis septentrionalis*	5
Northern River Otter	*Lontra canadensis*	50
Plains Harvest Mouse	*Reithrodontomys montanus*	5
Plains Pocket Mouse	*Perognathus flavescens*	5
Plains Spotted Skunk	*Spilogale putorius interrupta*	10
Prairie Vole	*Microtus ochrogaster*	5
Pronghorn	*Antilocapra americana*	16
Raccoon	*Procyon lotor*	15
Red Fox	*Vulpes vulpes*	15
Sagebrush Vole	*Lemmiscus curtatus*	5
Short-tailed Shrew	*Blarina brevicauda*	5
Short-tailed Weasel	*Mustela erminea*	5
Silver-haired Bat	*Lasionycteris noctivagans*	5
Southern Bog Lemming	*Synaptomys cooperi*	5
Southern Red-backed Vole	*Myodes gapperi*	5
Spotted Ground Squirrel	*Xerospermophilus spilosoma*	5
Striped Skunk	*Mephitis mephitis*	10
Swift Fox	*Vulpes velox*	15
Thirteen-lined Ground Squirrel	*Ictidomys tridecemlineatus*	5
Townsend's Big-eared Bat	*Corynorhinus townsendii*	5
Western Harvest Mouse	*Reithrodontomys megalotis*	5
White-footed Mouse	*Peromyscus leucopus*	5
Woodchuck	*Marmota monax*	5
Plant Communities		
Silver Maple-American Elm Forest	*Acer saccharinum-ulmus americana forest*	1
Alaska Oniongrass	*Melica subulata*	1
Alderleaf Buckthorn	*Rhamnus alnifolia*	1
Alkali Marsh Aster	*Almutaster pauciflorus*	1
American Beakgrain	*Diarrhena americana*	1

American Ginseng	*Panax quinquefolius*	1
American Gromwell	*Lithospermum latifolium*	1
American Milkvetch	*Astragalus americanus*	1
American Rockbrake	*Cryptogramma acrostichoides*	1
American Silverberry	*Elaeagnus commutata*	1
American Spikenard	*Aralia racemosa*	1
American Thorowax	*Bupleurum americanum*	1
American Trailplant	*Adenocaulon bicolor*	1
American Water-lily	*Nymphaea odorata*	1
American Yellow Lady's-slipper	*Cypripedium parviflorum*	1
Big Bluestem community	*Andropogon gerardii community*	1
Arrowleaf Sweet-colt's-foot	*Petasites sagittatus*	1
Sand sagebrush/sand reedgrass shrubland	*Artemisia filifolia/calamovilfa longifolia shrubland*	1
Autumn Coralroot	*Corallorhiza odontorhiza*	1
Autumn Willow	*Salix serissima*	1
Balsam Poplar	*Populus balsamifera*	1
Barr's Milkvetch	*Astragalus barrii*	1
Beaked Spikerush	*Eleocharis rostellata*	1
Beautiful Sedge	*Carex concinna*	1
Beckwith's Clover	*Trifolium beckwithii*	1
Bog birch-Willow species rich transition fen shrubland	*Betula pumila-salix spp. rich transition fen shrubland*	1
Bicknell's Northern Crane's-bill	*Geranium bicknellii*	1
Bitter Fleabane	*Erigeron acris*	1
Black Walnut	*Juglans nigra*	1
Bloodroot	*Sanguinaria canadensis*	1
Blue Cohosh	*Caulophyllum thalictroides*	1
Blunt Broom Sedge	*Carex tribuloides*	1
Bog Buckbean	*Menyanthes trifoliata*	1
Boreal Aster	*Symphyotrichum boreale*	1
Branched False Goldenweed	*Oonopsis multicaulis*	1
Bristly-stalk Sedge	*Carex leptalea ssp. leptalea*	1
Broadleaf Twayblade	*Listera convallarioides*	1
Broadleaf Water-milfoil	*Myriophyllum heterophyllum*	1
Broom Groundsel	*Senecio spartioides*	1
Brownish Sedge	*Carex brunnescens*	1
Buff Fleabane	*Erigeron ochroleucus*	1
Bulblet Fern	*Cystopteris bulbifera*	1
Bulbous Woodland-star	*Lithophragma glabrum*	1
Bur-reed Sedge	*Carex sparganioides*	1
Caespitose Rockmat	*Petrophytum caespitosum*	1
California Oatgrass	*Danthonia californica*	1
Canada Rush	*Juncus canadensis*	1
Canada Wild Ginger	*Asarum canadense*	1
Inland sedge and spike rush community	*Carex interior-eleocharis erythropoda community*	1

Carpenter's Square Figwort	*Scrophularia marilandica*	1
Cattail Gayfeather	*Liatris pycnostachya*	
Mountain mahogany/sideoats grama shrubland	*Cercocarpus montanus/bouteloua curtipendula shrubland*	1
Chamomile Grapefern	*Botrychium matricariifolium*	1
Clustered Leather-flower	*Clematis hirsutissima*	1
Common Labrador Tea	*Ledum groenlandicum*	1
Common Moonwort	*Botrychium lunaria*	1
Compass Plant	*Silphium laciniatum*	
Cottongrass Bulrush	*Scirpus cyperinus*	1
Culver's-root	*Veronicastrum virginicum*	1
Cutleaf Toothwort	*Cardamine concatenata*	1
Dakota Buckwheat	*Eriogonum visheri*	1
Downy Gentian	*Gentiana puberulenta*	1
Drummond's Thistle	*Cirsium drummondii*	1
Dwarf Scouring-rush	*Equisetum scirpoides*	1
Early Coralroot	*Corallorhiza trifida*	1
Eastern Marsh Fern	*Thelypteris palustris*	1
Eastern Wild Rice	*Zizania aquatica*	1
Elegant Sedge	*Carex bella*	1
Common spikerush	*Eleocharis palustris*	1
Entireleaf Stonecrop	*Rhodiola integrifolia*	1
Exposed sandbar		1
Fairy Slipper	*Calypso bulbosa*	1
False Rue-anemone	*Enemion biternatum*	1
Fen Grass-of-Parnassus	*Parnassia glauca*	1
Fendler's Broomspurge	*Chamaesyce fendleri*	1
Fendler's Whitethorn	*Ceanothus fendleri*	1
Five-point Bishop's-cap	*Mitella pentandra*	1
Flat-top White Aster	*Doellingeria umbellata*	1
Floriferous Monkeyflower	*Mimulus floribundus*	1
Four-flower Yellow Loosestrife	*Lysimachia quadriflora*	1
Four-point Evening-primrose	*Oenothera rhombipetala*	1
Foxtail Sedge	*Carex alopecoidea*	1
Frenchman's Bluff Moonwort	*Botrychium gallicomontanum*	1
Fresh limnetic lake		1
Giant Helleborine	*Epipactis gigantea*	1
Glomerate Sedge	*Carex aggregata*	1
Golden Puccoon	*Lithospermum caroliniense*	1
Grassleaf Rush	*Juncus marginatus*	1
Gray's Lousewort	*Pedicularis procera*	1
Great Basin Navarretia	*Navarretia intertexta ssp. propinqua*	1
Great Plains Ladies'-tresses	*Spiranthes magnicamporum*	1
Great Plains Marl Fen		1
Greater Bladder Sedge	*Carex intumescens*	1
Great-spurred Violet	*Viola selkirkii*	1

Green Spleenwort	*Asplenium viride*	1
Greene's Mountain-ash	*Sorbus scopulina*	1
Green-flower Hedgehog Cactus	*Echinocereus viridiflorus*	1
Greenfruit Bur-reed	*Sparganium angustifolium*	1
Groove-stem Indian-plantain	*Arnoglossum plantagineum*	1
Hairlike Sedge	*Carex capillaris*	1
Hairy Woodrush	*Luzula acuminata*	1
Hoary Pincushion	*Chaenactis douglasii*	1
Hoary Sedge	*Carex canescens*	1
Hoary Willow	*Salix candida*	1
Holly-leaf Naiad	*Najas marina*	1
Hooker's Mandarin	*Prosartes hookeri*	1
Hooker's Townsend-daisy	*Townsendia hookeri*	1
Hopi-tea	*Thelesperma megapotamicum*	1
Horned Beakrush	*Rhynchospora capillacea*	1
Idaho Fescue	*Festuca idahoensis*	1
Indian-pipe	*Monotropa uniflora*	1
Inflated Sedge	*Carex vesicaria*	1
Interrupted Wild Rye	*Elymus diversiglumis*	1
James' Cat's-eye	*Cryptantha cinerea*	1
Jame's Cristatella	*Polanisia jamesii*	1
Jointed Rush	*Juncus articulatus*	1
Jointed-spike Sedge	*Carex athrostachya*	1
Creeping juniper/sedge dwarf shrubland	*Juniperus horizontalis/carex spp.dwarf-shrubland*	1
Kalm's Lobelia	*Lobelia kalmii*	1
Kentucky Coffeetree	*Gymnocladus dioicus*	1
Kidneyleaf White Violet	*Viola renifolia*	1
Lake-bank Sedge	*Carex lacustris*	1
Large-flower Bellwort	*Uvularia grandiflora*	1
Large-flower Townsend-daisy	*Townsendia grandiflora*	1
Large-flowered Ground-cherry	*Leucophysalis grandiflora*	1
Largeleaf Pondweed	*Potamogeton amplifolius*	1
Leafy White Orchis	*Platanthera dilatata*	1
Least Grapefern	*Botrychium simplex*	1
Leathery Grapefern	*Botrychium multifidum*	1
Lesser Fringed Gentian	*Gentianopsis procera*	1
Lesser Roundleaf Orchid	*Platanthera orbiculata*	1
Limber Pine	*Pinus flexilis*	1
Linearleaf Phacelia	*Phacelia linearis*	1
Little Green Sedge	*Carex viridula*	1
Lodgepole Pine	*Pinus contorta*	1
Loesel's Twayblade	*Liparis loeselii*	1
Longstalk Sedge	*Carex pedunculata*	1
Long-tubed Evening-primrose	*Oenothera flava*	1
Lower intermittent stream		1

Lower perennial stream		1
Maidenhair Spleenwort	*Asplenium trichomanes*	1
Marsh Grass-of-Parnassus	*Parnassia palustris*	1
Marsh Muhly	*Muhlenbergia glomerata*	1
Michigan Lily	*Lilium michiganense*	1
Mountain Bladderpod	*Lesquerella montana*	1
Mountain Cat's-eye	*Cryptantha cana*	1
Mountain Timothy	*Phleum alpinum*	1
Mountain-sorrel	*Oxyria digyna*	1
Musk-root	*Adoxa moschatellina*	1
Narrowleaf Cotton-grass	*Eriophorum angustifolium*	1
Narrowleaf Cottonwood	*Populus angustifolia*	1
Narrowleaf Grapefern	*Botrychium lineare*	1
Narrowleaf Peatmoss	*Sphagnum angustifolium*	1
Narrowleaf Pinweed	*Lechea intermedia*	1
Narrowleaf Scurfpea	*Pediomelum linearifolium*	1
Narrowleaf White Meadowsweet	*Spiraea alba*	1
Nodding Saxifrage	*Saxifraga cernua*	1
Nodding Silverpuffs	*Microseris nutans*	1
Nodding Trillium	*Trillium cernuum*	1
North-central Maple - Basswood Forest	*Acer-Tilia american forest*	1
Northern Holly Fern	*Polystichum lonchitis*	1
Northern Maidenhair Fern	*Adiantum pedatum*	1
Northern Tallgrass Calcareous Fen		1
Northern Wet-Mesic Tallgrass Prairie		1
Northern Wild Comfrey	*Cynoglossum virginianum var. boreale*	1
Nuttall's Desert-parsley	*Lomatium nuttallii*	1
One-flower Wintergreen	*Moneses uniflora*	1
One-flowered Broomrape	*Orobanche uniflora*	1
Orange-flower False Dandelion	*Agoseris aurantiaca*	1
Pale Moonwort	*Botrychium pallidum*	1
Parry's Rabbitbrush	*Ericameria parryi*	1
	Pascopyrum smithii-bouteloua gracilis/carex filifolia herbaceous vegetation	1
	Picea glauca alluvial black hills forest	1
	Picea glauca/linnaea borealis forest	1
	Pinus ponderosa/shizachyrium scoparium sparse woodland	1
Plains Lemmon Beebalm	*Monarda pectinata*	1
	Populus deltoides/juniperus virginiana floodplain forest	1
	Populus tremuloides/picea glauca black hills forest	1
Prairie Dunewort	*Botrychium campestre*	1
Prairie Gentian	*Gentiana affinis*	1
Prairie Milkweed	*Asclepias sullivantii*	1
Prairie Willow	*Salix humilis*	1

Purple Giant-hyssop	*Agastache scrophulariifolia*	1
Purple Sandgrass	*Triplasis purpurea*	1
	Quercus macrocarpa northwestern tallgrass sparse woodland	1
Richardson's Rush		1
Richardson's Sedge	*Carex richardsonii*	1
Riddell's Goldenrod	*Oligoneuron riddellii*	1
Rock Elm	*Ulmus thomasii*	1
Rock Polypody	*Polypodium virginianum*	1
Rock Sedge	*Carex rupestris*	1
Rough Rattlesnake-root	*Prenanthes aspera*	1
Round-head Bushclover	*Lespedeza capitata*	1
Saline littoral lake		1
Bebb's Willow shrubland	*Salix bebbiana shrubland*	1
Meadow Willow/Sedge spp. Shrubland	*Salix petiolaris/carex interior shrubland*	1
Sand Lovegrass	*Eragrostis trichodes*	1
Little Bluestem/Sideoats Grama community	*Schizachyrium scoparium/bouteloua curtipendula community*	1
Bullrush-Cattail species community	*Scirpus spp./typha spp. Community*	1
Secund Bladderpod	*Lesquerella arenosa var. argillosa*	1
Sessile-leaf Bellwort	*Uvularia sessilifolia*	1
Sheathed Pondweed	*Stuckenia vaginata*	1
Sheathed Sedge	*Carex vaginata*	1
Shining Willow	*Salix lucida*	1
Showy Prairie-gentian	*Eustoma exaltatum ssp. russellianum*	1
Sicklepod	*Arabis canadensis*	
Silky Dogwood	*Cornus amomum*	1
Silky Townsend-daisy	*Townsendia exscapa*	1
Sleepy Needlegrass	*Achnatherum robustum*	1
Slender Bog Orchid	*Platanthera stricta*	1
Slender Cotton-grass	*Eriophorum gracile*	1
Slender Mountain-ricegrass	*Piptatherum pungens*	1
Slender Phlox	*Phlox gracilis*	1
Slender Spikerush	*Eleocharis elliptica*	1
Slim-spike Three-awn Grass	*Aristida longespica*	1
Small White Lady's-slipper	*Cypripedium candidum*	1
Small-flower Sand-verbena	*Tripterocalyx micranthus*	1
Small-flower Woodrush	*Luzula parviflora*	1
Smooth Goosefoot	*Chenopodium subglabrum*	1
Smooth Hedge-nettle	*Stachys tenuifolia*	1
Smooth White Violet	*Viola macloskeyi*	1
Smooth Woody-aster	*Xylorhiza glabriuscula*	1
Snow Trillium	*Trillium nivale*	1
Soft Groovebur	*Agrimonia pubescens*	1
Southern Maidenhair Fern	*Adiantum capillus-veneris*	1
Spiked Standing-cypress	*Ipomopsis spicata*	1

Spinulose Shieldfern	*Dryopteris carthusiana*	1
Spring - coldwater		1
Spring - warmwater		1
Square-twigged Huckleberry	*Vaccinium membranaceum*	1
Squashberry	*Viburnum edule*	1
Stiff Clubmoss	*Lycopodium annotinum*	1
Stiff Tickseed	*Coreopsis palmata*	1
Needle-and-thread/blue grama community	*Stipa comata/bouteloua gracilis community*	1
Stout Wood Reedgrass	*Cinna arundinacea*	1
Streamside Bluebells	*Mertensia ciliata*	1
Subalpine Arnica	*Arnica rydbergii*	1
Summer Orophaca	*Astragalus hyalinus*	1
Sweetflag	*Acorus americanus*	1
Western snowberry shrubland	*Symphoricarpus occidentalis shrubland*	1
Three-nerved Goldenrod	*Solidago velutina*	1
Thrift Mock Goldenweed	*Stenotus armerioides*	1
Timber Milkvetch	*Astragalus miser*	1
Timberline Bluegrass	*Poa glauca ssp. rupicola*	1
Trailing Clubmoss	*Lycopodium complanatum*	1
Treelike Clubmoss	*Lycopodium dendroideum*	1
Tufted Hairgrass	*Deschampsia caespitosa*	1
Twisted Ladies'-tresses	*Spiranthes vernalis*	1
Cattail spp.	*Typha spp.*	1
Upper intermittent stream		1
Upper perennial stream - coldwater		1
Upper perennial stream - warm water		1
Upright Greenbrier	*Smilax ecirrhata*	1
Variegated Horsetail	*Equisetum variegatum*	1
Wax-leaf Beardtongue	*Penstemon nitidus*	1
Western Prairie White-fringed Orchid	*Platanthera praeclara*	1
Western Saxifrage	*Saxifraga occidentalis*	1
Western Sedge	*Carex occidentalis*	1
Western Swordfern	*Polystichum munitum*	1
White Nodding Ladies'-tresses	*Spiranthes cernua*	1
White Rattlesnake-root	*Prenanthes alba*	1
White Trout-lily	*Erythronium albidum*	1
White-flower Standing-cypress	*Ipomopsis longiflora*	1
White-vein Wintergreen	*Pyrola picta*	1
Whole-leaf Rosinweed	*Silphium integrifolium*	1
Wild Blue Phlox	*Phlox divaricata*	1
Wild Crane's-bill	*nium maculatum*	1
Winged Cudweed		1
Wood Anemone	*Anemone quinquefolia*	1
Woodhouse's False Bahia	*Picradeniopsis woodhousei*	1
Woodland Bluegrass	*Poa sylvestris*	1

Woodland Lettuce	*Lactuca floridana*	1
Woolly Milkweed	*Asclepias lanuginosa*	1
Reptiles		
Black Hills Redbelly Snake	*Storeria occipitomaculata pahasapae*	5
Blanding's Turtle	*Emydoidea blandingii*	10
Brownsnake	*Storeria dekayi*	5
Bull Snake	*Pituophis catenifer*	10
Eastern Garter Snake	*Thamnophis sirtalis sirtalis*	10
Eastern Hognose Snake	*Heterodon platirhinos*	10
Eastern Yellow-belly Racer	*Coluber constrictor flaviventris*	5
False Map Turtle	*Graptemys pseudogeographica*	20
Five-lined Skink	*Plestiodon fasciatus*	5
Lesser Earless Lizard	*Holbrookia maculata*	5
Lined Snake	*Tropidoclonion lineatum*	5
Many-lined Skink	*Plestiodon multivirgatus*	5
Milk Snake	*Lampropeltis triangulum*	10
Northern Prairie Lizard	*Sceloporus undulatus*	5
Northern Prairie Skink	*Plestiodon septentrionalis*	5
Northern Redbelly Snake	*Storeria occipitomaculata occipitomaculata*	5
Northern Watersnake	*Nerodia sipedon*	10
Ornate Box Turtle	*Terrapene ornata*	5
Plains Garter Snake	*Thamnophis radix*	10
Red Milksnake	*Lampropeltis triangulum syspila*	5
Red-eared Slider	*Trachemys scripta elegans*	5
Ringneck Snake	*Diadophis punctatus*	5
Sagebrush Lizard	*Sceloporus graciosus*	5
Short-horned Lizard	*Phrynosoma hernandesi*	5
Six-lined Racer	*Aspidoscelis sexlineata*	5
Smooth Greensnake	*Opheodrys vernalis*	5
Smooth Softshell	*Apalone mutica*	20
Snapping Turtle	*Chelydra serpentina*	10
Spiny Softshell	*Apalone spinifera*	20
Terrestrial Gartersnake	*Thamnophis elegans*	10
Western Foxsnake	*Pantherophis ramspotti*	10
Western Hognose Snake	*Heterodon nasicus*	10
Western Painted Turtle	*Chrysemys picta*	3
Western Rattlesnake	*Crotalus viridis*	5
Terrestrial Gastropds		
Callused Vertigo	*Vertigo arthuri*	1
Cooper's Rocky Mountainsnail	*Oreohelix strigosa cooperi*	1
Frigid Ambersnail	*Catinella gelida*	1
Mystery Vertigo	*Vertigo paradoxa*	1

Appendix R. Terrestrial conservation opportunity acreages by ecosite type using 10% representation goal.

Ecosite ID	Ecosite Type	MLRA	Ecosite Acres	10% Acre Goal	COA Acres Using Round 1 Criteria	COA Acres Using Round 2 Criteria	COA Acres Using Round 3 Criteria	Round # that met 10% COA Goal	Ecosite Goal %
R102AY011SD	CLAYEY	102A	241,611	24,161	50,791	0	0	1	21.0
R102AY013SD	CLAYPAN	102A	557	56	373	0	0	1	67.0
R102AY999SD	DISTURBED SITES	102A	4,971	497	1,358	0	0	1	27.3
R102AY010SD	LOAMY	102A	2,479,020	247,902	808,239	0	0	1	32.6
R102AY008SD	SANDS	102A	2,094	209	902	0	0	1	43.1
R102AY009SD	SANDY	102A	66,155	6,616	31,941	0	0	1	48.3
R102AY014SD	SHALLOW TO GRAVEL	102A	193,698	19,370	113,451	0	0	1	58.6
R102AY012SD	THIN UPLAND	102A	267,890	26,789	101,392	0	0	1	37.8
R102AY016SD	VERY SHALLOW	102A	30,864	3,086	20,208	0	0	1	65.5
R102BY011SD	CLAYEY	102B	1,200	120	173	0	0	1	14.4
R102BY999SD	DISTURBED SITES	102B	935	94	604	0	0	1	64.5
R102BY010SD	LOAMY	102B	891,886	89,189	123,352	0	0	1	13.8
R102BY009SD	SANDY	102B	3,398	340	1,481	0	0	1	43.6
R102BY014SD	SHALLOW TO GRAVEL	102B	21,085	2,108	8,456	0	0	1	40.1
R102BY012SD	THIN UPLAND	102B	102,786	10,279	16,061	0	0	1	15.6
R102BY016SD	VERY SHALLOW	102B	2,793	279	513	0	0	1	18.4
R102BY011SD	CLAYEY	102C	18,843	1,884	4,625	0	0	1	24.5
R102CY999SD	DISTURBED SITES	102C	1,221	122	947	0	0	1	77.5
R102BY010SD	LOAMY	102C	509,438	50,944	161,148	0	0	1	31.6
R102BY008SD	SANDS	102C	8,426	843	6,252	0	0	1	74.2
R102BY009SD	SANDY	102C	16,130	1,613	9,017	0	0	1	55.9
R102BY014SD	SHALLOW TO GRAVEL	102C	3,645	365	1,962	0	0	1	53.8
R102BY012SD	THIN UPLAND	102C	78,007	7,801	19,997	0	0	1	25.6

Appendix R (continued). Terrestrial conservation opportunity acreages by ecosite type using 10% representation goal.

R102BY016SD	VERY SHALLOW	102C	466	47	445	0	0	1	95.6
R053BY001ND	CLAYEY	53B	267,166	26,717	103,851	0	0	1	38.9
R053BY002ND	CLAYPAN	53B	34,177	3,418	14,890	0	0	1	43.6
R053BY999ND	DISTURBED SITES	53B	2,061	206	658	0	0	1	31.9
R053BY011ND	LOAMY	53B	1,866,635	101,018	1,006,236	0	0	1	53.9
R053BY007ND	SANDS	53B	19,954	1,995	4,614	0	0	1	23.1
R053BY008ND	SANDY	53B	40,712	4,071	11,530	0	0	1	28.3
R053BY026ND	SANDY CLAYPAN	53B	7,892	789	4,131	0	0	1	52.3
R053BY010ND	SHALLOW TO GRAVEL	53B	85,594	8,559	38,020	0	0	1	44.4
R053BY013ND	THIN CLAYPAN	53B	11,117	1,112	2,567	0	0	1	23.1
R053BY015ND	THIN UPLAND	53B	32,737	3,274	12,304	0	0	1	37.6
R053BY017ND	VERY SHALLOW	53B	53,650	5,365	34,155	0	0	1	63.7
R053CY011SD	CLAYEY	53C	382,159	38,216	53,612	0	0	1	14.0
R053CY018SD	DENSE CLAY	53C	3,557	356	1,148	0	0	1	32.3
R053CY999SD	DISTURBED SITES	53C	1,008	101	241	0	0	1	24.0
R053CY010SD	LOAMY	53C	1,390,165	139,016	228,624	0	0	1	16.4
R053CY999SD	ROCK OUTCROP	53C	36	4	35	0	0	1	98.1
R053CY014SD	SHALLOW TO GRAVEL	53C	19,054	1,905	4,230	0	0	1	22.2
R053CY015SD	THIN CLAYPAN	53C	19,502	1,950	2,512	0	0	1	12.9
R053CY012SD	THIN UPLAND	53C	252,286	25,229	85,068	0	0	1	33.7
R053CY016SD	VERY SHALLOW	53C	16,857	1,686	5,064	0	0	1	30.0
R054XY999ND	BADLANDS	54	11,595	1,159	8,728	0	0	1	75.3
R054XY020ND	CLAYEY	54	691,448	69,145	83,144	0	0	1	12.0
R054XY021ND	CLAYPAN	54	262,008	26,201	76,166	0	0	1	29.1
R062XY043SD	COOL SLOPES	54	794	79	776	0	0	1	97.8
R054XY999ND	DISTURBED SITES	54	2,401	240	897	0	0	1	37.3
R054XY031ND	LOAMY	54	1,556,992	155,699	275,896	0	0	1	17.7
R054XY999ND	ROCK OUTCROP	54	30,018	3,002	21,269	0	0	1	70.9

Appendix R (continued). Terrestrial conservation opportunity acreages by ecosite type using 10% representation goal.

R054XY025ND	SANDS	54	54,910	5,491	40,491	0	0	1	73.7
R054XY026ND	SANDY	54	859,343	85,934	302,648	0	0	1	35.2
R054XY027ND	SANDY CLAYPAN	54	48,321	4,832	20,218	0	0	1	41.8
R054XY028ND	SHALLOW CLAY	54	86,544	8,654	17,887	0	0	1	20.7
R054XY030ND	SHALLOW LOAMY	54	456,985	45,698	153,087	0	0	1	33.5
R054XY043ND	SHALLOW SANDY	54	333,389	33,339	139,931	0	0	1	42.0
R058DY029SD	STONY HILLS	54	1,473	147	1,473	0	0	1	100.0
R054XY033ND	THIN CLAYPAN	54	1,161,529	116,153	498,245	0	0	1	42.9
R054XY038ND	THIN UPLAND	54	201,049	20,105	42,315	0	0	1	21.0
R054XY035ND	VERY SHALLOW	54	32,961	3,296	14,716	0	0	1	44.6
R055BY056ND	CLAYEY	55B	372,507	37,251	60,249	0	0	1	16.2
R055BY057ND	CLAYPAN	55B	120,027	12,003	22,445	0	0	1	18.7
R055BY064ND	LOAMY	55B	996,175	99,617	225,672	0	0	1	22.7
R055BY061ND	SANDS	55B	22,754	2,275	8,744	0	0	1	38.4
R055BY062ND	SANDY	55B	55,327	5,533	23,601	0	0	1	42.7
R055BY072ND	SANDY CLAYPAN	55B	1,273	127	446	0	0	1	35.0
R055BY999ND	SLICKSPOTS	55B	90	9	59	0	0	1	65.5
R055BY066ND	THIN CLAYPAN	55B	77,154	7,715	11,777	0	0	1	15.3
R055BY068ND	THIN UPLAND	55B	29,013	2,901	6,594	0	0	1	22.7
R055CY011SD	CLAYEY	55C	352,830	35,283	61,312	0	0	1	17.4
R055CY013SD	CLAYPAN	55C	204,761	20,476	29,208	0	0	1	14.3
R055CY999SD	DISTURBED SITES	55C	3,465	347	1,050	0	0	1	30.3
R055CY010SD	LOAMY	55C	4,265,047	426,505	743,357	0	0	1	17.4
R055CY999SD	ROCK OUTCROP	55C	315	32	313	0	0	1	99.3
R055CY008SD	SANDS	55C	1,607	161	1,532	0	0	1	95.3
R055CY009SD	SANDY	55C	175,708	17,571	40,499	0	0	1	23.0
R055CY017SD	SHALLOW CLAY	55C	6,270	627	1,010	0	0	1	16.1
R055CY014SD	SHALLOW TO GRAVEL	55C	65,835	6,583	11,937	0	0	1	18.1

Appendix R (continued). Terrestrial conservation opportunity acreages by ecosite type using 10% representation goal.

R055CY015SD	THIN CLAYPAN	55C	20,530	2,053	2,613	0	0	1	12.7
R055CY012SD	THIN UPLAND	55C	368,979	36,898	107,066	0	0	1	29.0
R055CY016SD	VERY SHALLOW	55C	8,645	865	1,918	0	0	1	22.2
R102AY008SD	SANDS	56	90	9	25	0	0	1	27.8
R058DY999SD	BADLANDS	58D	14,079	1,408	10,111	0	0	1	71.8
R058DY011SD	CLAYEY	58D	11,745	1,175	8,432	0	0	1	71.8
R058DY013SD	CLAYPAN	58D	187,402	18,740	94,491	0	0	1	50.4
R062XY043SD	COOL SLOPES	58D	12,043	1,204	8,898	0	0	1	73.9
R058DY999SD	DISTURBED SITES	58D	149	15	79	0	0	1	52.9
R058DY010SD	LOAMY	58D	96,814	9,681	47,464	0	0	1	49.0
R058DY999SD	ROCK OUTCROP	58D	12,377	1,238	10,317	0	0	1	83.4
R058DY008SD	SANDS	58D	89,730	8,973	59,959	0	0	1	66.8
R058DY009SD	SANDY	58D	320,020	32,002	168,068	0	0	1	52.5
R058DY027SD	SANDY CLAYPAN	58D	8,164	816	7,145	0	0	1	87.5
R058DY017SD	SHALLOW CLAY	58D	3,156	316	2,104	0	0	1	66.7
R058DY024SD	SHALLOW LOAMY	58D	105,625	10,562	57,714	0	0	1	54.6
R058DY028SD	SHALLOW SANDY	58D	25,490	2,549	19,942	0	0	1	78.2
R058DY999SD	SLICKSPOTS	58D	543	54	226	0	0	1	41.6
R058DY029SD	STONY HILLS	58D	13,004	1,300	11,884	0	0	1	91.4
R058DY015SD	THIN CLAYPAN	58D	170,210	17,021	90,938	0	0	1	53.4
R058DY012SD	THIN UPLAND	58D	9,747	975	5,772	0	0	1	59.2
R058DY016SD	VERY SHALLOW	58D	5,494	549	2,261	0	0	1	41.2
R060AY999ND	BADLANDS	60A	10,321	1,032	7,249	0	0	1	70.2
R060AY011SD	CLAYEY	60A	812,170	81,217	316,325	0	0	1	38.9
R060AY040SD	CLAYEY	60A	228,525	22,853	78,376	0	0	1	34.3
R060AY013SD	CLAYPAN	60A	25,214	2,521	4,934	0	0	1	19.6
R062XY043SD	COOL SLOPES	60A	589	59	332	0	0	1	56.5
R060AY018SD	DENSE CLAY	60A	424,018	42,402	251,670	0	0	1	59.4

Appendix R (continued). Terrestrial conservation opportunity acreages by ecosite type using 10% representation goal.

R060AY999SD	DISTURBED SITES	60A	4,526	453	3,301	0	0	1	72.9
R060AY010SD	LOAMY	60A	437,800	43,780	75,823	0	0	1	17.3
R060AY041SD	LOAMY	60A	295,089	29,509	79,949	0	0	1	27.1
R060AY030SD	POROUS CLAY	60A	2,623	262	995	0	0	1	37.9
R060AY999SD	ROCK OUTCROP	60A	33,738	3,374	18,016	0	0	1	53.4
R060AY026SD	SALINE UPLAND	60A	38,136	3,814	11,617	0	0	1	30.5
R060AY008SD	SANDS	60A	79,390	7,939	53,169	0	0	1	67.0
R060AY009SD	SANDY	60A	69,125	6,912	35,352	0	0	1	51.1
R058DY027SD	SANDY CLAYPAN	60A	299	30	229	0	0	1	76.4
R060AY031SD	SAVANNAH	60A	14,687	1,469	3,959	0	0	1	27.0
R063AY024SD	SHALLOW	60A	9,592	959	5,621	0	0	1	58.6
R060AY017SD	SHALLOW CLAY	60A	498,409	49,841	285,471	0	0	1	57.3
R060AY025SD	SHALLOW DENSE CLAY	60A	309,132	30,913	170,815	0	0	1	55.3
R060AY024SD	SHALLOW LOAMY	60A	118,295	11,830	50,448	0	0	1	42.6
R060AY017SD	SHALLOW POROUS CLAY	60A	34,955	3,495	11,016	0	0	1	31.5
R062XY041SD	SHALLOW RIDGE	60A	2,158	216	686	0	0	1	31.8
R060AY044SD	SHALLOW SANDY	60A	2,459	246	1,559	0	0	1	63.4
R062XY039SD	SILTY FOOTSLOPES	60A	1,209	121	219	0	0	1	18.1
R060AY999SD	SLICKSPOTS	60A	64,414	6,441	40,566	0	0	1	63.0
R060AY015SD	THIN CLAYPAN	60A	257,516	25,752	96,723	0	0	1	37.6
R060AY012SD	THIN UPLAND	60A	269,339	26,934	69,136	0	0	1	25.7
R060AY016SD	VERY SHALLOW	60A	34,935	3,493	18,383	0	0	1	52.6
R062XY044SD	WARM SLOPES	60A	2,913	291	2,628	0	0	1	90.2
R061XN011SD	CLAYEY	61	21,795	2,179	9,902	0	0	1	45.4
R062XY043SD	COOL SLOPES	61	2,777	278	424	0	0	1	15.2
R061XY999SD	DISTURBED SITES	61	1,568	157	1,438	0	0	1	91.7
R061XN010SD	LOAMY	61	107,184	10,718	71,027	0	0	1	66.3
R061XY999SD	ROCK OUTCROP	61	5,389	539	3,430	0	0	1	63.7

Appendix R (continued). Terrestrial conservation opportunity acreages by ecosite type using 10% representation goal.

R060AY008SD	SANDS	61	1,328	133	1,159	0	0	1	87.3
R061XY009SD	SANDY	61	2,070	207	1,440	0	0	1	69.6
R062XY038SD	SAVANNAH	61	801	80	136	0	0	1	16.9
R061XS017SD	SHALLOW CLAY	61	6,373	637	3,474	0	0	1	54.5
R061XN024SD	SHALLOW LOAMY	61	97,036	9,704	72,974	0	0	1	75.2
R061XS024SD	SHALLOW LOAMY	61	15,792	1,579	12,427	0	0	1	78.7
R062XY041SD	SHALLOW RIDGE	61	59,361	5,936	49,325	0	0	1	83.1
R062XY039SD	SILTY FOOTSLOPES	61	14,886	1,489	8,453	0	0	1	56.8
R061XN029SD	STONY HILLS	61	12,424	1,242	6,033	0	0	1	48.6
R060AY015SD	THIN CLAYPAN	61	360	36	146	0	0	1	40.5
R061XN012SD	THIN UPLAND	61	68,186	6,819	45,051	0	0	1	66.1
R061XY016SD	VERY SHALLOW	61	6,182	618	4,556	0	0	1	73.7
R062XY044SD	WARM SLOPES	61	90,524	9,052	79,329	0	0	1	87.6
R061XN011SD	CLAYEY	62	1,677	168	1,263	0	0	1	75.3
R062XY043SD	COOL SLOPES	62	166,336	16,634	164,250	0	0	1	98.7
R062XY999SD	DISTURBED SITES	62	3,821	382	3,677	0	0	1	96.2
R062XY033SD	HIGH COUNTRY LOAMY	62	7,043	704	6,687	0	0	1	95.0
R062XY035SD	HIGH COUNTRY OVERFLOW	62	186,042	18,604	184,399	0	0	1	99.1
R062XY010SD	LOAMY	62	28,811	2,881	26,191	0	0	1	90.9
R062XY032SD	MOUNTAIN PRAIRIE	62	21,519	2,152	20,527	0	0	1	95.4
R062XY999SD	ROCK OUTCROP	62	940	94	939	0	0	1	99.9
R062XY040SD	ROCKY SIDESLOPES	62	283,584	28,358	281,244	0	0	1	99.2
R062XY038SD	SAVANNAH	62	6,664	666	6,664	0	0	1	100.0
R062XY024SD	SHALLOW	62	47,147	4,715	40,180	0	0	1	85.2
R061XN024SD	SHALLOW LOAMY	62	2,821	282	2,028	0	0	1	71.9
R062XY041SD	SHALLOW RIDGE	62	134,919	13,492	128,101	0	0	1	94.9
R062XY029SD	STONY HILLS	62	31,213	3,121	27,172	0	0	1	87.1

Appendix R (continued). Terrestrial conservation opportunity acreages by ecosite type using 10% representation goal.

R061XN012SD	THIN UPLAND	62	4,312	431	3,661	0	0	1	84.9
R061XY016SD	VERY SHALLOW	62	1,019	102	893	0	0	1	87.6
R062XY044SD	WARM SLOPES	62	413,721	41,372	395,539	0	0	1	95.6
R063AY999SD	BADLANDS	63A	1,993	199	1,250	0	0	1	62.7
R063AY011SD	CLAYEY	63A	2,508,227	250,823	393,639	0	0	1	15.7
R063AY013SD	CLAYPAN	63A	40,720	4,072	13,675	0	0	1	33.6
R063AY018SD	DENSE CLAY	63A	402,987	40,299	138,347	0	0	1	34.3
R063AY999SD	DISTURBED SITES	63A	3,569	357	2,993	0	0	1	83.8
R063AY010SD	LOAMY	63A	414,663	41,466	118,709	0	0	1	28.6
R063AY999SD	ROCK OUTCROP	63A	25,723	2,572	14,747	0	0	1	57.3
R063AY008SD	SANDS	63A	18,421	1,842	16,878	0	0	1	91.6
R063AY009SD	SANDY	63A	25,112	2,511	15,706	0	0	1	62.5
R063AY024SD	SHALLOW	63A	41,147	4,115	13,930	0	0	1	33.9
R063AY017SD	SHALLOW CLAY	63A	1,617,071	161,707	691,556	0	0	1	42.8
R063AY014SD	SHALLOW TO GRAVEL	63A	5,442	544	1,142	0	0	1	21.0
R063AY999SD	SLICKSPOTS	63A	846	85	530	0	0	1	62.7
R063AY015SD	THIN CLAYPAN	63A	167,615	16,761	41,482	0	0	1	24.7
R063AY012SD	THIN UPLAND	63A	453,997	45,400	124,328	0	0	1	27.4
R063AY016SD	VERY SHALLOW	63A	87,386	8,739	42,462	0	0	1	48.6
R063BY999NE	BADLANDS	63B	56	6	18	0	0	1	33.0
R065XY034NE	CHOPPY SANDS	63B	1,040	104	328	0	0	1	31.6
R063BY011SD	CLAYEY	63B	841,136	84,114	89,662	0	0	1	10.7
R063BY018SD	DENSE CLAY	63B	60,532	6,053	26,203	0	0	1	43.3
R063BY999SD	DISTURBED SITES	63B	1,872	187	1,453	0	0	1	77.6
R063BY010SD	LOAMY	63B	244,186	24,419	68,255	0	0	1	28.0
R063BY999SD	ROCK OUTCROP	63B	12,346	1,235	10,817	0	0	1	87.6
R066XY033NE	SANDS	63B	8,445	845	3,815	0	0	1	45.2
R066XY055NE	SANDS	63B	2,540	254	2,514	0	0	1	99.0

Appendix R (continued). Terrestrial conservation opportunity acreages by ecosite type using 10% representation goal.

R066XY054NE	SANDY	63B	33,686	3,369	18,324	0	0	1	54.4
R066XY032NE	SANDY	63B	6,260	626	3,858	0	0	1	61.6
R063BY024SD	SHALLOW	63B	18,438	1,844	3,942	0	0	1	21.4
R063BY017SD	SHALLOW CLAY	63B	493,430	49,343	221,816	0	0	1	45.0
R066XY040NE	SHALLOW LIMY	63B	234	23	34	0	0	1	14.6
R063AY014SD	SHALLOW TO GRAVEL	63B	12,894	1,289	1,961	0	0	1	15.2
R063BY015SD	THIN CLAYPAN	63B	35,217	3,522	4,693	0	0	1	13.3
R063BY012SD	THIN UPLAND	63B	195,527	19,553	31,094	0	0	1	15.9
R063BY016SD	VERY SHALLOW	63B	19,434	1,943	8,330	0	0	1	42.9
R064XY999NE	BADLANDS	64	344,627	34,463	253,912	0	0	1	73.7
R064XY035NE	CLAYEY	64	183,018	18,302	74,875	0	0	1	40.9
R064XY014NE	CLAYEY	64	43,538	4,354	19,885	0	0	1	45.7
R064XY044NE	CLAYPAN	64	89,290	8,929	35,737	0	0	1	40.0
R064XY045NE	DENSE CLAY	64	48,220	4,822	40,255	0	0	1	83.5
R064XY999NE	DISTURBED SITES	64	87	9	32	0	0	1	36.3
R064XY036NE	LOAMY	64	997,903	99,790	261,827	0	0	1	26.2
R064XY015NE	LOAMY	64	36,598	3,660	18,369	0	0	1	50.2
R064XY012NE	SANDS	64	75,657	7,566	34,488	0	0	1	45.6
R064XY032NE	SANDY	64	193,478	19,348	82,797	0	0	1	42.8
R064XY011NE	SANDY	64	10,745	1,074	6,472	0	0	1	60.2
R064XY040NE	SHALLOW	64	548,968	54,897	103,473	0	0	1	18.8
R064XY039NE	SHALLOW CLAY	64	117,507	11,751	89,784	0	0	1	76.4
R066XY040NE	SHALLOW LIMY	64	5,479	548	2,150	0	0	1	39.2
R064XY046NE	THIN CLAYPAN	64	69,575	6,957	38,889	0	0	1	55.9
R064XY037NE	THIN UPLAND	64	68,550	6,855	33,135	0	0	1	48.3
R064XY047NE	VERY SHALLOW	64	25,790	2,579	12,731	0	0	1	49.4
R065XY034NE	CHOPPY SANDS	65	13,540	1,354	7,643	0	0	1	56.5
R064XY044NE	CLAYPAN	65	461	46	83	0	0	1	18.0

Appendix R (continued). Terrestrial conservation opportunity acreages by ecosite type using 10% representation goal.

R065XY033NE	SANDS	65	233,065	23,307	146,713	0	0	1	62.9
R065XY032NE	SANDY	65	11,382	1,138	4,133	0	0	1	36.3
R065XY054NE	SANDY	65	539	54	438	0	0	1	81.2
R066XY040NE	SHALLOW LIMY	65	895	89	890	0	0	1	99.5
R065XY034NE	CHOPPY SANDS	66	747	75	635	0	0	1	85.1
R066XY999NE	DISTURBED SITES	66	281	28	41	0	0	1	14.7
R066XY033NE	SANDS	66	263,652	26,365	100,410	0	0	1	38.1
R066XY032NE	SANDY	66	368,211	36,821	106,084	0	0	1	28.8
R066XY054NE	SANDY	66	297,623	29,762	30,978	0	0	1	10.4
R063BY024SD	SHALLOW	66	9,949	995	1,620	0	0	1	16.3
R066XY040NE	SHALLOW LIMY	66	63,376	6,338	24,072	0	0	1	38.0
R063BY015SD	THIN CLAYPAN	66	5,665	566	951	0	0	1	16.8
R066XY059NE	THIN UPLAND	66	30,975	3,097	4,344	0	0	1	14.0
R053CY013SD	CLAYPAN	53C	64,469	6,447	5,437	21,833	0	2	42.3
R053CY009SD	SANDY	53C	1,256	126	2	329	0	2	26.3
R054XY999ND	SLICKSPOTS	54	99	10	9	7	0	2	16.1
R055BY999ND	DISTURBED SITES	55B	1,753	175	161	351	0	2	29.2
R055BY073ND	SHALLOW LOAMY	55B	1,394	139	0	369	0	2	26.5
R055BY063ND	SHALLOW TO GRAVEL	55B	12,140	1,214	751	2,546	0	2	27.2
R055BY069ND	VERY SHALLOW	55B	744	74	27	122	0	2	20.0
R102AY011SD	CLAYEY	56	4,828	483	0	3,346	0	2	69.3
R102AY010SD	LOAMY	56	4,685	469	0	2,779	0	2	59.3
R102AY009SD	SANDY	56	2,216	222	14	783	0	2	36.0
R102AY014SD	SHALLOW TO GRAVEL	56	1,265	126	8	549	0	2	44.0
R102AY012SD	THIN UPLAND	56	537	54	5	130	0	2	25.1
R062XY029SD	STONY HILLS	60A	154	15	0	24	0	2	15.6
R063BY013SD	CLAYPAN	63B	39,522	3,952	2,858	5,897	0	2	22.2
R060AY024SD	SHALLOW LOAMY	64	1,605	160	141	960	0	2	68.6

Appendix R (continued). Terrestrial conservation opportunity acreages by ecosite type using 10% representation goal.

R063AY014SD	SHALLOW TO GRAVEL	64	1,936	194	189	662	0	2	44.0
R063BY011SD	CLAYEY	66	84,887	8,489	2,886	29,354	0	2	38.0
R063BY013SD	CLAYPAN	66	30,968	3,097	3,066	7,749	0	2	34.9
R066XY036NE	LOAMY	66	217,181	21,718	15,907	61,606	0	2	35.7
R066XY058NE	LOAMY	66	57,927	5,793	2,169	11,795	0	2	24.1
R063BY017SD	SHALLOW CLAY	66	9,976	998	482	2,508	0	2	30.0
R066XY062NE	SHALLOW TO GRAVEL	66	27,744	2,774	2,192	4,186	0	2	23.0
R064XY036NE	LOAMY	65	1,359	136	35	0	1,226	3	92.8
R064XY040NE	SHALLOW	65	599	60	2	0	596	3	100.0
R064XY046NE	THIN CLAYPAN	65	1,026	103	2	13	1,002	3	99.1
R064XY047NE	VERY SHALLOW	66	448	45	15	15	416	3	99.7

Appendix S. Existing federal, state and private programs to assist collaborative efforts and individual landowners in maintaining and restoring ecosystem diversity in South Dakota.

FEDERAL PROGRAMS

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)

*Funding for some of these programs is provided through the federal Farm Bill and is not guaranteed on a long term basis.

***Agricultural Conservation Easement Program (ACEP)* -** A voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands and protect grasslands and working farms and ranches on their property. The NRCS provides technical and financial assistance to eligible landowners. Landowners have the opportunity of enrolling eligible lands through permanent or 30-year easements. The program is offered on a continuous sign-up basis and is available Statewide. This program offers landowners an opportunity to establish, at minimal cost, long-term conservation and wildlife habitat enhancement practices and protection.

Conservation Reserve Program (CRP) and Continuous Conservation Reserve Program (CCRP) - Provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, State, and tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation (CCC). CRP is administered by the Farm Service Agency, with NRCS providing technical land eligibility determinations, conservation planning and practice implementation. The Conservation Reserve Program reduces soil erosion, protects the Nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost sharing is provided to establish the vegetative cover practices.

***Environmental Quality Incentives Program (EQIP)* -** Provides a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible goals. EQIP offers financial and technical assistance for eligible farmers and ranchers to install or implement structural and land management practices on eligible agricultural land. Any farmer or rancher who is engaged in livestock or agricultural production on eligible land may participate in the EQIP program. EQIP may provide cost-share for implementing certain conservation practices important to improving and maintaining the health of South Dakota's natural resources. A minimum of 5% of EQIP funds must be expended on wildlife habitat.

Appendix S (continued). Existing federal, state, and private programs to assist collaborative efforts and individual landowners in maintaining and restoring ecosystem diversity in South Dakota.

***Conservation Security Programs (CSP)* -** A voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on Tribal and private working lands. Working lands include cropland, grassland, prairie land, improved pasture, and range land, as well as forested land that is an incidental part of an agriculture operation. The program provides equitable access to benefits to all producers, regardless of size of operation, crops produced, or geographic location.

U.S. Department of Interior, Fish and Wildlife Service

North American Wetlands Conservation Act Grants Program - Established to support the long-term protection of wetlands and associated uplands habitats needed by waterfowl and other migratory birds in North America. Projects must support long-term wetlands acquisition, restoration, and/or enhancement.

***Partners for Fish and Wildlife* -** Supports voluntary habitat conservation on private and Tribal land through public-private partnerships. Projects are typically designed to restore, enhance, or establish grassland and wetland habitats. A common thread through every South Dakota Partners project is the ability to be flexible and response enough to accommodate the site-specific needs and concerns of landowners. Since 1991, this approach has resulted in over 6,100 South Dakota landowners becoming valued Partners for Fish and Wildlife and the number of new landowner requests for assistance continues to accelerate.

Private Stewardship Program - Provides grants and other assistance on a competitive basis to individuals and groups for voluntary conservation efforts to benefit federally listed, proposed, or candidate species, or other at-risk species on private lands**.**

Cooperative Endangered Species Conservation Fund - Includes several programs including Conservation Grants, Recovery Land Acquisition, Habitat Conservation Planning Assistance, and Habitat Conservation Plan Land Acquisition. All aimed at protecting endangered, threatened, proposed, or candidate species.

Landowner Incentive Program (LIP) - funded through the State of South Dakota

Habitat Fence Construction - This practice is provided to protect certain high quality and normally high expense habitat practices from livestock damage. Although most practices—even expensive ones—normally will not require fencing, occasionally practices are designed in such a way that require some type of protection. In those cases, the department may provide cost share to help the participating landowner in providing the needed protection.

Native Warm Season Grass Establishment - This project will establish NWSG for wildlife by seeding or inter-seeding to provide high quality roosting and escape cover for birds, especially in months with heavy snow-cover. It will also provide cover for ground nesting birds, provide broodrearing cover for ground-nesting birds, and provide grassland habitat for various wildlife species.

Appendix S (continued). Existing federal, state, and private programs to assist collaborative efforts and individual landowners in maintaining and restoring ecosystem diversity in South Dakota.

U.S. Department of Agriculture, Forest Service

Forest Legacy Program (FLP) - A federal program in partnership with states; supports state efforts to protect environmentally sensitive forest lands. Designed to encourage the protection of privately owned forest lands, FLP is an entirely voluntary program. To maximize the public benefits it achieves, the program focuses on the acquisition of partial interests in privately owned forest lands.

Forest Stewardship Program (FSP) - Provide technical assistance, through state forestry agencies, to non-industrial private forest owners to encourage and enable active long-term forest management to provide timber, wildlife habitat, watershed protection, recreational opportunities and many other benefits for landowners and society, both now and in the future.

STATE OF SOUTH DAKOTA PROGRAMS

South Dakota Department of Game, Fish and Parks, Division of Wildlife

Wetland and Grassland Habitat Program – This program implements conservation practices on private land that benefit breeding waterfowl and other wetland or grassland dependent wildlife by assisting landowners with projects on working grasslands. Practices eligible for technical assistance and project cost share include:

- Wetland Restorations
- Wetland Creations & Enhancements
- Water Development
- Grassland/Grazing Enhancements
- Riparian Pastures
- Wildlife Friendly Fences

Wildlife Partners Program – Voluntary program for private landowners interested in establishing habitat for wildlife by providing cost-share for habitat projects such as native grass establishment, woody cover plantings, and food plots. One of the goals of this program is to assist landowners with the establishment of woody habitat to enhance winter cover for game and nongame wildlife. Large woody plantings with appropriate shrubs and trees help ensure survival in the worst possible winter weather, afford vulnerable wildlife year-round protection from predators and provide important sources of food for a variety of wildlife.

For more information about these programs, visit: http://gfp.sd.gov/wildlife/private-land/

Appendix S (continued). Existing federal, state, and private programs to assist collaborative efforts and individual landowners in maintaining and restoring ecosystem diversity in South Dakota.

South Dakota Department of Agriculture

Coordinated Natural Resources Conservation Grant Fund - Grants are available for projects that show a natural resource conservation benefit to the state. Any organized conservation district within the state may make an application to the State Conservation Commission. These grants are competitive in nature and there is limited funding for these grants.

For more information about this program, visit: http://sdda.sd.gov/grants/conservation-grant/

South Dakota Department of Environment and Natural Resources, Watershed Protection

Section 319 Nonpoint Source Pollution (NPS) Project Grant - 319 grant funds may be used for watershed assessment, planning and project implementation, or for ground water, and information and education projects that control or prevent NPS pollution.

For more information about this program, visit: http://denr.sd.gov/dfta/wp/wp.aspx

PRIVATE PROGRAMS AND SOURCES

Ducks Unlimited – Often works closely with USFWS Partners for Fish and Wildlife Program and/or South Dakota Department of Game, Fish and Parks' Wetland and Grassland Program to provide technical assistance and cost-share for wetland and grassland enhancement projects on private land. Some cost share programs are designed to be applied with monies from existing federal programs. Also works with federal agencies to secure funding for waterfowl production habitat protection. For more information call: (701) 355-3500.

The South Dakota Grassland Coalition – A non-profit organization of individuals, private organizations, and local, state and federal entities that partners with people working to voluntarily improve grasslands for the long term needs of the resource, people and the environment. The Coalition is a major partner in the Grassland Management and Planning Project which assists landowners with grazing and ranch management planning.

For more detailed information, visit: http://www.sdgrass.org/

The Nature Conservancy

Prairie Coteau Habitat Partnership – This program provides services for prescribed fire planning and more natural grazing regimes for landowners in the Prairie Coteau region of South Dakota.

For more information, visit:
http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/southdakota/fire-management-on-private-lands.xml

Appendix S (continued). Existing federal, state, and private programs to assist collaborative efforts and individual landowners in maintaining and restoring ecosystem diversity in South Dakota.

Rocky Mountain Elk Foundation

Permanent Land Protection - Through conservation easements and acquisitions, the Elk Foundation can forever protect crucial elk winter and summer ranges, migration corridors, calving grounds and other vital areas where habitat and wildlife are threatened by fragmentation and encroaching development.

Habitat Stewardship - Since healthy habitat is essential for healthy elk and other wildlife, the Elk Foundation helps fund and conduct a variety of projects to improve the essential forage, water, cover and space components of wildlife habitat. Restoring aspen communities, fighting the spread of noxious weed, and boosting rangeland productivity are just a few of the activities that we fund.

Conservation Education - Through outreach to young and old alike, the Elk Foundation is working to nurture a better understanding of the role people play in conserving elk, other wildlife and their habitat.

Sand County Foundation

Leopold Stewardship Fund - Provides incentives for private landowners who improve habitat on their own land for imperiled species. The resources of the Leopold Stewardship Fund provide direct grants to landowners for securing professional assistance in planning and implementing scientifically sound conservation actions, for undertaking specific actions beneficial to imperiled species, and for complying with applicable legal and regulatory requirements. The Leopold Stewardship Fund will seek to reduce the need to place species on the federal endangered species list.

The Bradley Fund for the Environment - Intended to foster ethically sound and science-based environmental programs that are leading edge solutions to major problems. Proposals that emphasize private responsibility, create sustaining partnerships and integrate habitat improvement with human considerations are solicited by Sand County Foundation on behalf of the Bradley Foundation.

Appendix T. Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T1. Bad/Choteau Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

BAD/CHOTEAU						
COA Name	**Acres**	**Aquatic SGCN**	**Public Lands**	**% Public**	**HSI**	**Major Stressors**
Bull Creek	1,657,787	False Map Turtle Higgin's Eye Mapleleaf Pallid Sturgeon Scaleshell Shovelnose Sturgeon Sicklefin Chub	Game Production Areas Parks and Recreation School and Public Lands Bureau of Land Mgmt Corps of Engineers USFWS Refuge Waterfowl Production Areas	3.6	418	Dams Hydrologic Alterations
Cedar Creek	106,513	Blue Sucker False Map Turtle	School and Public Lands Corps of Engineers Waterfowl Production Areas	18.8	314	Minor to Moderate Stressors Only
Choteau Creek	420,032	False Map Turtle Higgin's Eye Mapleleaf Pallid Sturgeon Scaleshell Sicklefin Chub Smooth Softshell	Game Production Areas Waterfowl Production Areas	0.9	318	Minor to Moderate Stressors Only
Emanuel Creek	125,066	Blue Sucker False Map Turtle Higgin's Eye Mapleleaf Pallid Sturgeon Scaleshell Shovelnose Sturgeon Sicklefin Chub Smooth Softshell	Game Production Areas Waterfowl Production Areas	2.1	418	Road-Stream Crossings
Ponca Creek	286,041	Northern Pearl Dace		0.1	416	Dams

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

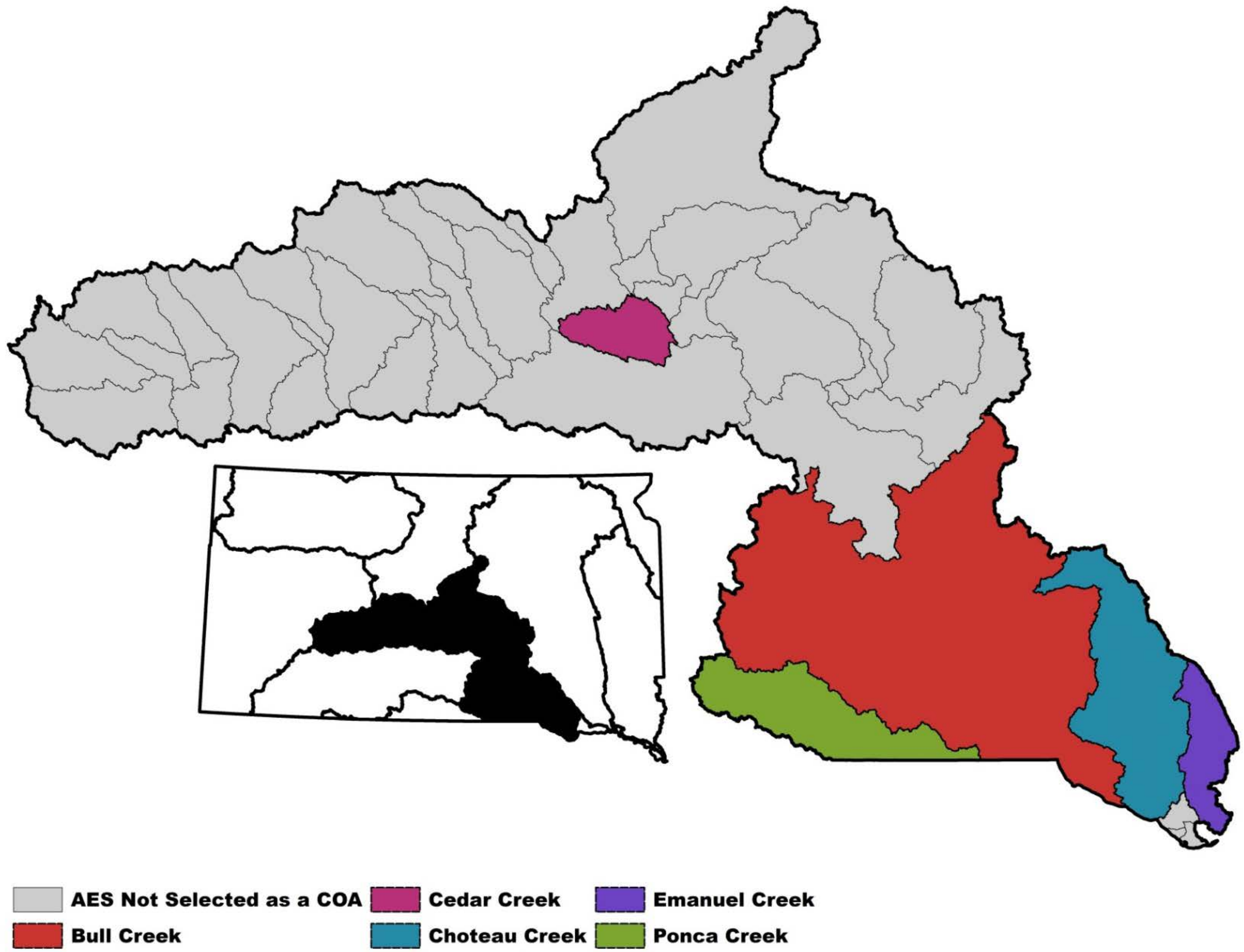


Figure T1. Bad/Choteau Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) map.

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T2. Big Sioux/Vermillion Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

BIG SIOUX/VERMILLION						
COA Name	**Acres**	**Aquatic SGCN**	**Public Lands**	**% Public**	**HSI**	**Major Stressors**
Big Sioux River	200,933	Creek Heelsplitter Elktoe Logperch Northern Redbelly Dace Stonefly Topeka Shiner Trout-perch	Game Production Areas Parks and Recreation Waterfowl Production Areas	3.4	317	Minor to Moderate Stressors Only
Brule Creek	72,296	Blackside Darter Creek Heelsplitter Elktoe False Map Turtle Hickorynut Logperch Mapleleaf Pimpleback Smooth Softshell Southern Redbelly Dace Stonefly Topeka Shiner Trout-perch Yellow Sandshell	Game Production Areas Waterfowl Production Areas	0.3	418	Dams
East Brule Creek	135,394	Blackside Darter Blue Sucker Creek Heelsplitter Elktoe	Parks and Recreation	0.4	420	Landuse Road-Stream Crossings

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T2 (continued). Big Sioux/Vermillion Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

BIG SIOUX/VERMILLION (continued)

COA Name	Acres	Aquatic SGCN	Public Lands	% Public	HSI	Major Stressors
East Brule Creek (continued)		Hickorynut				
		Logperch				
		Mapleleaf				
		Southern Redbelly Dace				
		Stonefly				
		Topeka Shiner				
		Trout-perch				
		Yellow Sandshell				
Pattee Creek	215,741	Blackside Darter	Game Production Areas	1.9	418	Dams
		Creek Heelsplitter	Parks and Recreation			
		Elktoe	Waterfowl Production Areas			
		Logperch				
		Mapleleaf				
		Pimpleback				
		Southern Redbelly Dace				
		Stonefly				
		Topeka Shiner				
		Trout-perch				
		Yellow Sandshell				
Silver Creek	83,709	Blackside Darter	Parks and Recreation	0.5	421	Impervious Surfaces
		Blue Sucker				Road-Stream Crossings
		Creek Heelsplitter				
		Elktoe				
		Logperch				
		Mapleleaf				

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T2 (continued). Big Sioux/Vermillion Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

Silver Creek (continued)	Pimpleback
	Southern Redbelly Dace
	Stonefly
	Topeka Shiner
	Trout-perch
	Yellow Sandshell

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

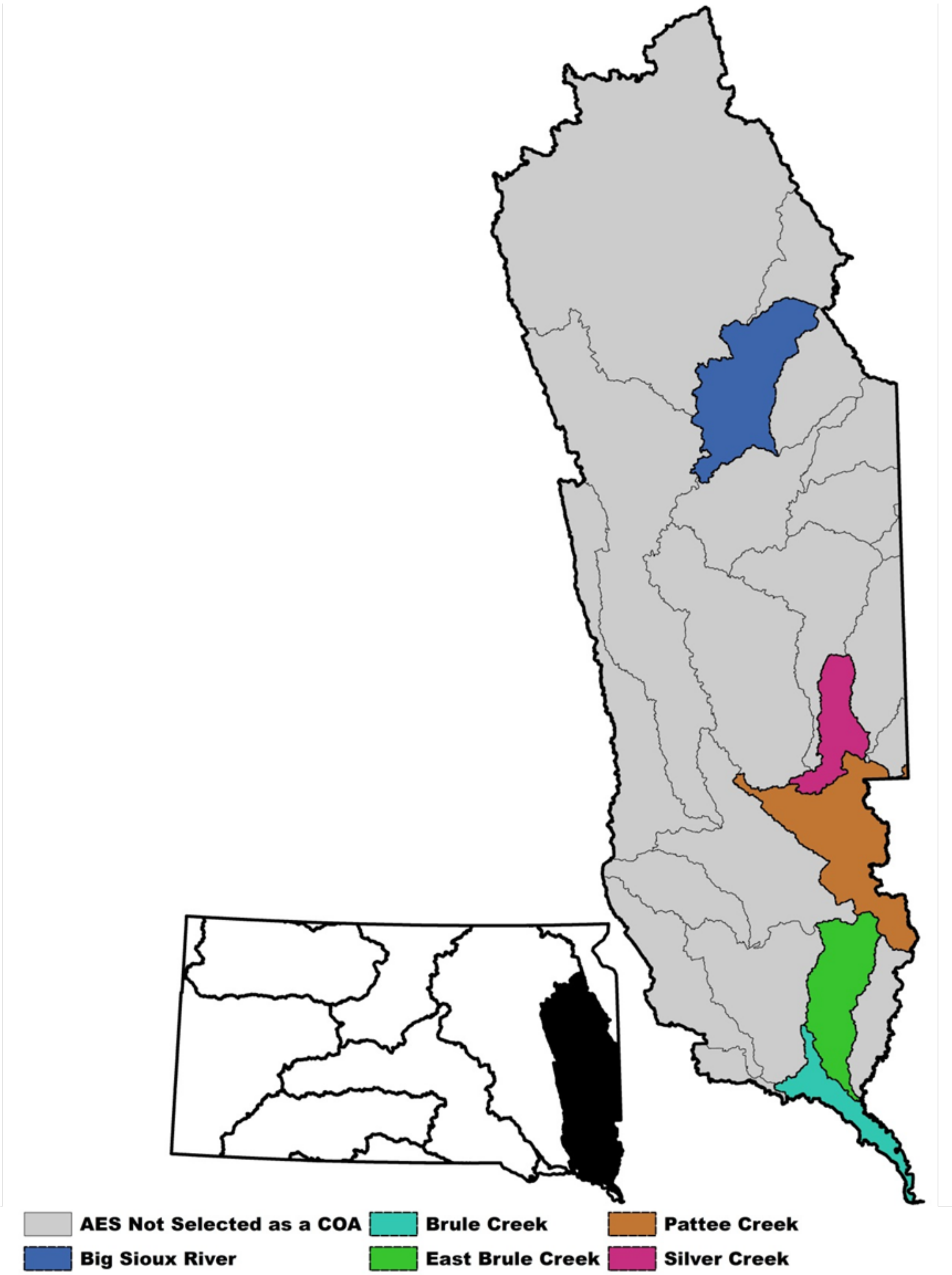


Figure T2. Big Sioux/Vermillion Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) map.

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T3. Cheyenne Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

CHEYENNE

COA Name	Acres	Aquatic SGCN	Public Lands	% Public	HSI	Major Stressors
Cherry Creek	16,632			0.0	210	Minor to Moderate Stressors Only
Cheyenne River	45,037	Finescale Dace Dot-winged Baskettail Mountain Sucker Stonefly Sturgeon Chub	School and Public Lands US Forest Service	44.2	210	Minor to Moderate Stressors Only
Cottonwood Springs Creek	104,452	Finescale Dace Dot-winged Baskettail Mountain Sucker Stonefly Sturgeon Chub	Game Production Areas Bureau of Land Mgmt US Forest Service National Park Service	34.1	415	Road-Stream Crossings
French Creek	172,409	Finescale Dace Dot-winged Baskettail Mountain Sucker Stonefly Sturgeon Chub	Parks and Recreation School and Public Lands US Forest Service	41.6	315	Minor to Moderate Stressors Only
Hat Creek	25,773		School and Public Lands US Forest Service	33.0	211	Minor to Moderate Stressors Only
Hay Creek	24,989	Finescale Dace Longnose Sucker Mountain Sucker	Bureau of Land Mgmt	0.3	313	Minor to Moderate Stressors Only
Indian Creek	89,486	Finescale Dace Dot-winged Baskettail Mountain Sucker Stonefly Sturgeon Chub	School and Public Lands Bureau of Land Mgmt US Forest Service National Park Service	58.4	210	Minor to Moderate Stressors Only

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T3 (continued). Cheyenne Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

CHEYENNE (continued)

COA Name	Acres	Aquatic SGCN	Public Lands	% Public	HSI	Major Stressors
Newton Fork	245,638	Finescale Dace	Game Production Areas	47.5	314	Minor to Moderate
		Dot-winged Baskettail	Parks and Recreation			Stressors Only
		Mountain Sucker	School and Public Lands			
		Stonefly	US Forest Service			
		Sturgeon Chub				
Rapid Creek	459,856	Lake Chub	School and Public Lands	52.8	416	Dams
		Longnose Sucker	Bureau of Land Mgmt			Road-Stream Crossings
		Mountain Sucker	US Forest Service			
Redwater Creek	76,562	Finescale Dace	Game Production Areas	48.7	313	Minor to Moderate
		Longnose Sucker	US Forest Service			Stressors Only
		Mountain Sucker				

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

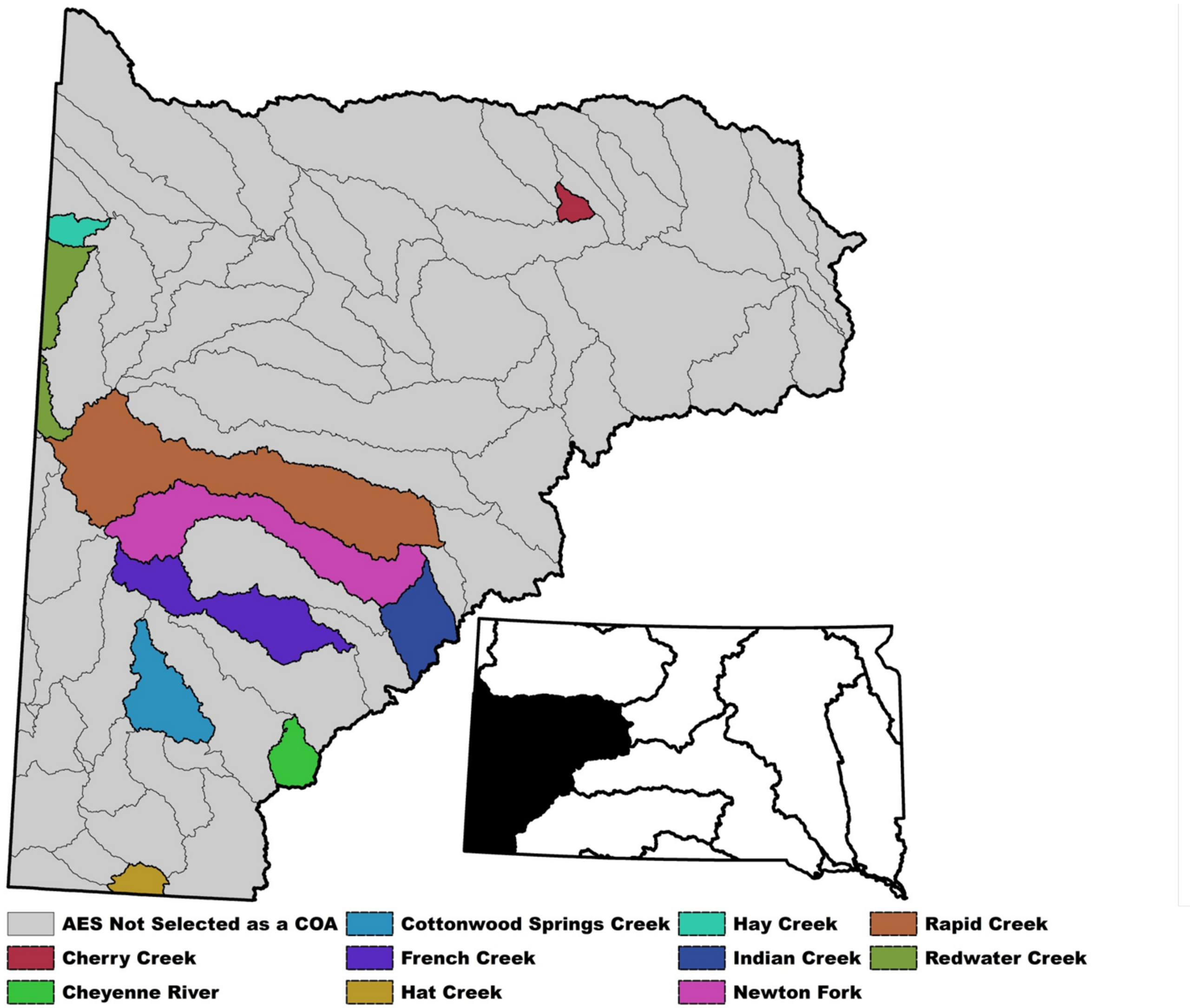


Figure T3. Cheyenne Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) map.

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T4. Grand/Moreau Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

GRAND/MOREAU						
COA Name	**Acres**	**Aquatic SGCN**	**Public Lands**	**% Public**	**HSI**	**Major Stressors**
Fourmile Creek	56,735		School and Public Lands Bureau of Land Mgmt	40.0	210	Minor to Moderate Stressors Only
Grand River	461,643	False Map Turtle	School and Public Lands Corps of Engineers	2.2	416	Hydrologic Alterations
Little Moreau River	353,507		Game Production Areas Parks and Recreation School and Public Lands	1.2	413	Dams

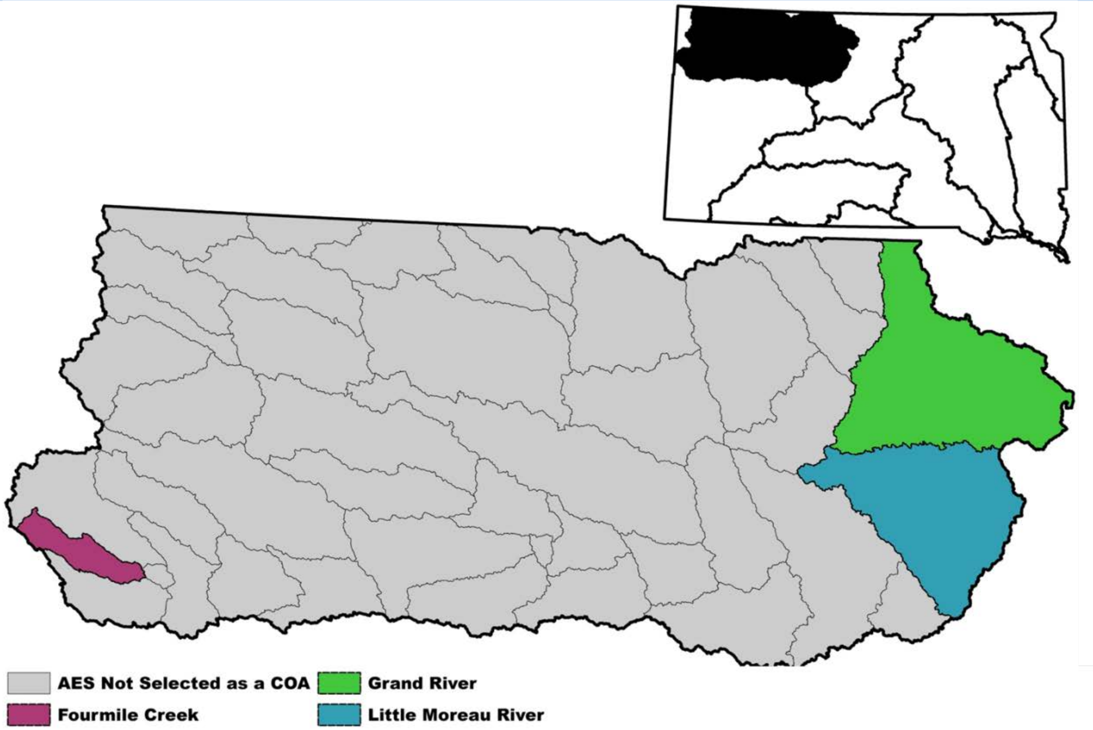


Figure T4. Grand/Moreau Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) map.

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T5. Heart Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

HEART						
COA Name	**Acres**	**Aquatic SGCN**	**Public Lands**	**% Public**	**HSI**	**Major Stressors**
Roger Creek	58,092			2.5	212	Minor to Moderate Stressors Only

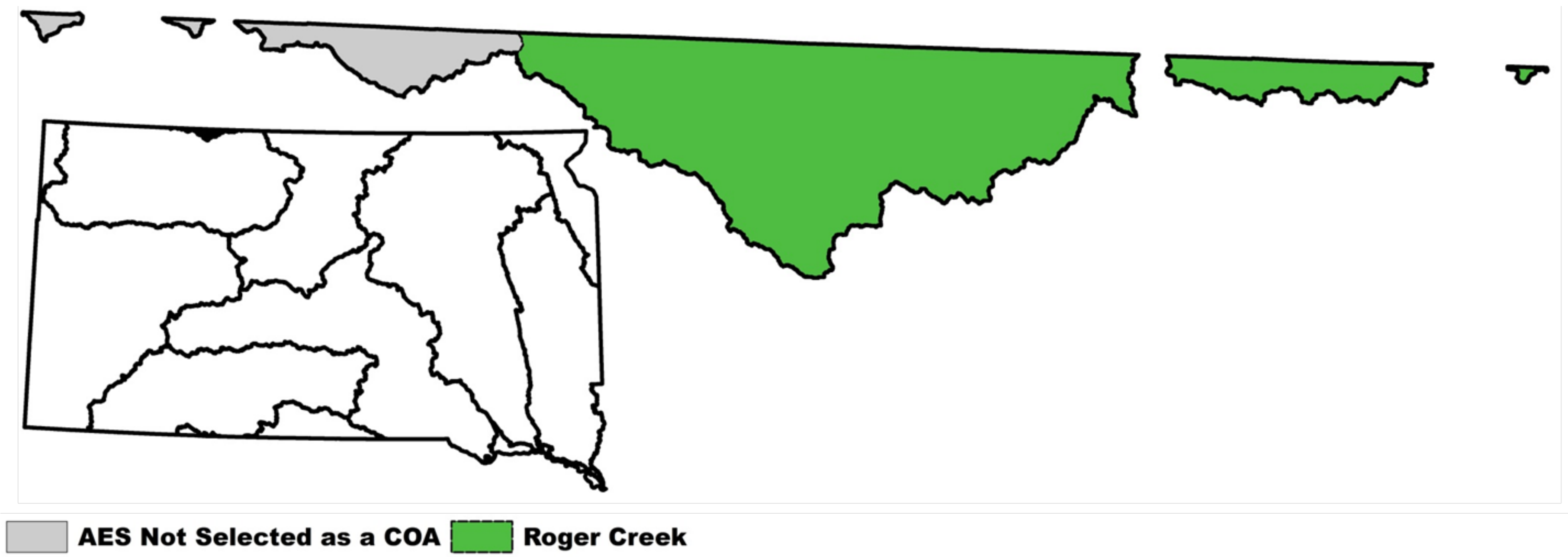


Figure T5. Heart Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) map.

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T6. James Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

JAMES						
COA Name	**Acres**	**Aquatic SGCN**	**Public Lands**	**% Public**	**HSI**	**Major Stressors**
Beaver Creek	464,043	Blue Sucker Hickorynut Mapleleaf Pimpleback Rock Pocketbook Smooth Softshell Topeka Shiner Yellow Sandshell	Game Production Areas Waterfowl Production Areas	0.5	317	Minor to Moderate Stressors Only
Firesteel Creek	442,873	Blue Sucker Hickorynut Mapleleaf Pimpleback Rock Pocketbook Smooth Softshell Topeka Shiner Yellow Sandshell	Game Production Areas School and Public Lands Waterfowl Production Areas	1.6	215	Minor to Moderate Stressors Only
Wolf Creek	259,582	Blue Sucker Hickorynut Mapleleaf Pimpleback Rock Pocketbook Smooth Softshell Topeka Shiner Yellow Sandshell	Game Production Areas Waterfowl Production Areas	1.2	316	Minor to Moderate Stressors Only

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

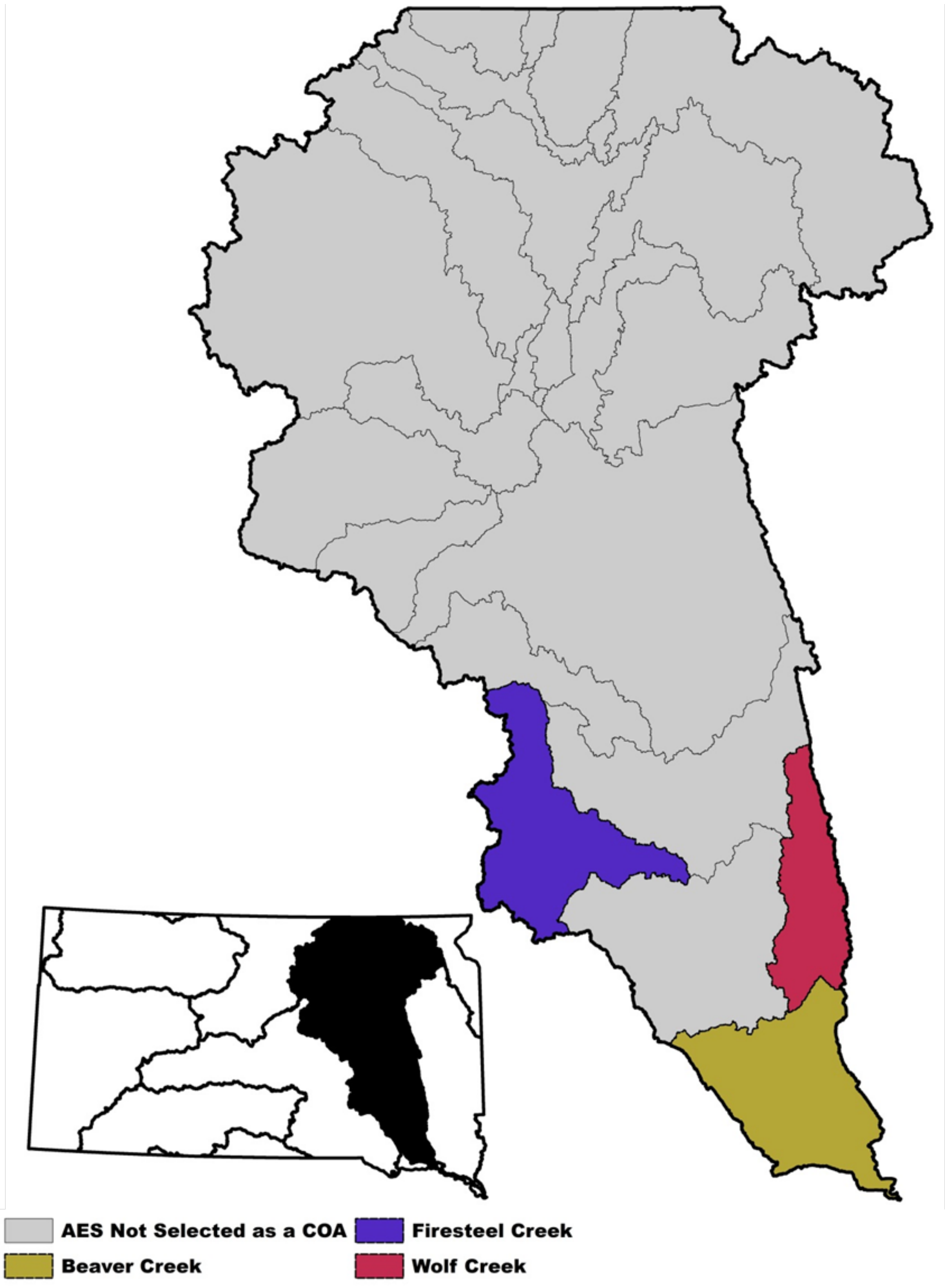


Figure T6. James Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) map.

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T7. Little Missouri Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

LITTLE MISSOURI						
COA Name	**Acres**	**Aquatic SGCN**	**Public Lands**	**% Public**	**HSI**	**Major Stressors**
Boxelder Creek	18,596		School and Public Lands Bureau of Land Mgmt	9.7	413	Dams
Little Missouri River	317,939		Game Production Areas School and Public Lands Bureau of Land Mgmt US Forest Service	22.1	415	Dams

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

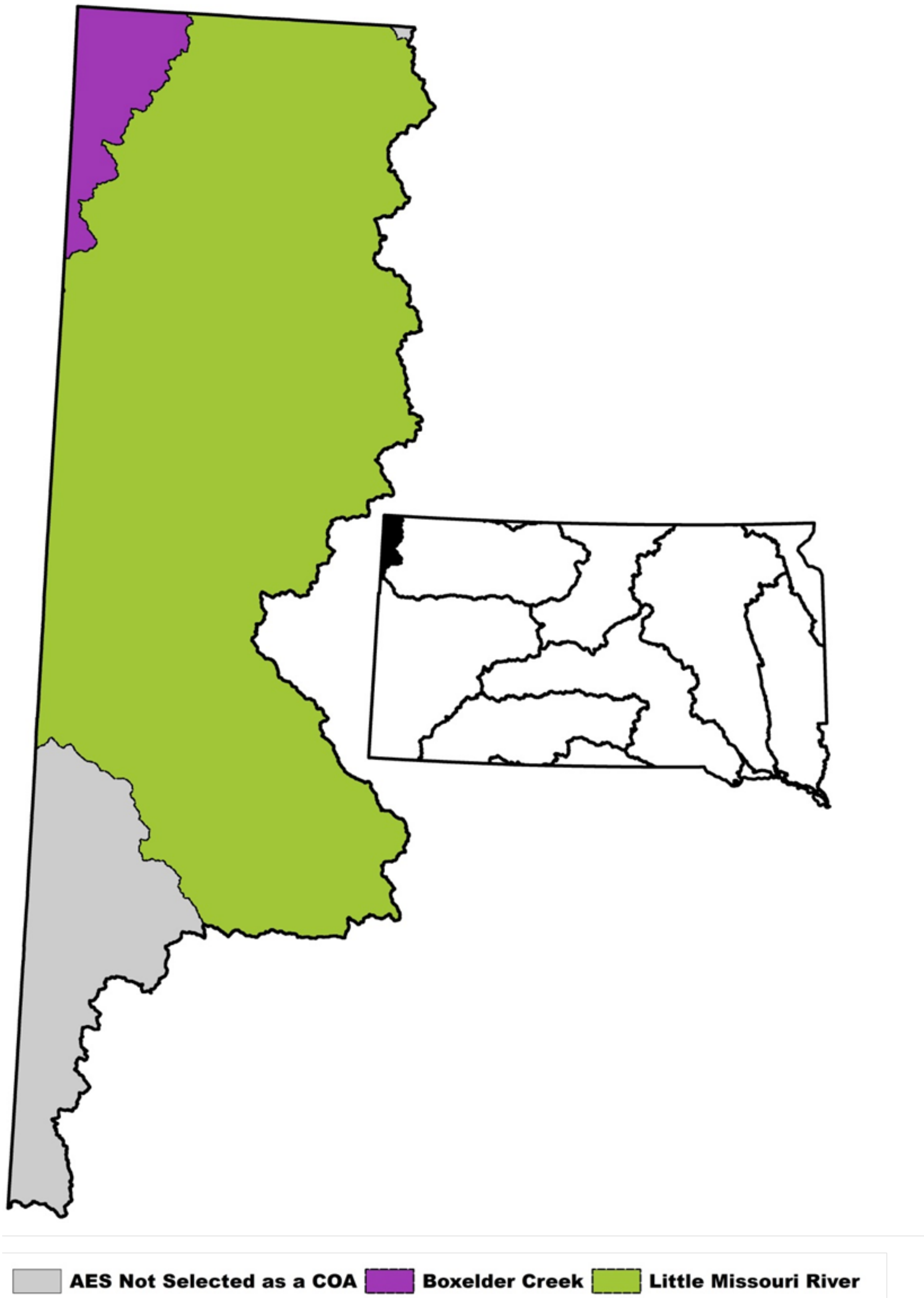


Figure T7. Little Missouri Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) map.

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T8. Little Sioux/Nemaha Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

LITTLE SIOUX/NEMAHA						
COA Name	**Acres**	**Aquatic SGCN**	**Public Lands**	**% Public**	**HSI**	**Major Stressors**
Aowa Creek	24,738	False Map Turtle Higgin's Eye Mapleleaf Pallid Sturgeon Scaleshell Shovelnose Sturgeon Sicklefin Chub Smooth Softshell	Parks and Recreation	6.0	315	Minor to Moderate Stressors Only
Elk Creek	1	Blue Sucker Higgin's Eye Mapleleaf Scaleshell		0.0	316	Minor to Moderate Stressors Only
Missouri River	38,510	False Map Turtle Sicklefin Chub	Game Production Areas Waterfowl Production Areas	1.4	315	Minor to Moderate Stressors Only
Snatch Creek	150,363	False Map Turtle Higgin's Eye Mapleleaf Pallid Sturgeon Scaleshell Shovelnose Sturgeon Sicklefin Chub Smooth Softshell		1.8	420	Hydrologic Alterations Road-Stream Crossings

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

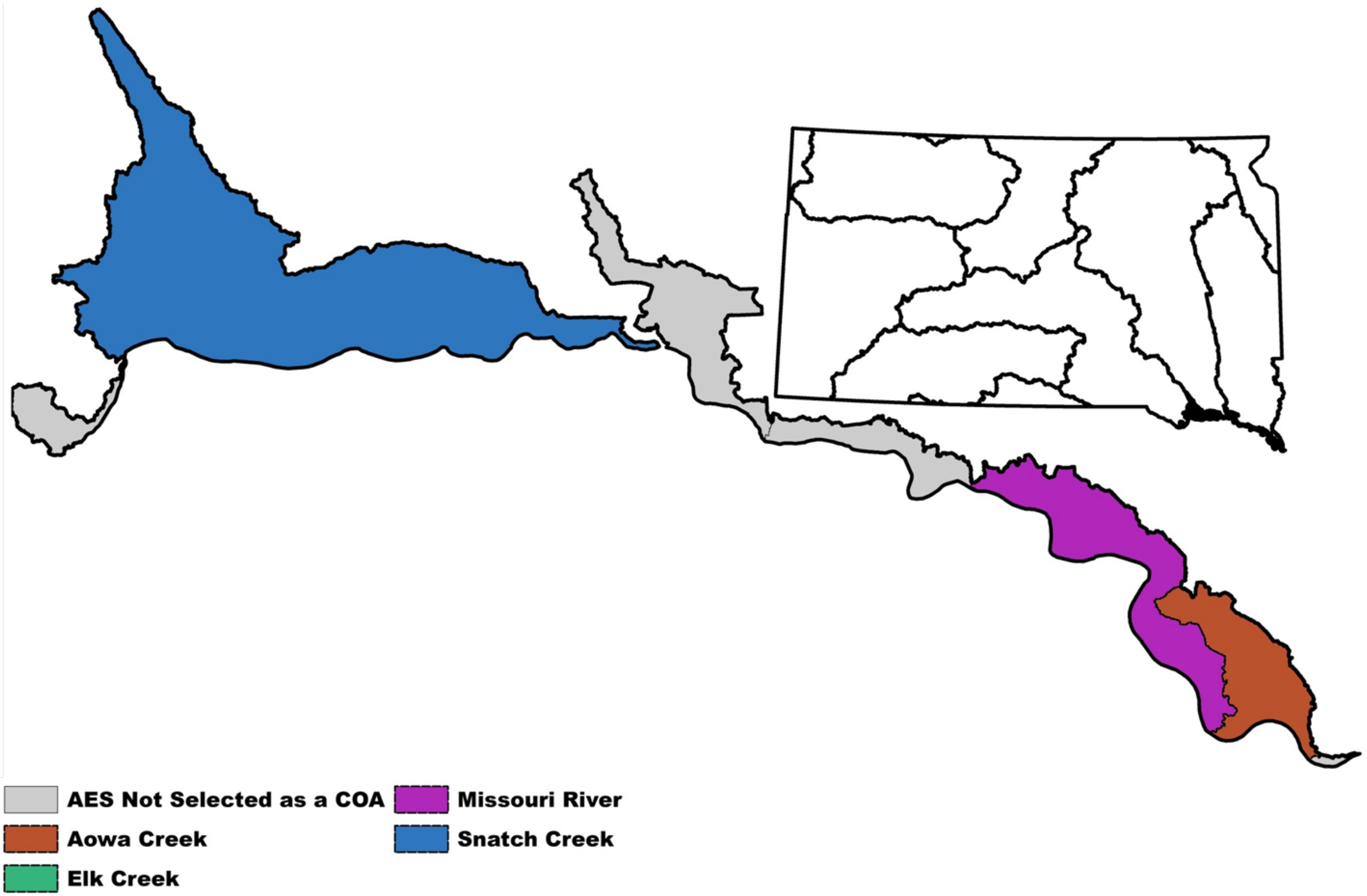


Figure T8. Little Sioux/Nemaha Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) map.

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T9. Middle Missouri Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

MIDDLE MISSOURI						
COA Name	**Acres**	**Aquatic SGCN**	**Public Lands**	**% Public**	**HSI**	**Major Stressors**
Hermaphrodite Creek	74,835	Blue Sucker	Game Production Areas	0.1	213	Minor to Moderate Stressors Only
Hunkpapa Creek	62,263	False Map Turtle Shovelnose Sturgeon	Game Production Areas Corps of Engineers	5.3	415	Hydrologic Alterations
Moreau River	129,363	False Map Turtle Shovelnose Sturgeon	Corps of Engineers	0.0	415	Hydrologic Alterations
Oak Creek	198,948	False Map Turtle Shovelnose Sturgeon	School and Public Lands Corps of Engineers	1.4	316	Minor to Moderate Stressors Only
Spring Creek	969,015	False Map Turtle	Game Production Areas Parks and Recreation School and Public Lands Corps of Engineers Waterfowl Production Areas	4.0	418	Dams

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

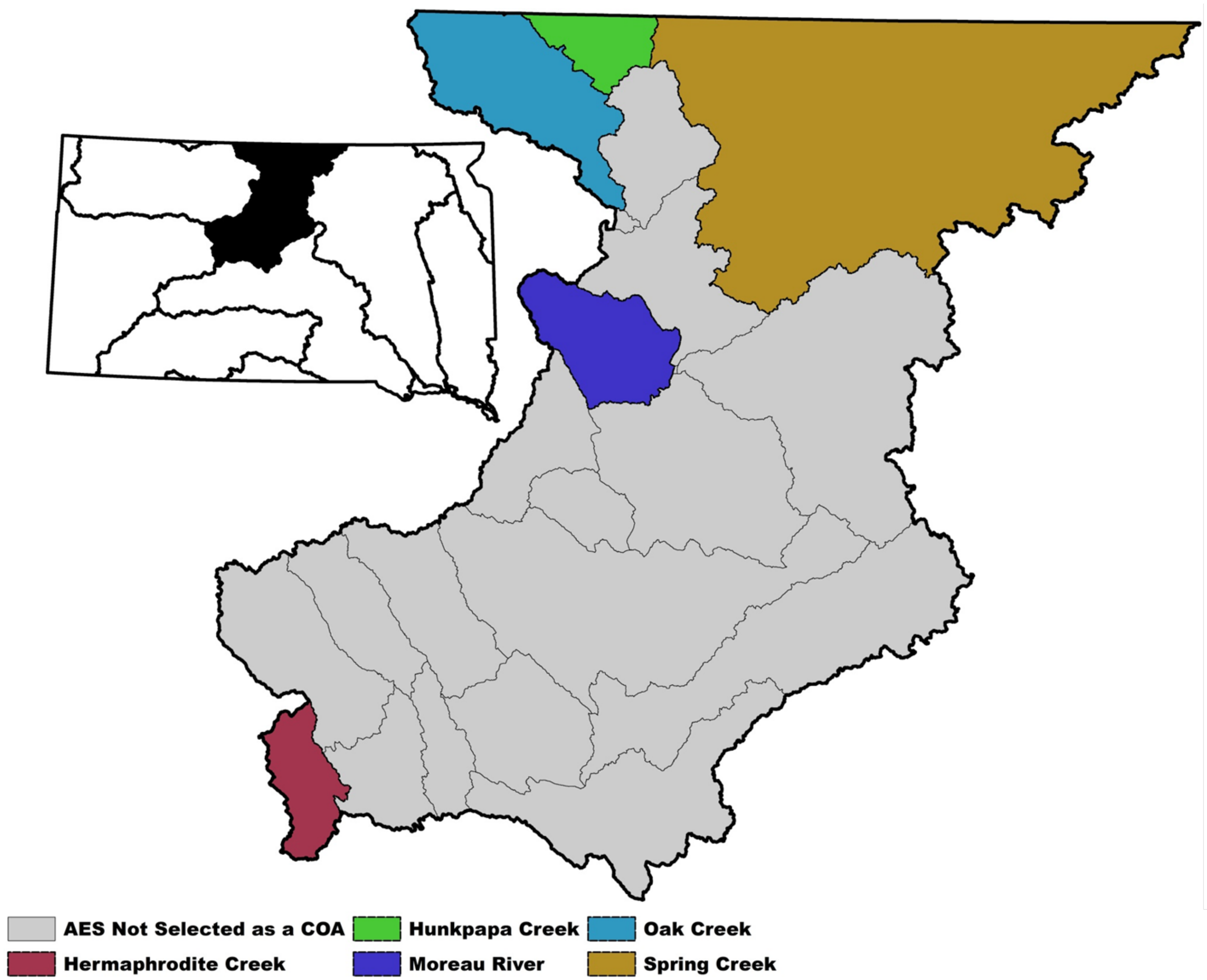


Figure T9. Middle Missouri Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) map.

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T10. Niobrara Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

NIOBRARA						
COA Name	**Acres**	**Aquatic SGCN**	**Public Lands**	**% Public**	**HSI**	**Major Stressors**
Keya Paha River	673,513	Blacknose Shiner Northern Redbelly Dace Northern Pearl Dace Stonefly	Game Production Areas School and Public Lands	0.3	415	Dams
Niobrara River	102	Blue Sucker False Map Turtle Higgin's Eye Mapleleaf Pallid Sturgeon Scaleshell Shovelnose Sturgeon Sicklefin Chub Smooth Softshell		0.0	212	Minor to Moderate Stressors Only

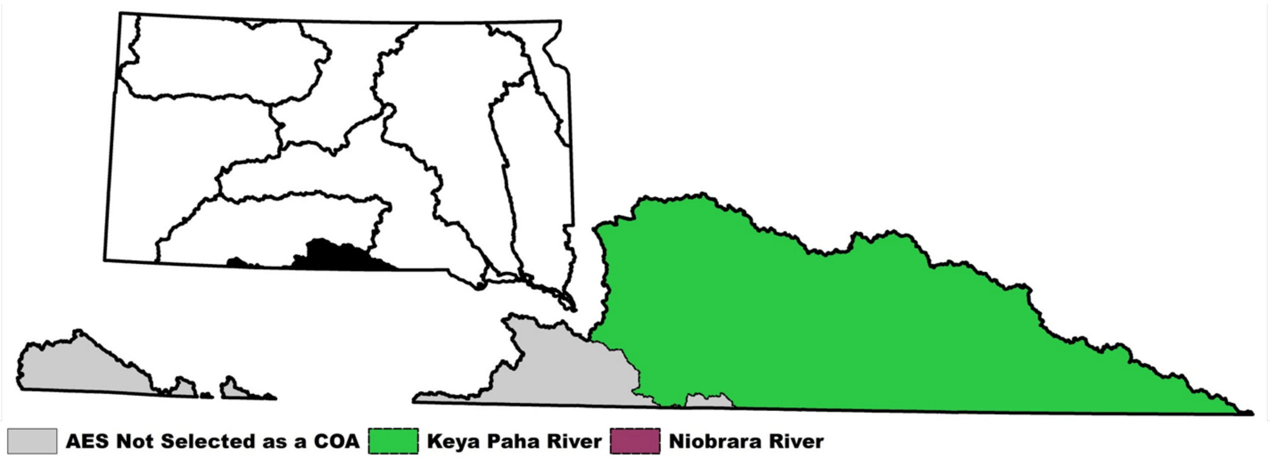


Figure T10. Niobrara Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) map.

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T11. White Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

WHITE						
COA Name	**Acres**	**Aquatic SGCN**	**Public Lands**	**% Public**	**HSI**	**Major Stressors**
Cut Meat Creek	108,761	Finescale Dace Northern Redbelly Dace Northern Pearl Dace Sturgeon Chub		0.0	213	Minor to Moderate Stressors Only
Lake Creek	649,637	Finescale Dace Northern Redbelly Dace Northern Pearl Dace Sturgeon Chub	Game Production Areas School and Public Lands USFWS Refuge	4.1	313	Minor to Moderate Stressors Only
Little White River	52,323	Finescale Dace Northern Redbelly Dace Northern Pearl Dace Sturgeon Chub	School and Public Lands	0.8	414	Dams
Pine Creek	83,811	Finescale Dace Northern Redbelly Dace Northern Pearl Dace Sturgeon Chub	School and Public Lands	2.5	413	Dams
White Thunder Creek	107,156	Northern Pearl Dace Sturgeon Chub Stonefly	School and Public Lands	1.6	315	Minor to Moderate Stressors Only

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

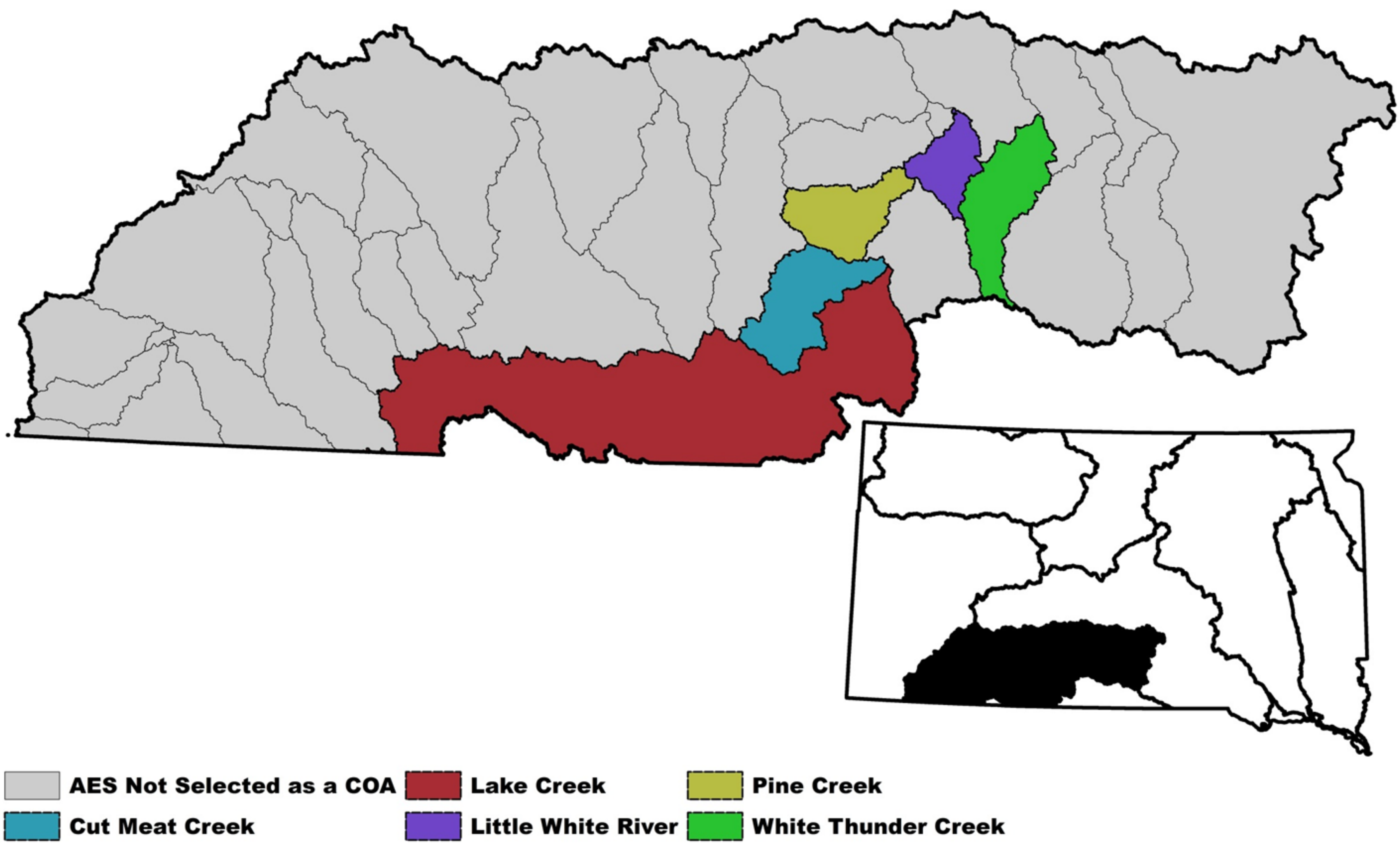


Figure T11. White Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) map.

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

Table T12. Upper Minnesota River Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) descriptions.

UPPER MINNESOTA						
COA Name	**Acres**	**Aquatic SGCN**	**Public Lands**	**% Public**	**HSI**	**Major Stressors**
Cobb Creek	216,026	Banded Killifish Blackside Darter Creek Heelsplitter Hornyhead Chub Northern Redbelly Dace	Game Production Areas Parks and Recreation Waterfowl Production Areas	2.9	NA	NA
Little Minnesota River	858,501	Blackside Darter Carmine Shiner Central Mudminnow Creek Heelsplitter Hornyhead Chub	Game Production Areas Parks and Recreation Waterfowl Production Areas	1.9	NA	NA
Upper Yellow Medicine River	92	Stonefly		0.0	NA	NA
Wild Rice River	135,036		Game Production Areas School and Public Lands Waterfowl Production Areas	1.9	NA	NA

Appendix T (continued). Descriptions of aquatic Conservation Opportunity Areas (COAs) by Ecological Drainage Unit (EDU) and associated maps.

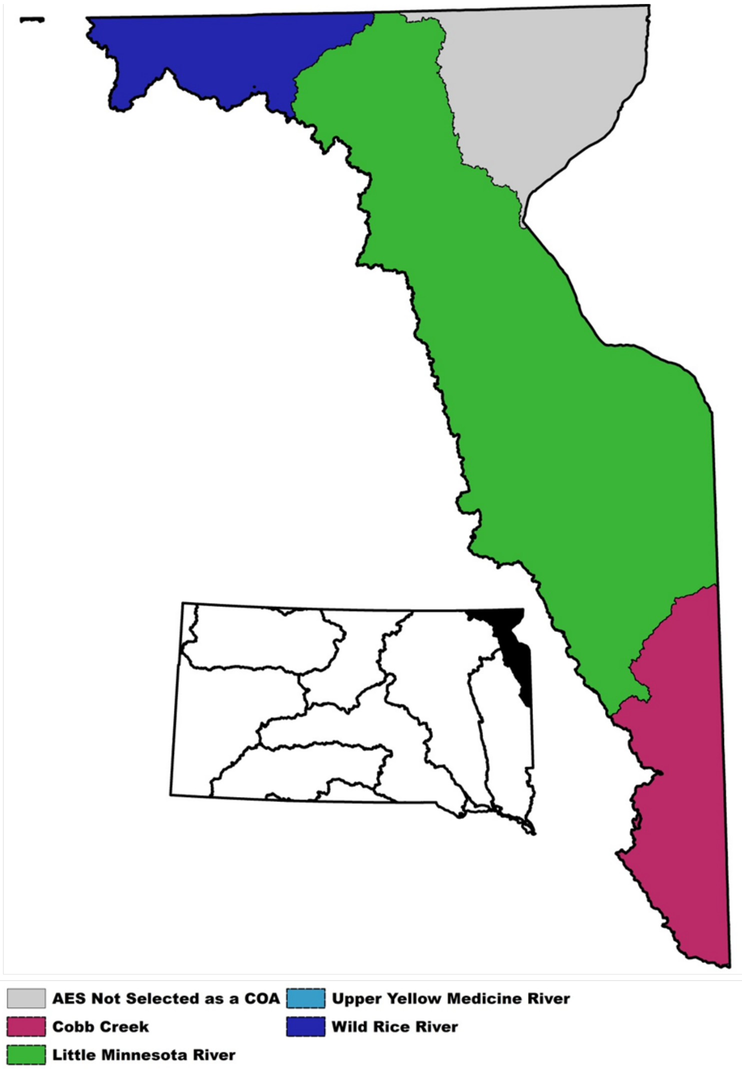


Figure T12. Upper Minnesota Ecological Drainage Unit (EDU) Conservation Opportunity Area (COA) map.

Appendix U. Aquatic species of greatest conservation need with associated Conservation Opportunity Areas (COA) and total number of acres contained within a COA.

Aquatic SGCN	# of COAs	COA Name	Total Acres
Banded Killifish	1	Cobb Creek	216,026
Blacknose Shiner	1	Keya Paha River	673,513
Blackside Darter	6	Brule Creek	1,581,667
		East Brule Creek	
		Pattee Creek	
		Silver Creek	
		Cobb Creek	
		Little Minnesota River	
Blue Sucker	10	Beaver Creek	1,692,119
		Cedar Creek	
		East Brule Creek	
		Elk Creek	
		Emanuel Creek	
		Firesteel Creek	
		Hermaphrodite Creek	
		Niobrara River	
		Silver Creek	
		Wolf Creek	
Carmine Shiner	1	Little Minnesota River	858,501
Central Mudminnow	1	Little Minnesota River	858,501

Appendix U (continued). Aquatic species of greatest conservation need with associated Conservation Opportunity Areas (COA) and total number of acres contained within a COA.

Aquatic SGCN	# of COAs	COA Name	Total Acres
Finescale Dace	11	Cheyenne River	1,653,105
		Cottonwood Springs Creek	
		French Creek	
		Hay Creek	
		Indian Creek	
		Newton Fork	
		Redwater Creek	
		Cut Meat Creek	
		Lake Creek	
		Little White River	
		Pine Creek	
Hornyhead Chub	2	Cobb Creek	1,074,527
		Little Minnesota River	
Lake Chub	1	Rapid Creek	459,856
Logperch	5	Big Sioux River	708,073
		Brule Creek	
		East Brule Creek	
		Pattee Creek	
		Silver Creek	
Longnose Sucker	3	Hay Creek	561,407
		Rapid Creek	
		Redwater Creek	

Appendix U (continued). Aquatic species of greatest conservation need with associated Conservation Opportunity Areas (COA) and total number of acres contained within a COA.

Aquatic SGCN	# of COAs	COA Name	Total Acres
Mountain Sucker	8	Cheyenne River	1,218,429
		Cottonwood Springs Creek	
		French Creek	
		Hay Creek	
		Indian Creek	
		Newton Fork	
		Rapid Creek	
		Redwater Creek	
Northern Pearl Dace	7	Ponca Creek	1,961,242
		Keya Paha River	
		Cut Meat Creek	
		Lake Creek	
		Little White River	
		Pine Creek	
		White Thunder Creek	
Northern Redbelly Dace	7	Big Sioux River	1,985,004
		Keya Paha River	
		Cut Meat Creek	
		Lake Creek	
		Little White River	
		Pine Creek	
		Cobb Creek	

Appendix U (continued). Aquatic species of greatest conservation need with associated Conservation Opportunity Areas (COA) and total number of acres contained within a COA.

Aquatic SGCN	# of COAs	COA Name	Total Acres
Pallid Sturgeon	6	Bull Creek	2,378,088
		Choteau Creek	
		Emanuel Creek	
		Aowa Creek	
		Snatch Creek	
		Niobrara River	
Shovelnose Sturgeon	8	Bull Creek	2,348,630
		Emanuel Creek	
		Aowa Creek	
		Snatch Creek	
		Hunkpapa Creek	
		Moreau River	
		Oak Creek	
		Niobrara River	
Sicklefin Chub	7	Bull Creek	2,416,598
		Choteau Creek	
		Emanuel Creek	
		Aowa Creek	
		Missouri River	
		Snatch Creek	
		Niobrara River	
Southern Redbelly Dace	4	Brule Creek	507,140
		East Brule Creek	
		Pattee Creek	
		Silver Creek	

Appendix U (continued). Aquatic species of greatest conservation need with associated Conservation Opportunity Areas (COA) and total number of acres contained within a COA.

Aquatic SGCN	# of COAs	COA Name	Total Acres
Sturgeon Chub	10	Cheyenne River	1,658,710
		Cottonwood Springs Creek	
		French Creek	
		Indian Creek	
		Newton Fork	
		Cut Meat Creek	
		Lake Creek	
		Little White River	
		Pine Creek	
		White Thunder Creek	
Topeka Shiner	8	Big Sioux River	1,874,571
		Brule Creek	
		East Brule Creek	
		Pattee Creek	
		Silver Creek	
		Beaver Creek	
		Firesteel Creek	
		Wolf Creek	
Trout-perch	5	Big Sioux River	708,073
		Brule Creek	
		East Brule Creek	
		Pattee Creek	
		Silver Creek	

Appendix U (continued). Aquatic species of greatest conservation need with associated Conservation Opportunity Areas (COA) and total number of acres contained within a COA.

Aquatic SGCN	# of COAs	COA Name	Total Acres
Creek Heelsplitter	7	Big Sioux River	1,782,600
		Brule Creek	
		East Brule Creek	
		Pattee Creek	
		Silver Creek	
		Cobb Creek	
		Little Minnesota River	
Elktoe	5	Big Sioux River	708,073
		Brule Creek	
		East Brule Creek	
		Pattee Creek	
		Silver Creek	
Hickorynut	6	Brule Creek	1,589,929
		East Brule Creek	
		Pattee Creek	
		Beaver Creek	
		Firesteel Creek	
		Wolf Creek	
Higgin's Eye	7	Bull Creek	2,378,089
		Choteau Creek	
		Emanuel Creek	
		Aowa Creek	
		Elk Creek	
		Snatch Creek	
		Niobrara River	

Appendix U (continued). Aquatic species of greatest conservation need with associated Conservation Opportunity Areas (COA) and total number of acres contained within a COA.

Aquatic SGCN	# of COAs	COA Name	Total Acres
Mapleleaf	14	Bull Creek	4,051,727
		Choteau Creek	
		Emanuel Creek	
		Brule Creek	
		East Brule Creek	
		Pattee Creek	
		Silver Creek	
		Beaver Creek	
		Firesteel Creek	
		Wolf Creek	
		Aowa Creek	
		Elk Creek	
		Snatch Creek	
		Niobrara River	
Pimpleback	7	Brule Creek	1,673,638
		East Brule Creek	
		Pattee Creek	
		Silver Creek	
		Beaver Creek	
		Firesteel Creek	
		Wolf Creek	
Rock Pocketbook	3	Beaver Creek	1,166,498
		Firesteel Creek	
		Wolf Creek	

Appendix U (continued). Aquatic species of greatest conservation need with associated Conservation Opportunity Areas (COA) and total number of acres contained within a COA.

Aquatic SGCN	# of COAs	COA Name	Total Acres
Scaleshell	7	Bull Creek	2,378,089
		Choteau Creek	
		Emanuel Creek	
		Aowa Creek	
		Elk Creek	
		Snatch Creek	
		Niobrara River	
Yellow Sandshell	7	Brule Creek	1,673,638
		East Brule Creek	
		Pattee Creek	
		Silver Creek	
		Beaver Creek	
		Firesteel Creek	
Dot-winged Baskettail	5	Cheyenne River	657,022
		Cottonwood Springs Creek	
		French Creek	
		Indian Creek	
		Newton Fork	
Stonefly	13	Big Sioux River	2,145,856
		Brule Creek	
		East Brule Creek	
		Pattee Creek	
		Silver Creek	
		Cheyenne River	
		Cottonwood Springs Creek	

Appendix U (continued). Aquatic species of greatest conservation need with associated Conservation Opportunity Areas (COA) and total number of acres contained within a COA.

Aquatic SGCN	# of COAs	COA Name	Total Acres
Stonefly (continued)		French Creek	
		Indian Creek	
		Newton Fork	
		Keya Paha River	
		White Thunder Creek	
		Upper Yellow Medicine River	
False Map Turtle	14	Bull Creek	4,416,639
		Cedar Creek	
		Choteau Creek	
		Emanuel Creek	
		Brule Creek	
		Grand River	
		Aowa Creek	
		Missouri River	
		Snatch Creek	
		Hunkpapa Creek	
		Moreau River	
		Oak Creek	
		Spring Creek	
		Niobrara River	

Appendix U (continued). Aquatic species of greatest conservation need with associated Conservation Opportunity Areas (COA) and total number of acres contained within a COA.

Aquatic SGCN	# of COAs	COA Name	Total Acres
Smooth Softshell	9	Choteau Creek	1,959,095
		Emanuel Creek	
		Brule Creek	
		Beaver Creek	
		Firesteel Creek	
		Wolf Creek	
		Aowa Creek	
		Snatch Creek	
		Niobrara River	

Appendix V. Land and resource agencies, universities, and tribes contacted during Wildlife Action Plan Revision

Name	Location
U.S. Fish and Wildlife Service, Ecological Services	Pierre, SD
U.S. Fish and Wildlife, Partners for Wildlife Program	Brookings, SD
U.S. Fish and Wildlife Service, Sand Lake National Wildlife Refuge	Columbia, SD
U.S. Fish and Wildlife Service, Waubay National Wildlife Refuge	Waubay, SD
U.S. Fish and Wildlife Service, LaCreek National Wildlife Refuge	Martin, SD
U.S. Fish and Wildlife Service, Lake Andes National Wildlife Refuge	Lake Andes, SD
Bureau of Land Management	Belle Fourche, SD
Bureau of Reclamation	Bismarck, ND
Bureau of Indian Affairs	Aberdeen, SD
U.S. Forest Service, Nebraska National Forest	Chadron, NE
U.S. Forest Service, Fort Pierre Ranger District	Fort Pierre, SD
U.S. Forest Service, Fall River Ranger District	Hot Springs, SD
U.S. Forest Service, Wall Ranger District	Wall, SD
Badlands National Park	Interior, SD
Wind Cave National Park	Hot Springs, SD
Jewel Cave National Park	Custer, SD
U.S. Forest Service, Dakota Prairie Grassland	Bismarck, ND
U.S. Forest Service, Black Hills National Forest	Custer, SD
U.S. Forest Service, Rocky Mountain Research Station	Rapid City, SD
Cheyenne River Sioux Tribe	Eagle Butte, SD
Oglala Sioux Tribe	Pine Ridge, SD
Oglala Sioux Parks and Recreation Authority	Kyle, SD

Appendix V (continued). Land and resource agencies, universities, and tribes contacted during Wildlife Action Plan Revision.

Standing Rock Sioux Tribe	Fort Yates, ND
Crow Creek Sioux Tribe	Fort Thompson, SD
Lower Brule Sioux Tribe	Lower Brule, SD
Sisseton-Wahpeton Oyate	Agency Village, SD
Flandreau Santee Sioux Tribe	Flandreau, SD
Rosebud Sioux Tribe	Rosebud, SD
U.S. Department of Agriculture, Natural Resources Conservation Service	Huron, SD
U.S. Park Service, Missouri National Recreational River	Yankton, SD
U.S. Geological Survey, Missouri River Coordinator	Yankton, SD
U.S. Geological Survey, Plains and Prairie Potholes Landscape Conservation Cooperative	Bismarck, ND
Prairie Pothole Joint Venture	Bismarck, ND
Northern Great Plains Joint Venture	Bismarck, ND
U.S. Fish and Wildlife Service, Huron Wetland Management District	Huron, SD
U.S. Fish and Wildlife Service, Madison Wetland Management District	Madison, SD
South Dakota Department of Environment and Natural Resources	Pierre, SD
South Dakota Department of Agriculture	Pierre, SD
South Dakota Department of Transportation	Pierre, SD
South Dakota Department of Tribal Relations	Pierre, SD
South Dakota State University, Department of Natural Resources	Brookings, SD
University of South Dakota, Department of Biology	Vermillion, SD
Black Hills State University, School of Natural Sciences	Spearfish, SD
Northern State University, Department of Biology	Aberdeen, SD

Appendix V (continued). Land and resource agencies, universities, and tribes contacted during Wildlife Action Plan Revision.

South Dakota Office of School and Public Lands	Pierre, SD
U.S. Army Corps of Engineers, Gavins Point Project	Yankton, SD
U.S. Army Corps of Engineers, Fort Randall Project	Pickstown, SD
U.S. Army Corps of Engineers, Oahe Project	Pierre, SD
U.S. Army Corps of Engineers, Big Bend Project	Chamberlain, SD
U.S. Army Corps of Engineers, Threatened and Endangered Species Program	Yankton, SD
South Dakota Governor's Office	Pierre, SD
Northern Prairies Land Trust	Sioux Falls, SD

Appendix W. Comments received during Plan review period (May 7 – June 6, 2014) and associated resolution of suggested input.

From: Larry E. Lewis [mailto:lew@nrctv.com]
Sent: Sunday, May 11, 2014 4:14 AM
To: GFP Wild Info
Cc: info@iwla.org
Subject: The South Dakota Wildlife Action Plan

Recently I have been watching with dismay as old tree groves, former building sites and wetlands are drained/destroyed.....most if it on private land where GFP and other public rights authorities have minimal authority to act on behalf of the public's interest. However, when the activity reaches the nearest public right-of-way (ROW) typically no one is there to represent the public interest and regulate activities.

South Dakota is laced with public road systems and ROW's that are impacted by and often facilitate such destruction by virtue of the authorities involved not exercising their authority and responsibility to regulate activities like wetland drainage, and farming encroachment occurring within our public road ROW's.

As a Wildlife Agency SDGFP shares this oversight responsibility with many other agencies, particularly township, county, state and federal highway authorities. Please commit staff and dollars to this very important need. High ag prices have caused habitat losses and aggressive behaviors in farming public ROW's that I witnessed in Minnesota. By the default practice of claiming you have no authority to regulate such activities you as an agency can destroy more habitat in the next few years that you will ever be able to purchase and protect via other means in an equal amount of time.

What needs to happen:

- Rally support from others with an interest such as the Izaak Walton League, Pheasants Forever, Ducks Unlimited, US Fish & Wildlife, etc.
- Rally support from township, county, state and federal highway authorities charged with enforcing existing policy protecting public ROW's
- Support and, when necessary, force those responsible for public ROW protection to defend, maintain and protect the public's interest in this existing, yet diminishing public recourse.

Your inclusion of this in your long term action plan would be appreciated, but more importantly, it deserves immediate attention and an organized effort to immediately curtail and control ROW habitat destruction. Greed rarely comes with a conscience, so when trees are removed, fencelines are removed, ditches are dug.......some authority needs to be there to properly mark and defend ROW boundaries. South Dakota citizens deserve that much from the organization charged with wildlife management within its boundaries!

Your consideration of my comments are appreciated;

Sincerely,

Larry Lewis
40751 102nd St.
Hecla, SD 57446
Ph - 605-994-7446 (cel)
lew@nrctv.com

SDGFP response: SDGFP regularly reminds the public and other agencies of mowing date restrictions on rights-of-ways covered by such restrictions. SDGFP has also encouraged the South Dakota Department of Transportation to use seed mixes that are more favorable to wildlife use than smooth brome. An additional bullet point was added to Conservation Actions Summary to represent this concern.

Appendix W (continued). Comments received during Plan review period (May 7 – June 6, 2014) and associated resolution of suggested input.

SOUTH DAKOTA DEPARTMENT OF AGRICULTURE

DIVISION OF RESOURCE CONSERVATION & FORESTRY
523 East Capitol Avenue, Pierre, SD 57501-3182
Phone: 605.773.3623 / FAX: 605.773.4003
Web: sdda.sd.gov/conservation-forestry/

June 2, 2014

Tom Kirschenmann
Chief, Terrestrial Resources
SD GFP, Wildlife Division
523 E Capitol Ave
Pierre, SD 57501

RE: South Dakota Wildlife Action Plan

Dear Mr. Kirschenmann:

The South Dakota Department of Agriculture, Division of Resource Conservation and Forestry has reviewed the South Dakota Wildlife action Plan.

We have no comments at this time. We appreciate the opportunity to comment.

Sincerely,

Ann M. Juette
Natural Resource Planner

XC: Bill Smith, Acting Division Director
Greg Josten, Acting State Forester

SDGFP response: None necessary

Appendix W (continued). Comments received during Plan review period (May 7 – June 6, 2014) and associated resolution of suggested input.

Rockies and Plains Office

535 16th Street, Suite 310 | Denver, Colorado 80202

www.defenders.org

Date: June 6, 2014

To: Eileen Dowd Stukel, South Dakota Game Fish and Parks (SDGFP)

RE: Comments to 2014 South Dakota State Wildlife Action Plan

Submitted electronically at: wildinfo@state.sd.us.

Dear Eileen and the SDWAP Planning Team:

On behalf of its 800 supporters in South Dakota, Defenders of Wildlife submits the following comments on the 2014 South Dakota State Wildlife Action Plan (SDWAP). Founded in 1947 as Defenders of Furbearers, Defenders of Wildlife is a nonprofit organization dedicated to the protection and restoration of wildlife and plants in their natural communities. Defenders' distinguished record of leadership on America's conservation efforts includes supporting policies and practices that help maintain populations of all of North America's wildlife species. Defenders' 10-year organizational conservation benchmarks include: 1) Ensuring that more than half of the species currently listed under the Endangered Species Act are stable or improving; 2) Ensuring that 25 of Defenders-identified vulnerable species are secure in important ecosystems and focal landscapes; and 3) doubling the acreage of high-priority wildlife habitat that is managed for ecological integrity. We are pleased to see a commonality in goals in the South Dakota SWAP and Defenders' conservation goals. We've reviewed the SWAP primarily from this perspective, and offer some general comments before more detailed comments that follow below.

Overall Comments

Defenders commends the SDWAP team for assembling a well-organized and well-articulated document overall. The ability to "jump to" relevant sections and appendices is very useful.
Defenders also appreciates the significant discussion regarding potential future impacts of climate change, which the organizational approach SDFWP has chosen for this SWAP (landscape/community) is particularly well-suited to analyze.

The range maps for aquatic species are more informational overall than those presented for terrestrial species. Distribution for terrestrial species would be far more compelling if: 1) they were presented similarly (e.g., some distributions are by county, some are circumscribed perimeters); 2) if some point locations were provided (as for some aquatic species); 3) if some sort of indicia of probability of likelihood of occurrence were presented (as for aquatic species); 4) if they were presented in some other format (e.g. suitable habitat, nesting habitat, etc). This may be a case where obtaining the level of detail of information needed to develop a map could drive more efficient monitoring.

Defenders is pleased to see the SDWAP include S-Ranked S3 Species in its Species of Greatest Conservation Need (SGCN) list. What would be useful, either in a table or in the individual species profiles, would be some indication of the severity/trend of the conservation challenges indicated for each species. For example, take the threat given in the example for the American Burying Beetle (p. 53), loss of carcasses: is this accelerating, incremental, or easily mitigated in some way? Are some forms of habitat loss occurring faster than others?

Defenders also concurs with the SDWAP's characterization of major historical ecological drivers over much of the South Dakota grasslands, particularly bison, black-tailed prairie dogs, beaver, fire, and floods. However, having identified the important role that these drivers play in maintaining ecosystem and wildlife health, there is virtually no further mention in the SDWAP of how these drivers might be restored over some area of the state. With the SDWAP goal of maintaining a minimum of 10% (by area) representation of historical ecosystems (SDWAP p. 148), a significant effort needs to be undertaken to revitalize these drivers, three of which also happen to be wildlife species.

Defenders notes that current South Dakota law severely restricts the ability to restore or maintain prairie dogs, for example, over even a fraction of the landscape that would be meaningful in terms of meeting the goals of maintaining 10% representation under historical conditions. Understanding that the political climate has hamstrung this plan from integrating this important driver as part of the SDWAP (SDWAP p.174), it almost goes without saying that the plan is limited in addressing conservation goals for a host of other of its target species. Others (see e.g. US Fish and Wildlife Service 2013) are asking even far less…the state's share of prairie dog occupancy to meet black- footed ferret recovery goals, according to the black-footed ferret Recovery Plan, is around 30,000 ac, or about .001% of the state's land base. At present, the state is far short of ensuring that acreage for black-footed ferret recovery. As a reality check, it seems unlikely the SDWAPs 10% representational goals can be achieved if the state can't deliver on 1/1000th of that amount for one of its most important drivers and ecological communities. Moreover, how it will address conservation threats for several of its SGCN species, such as burrowing owls, ferruginous hawks, and swift fox, without inclusion of a conservation strategy for prairie dogs is somewhat mystifying.

In this same light, bison and beaver targets should be made a part of this plan in order to ensure that some level of representation of those drivers are also maintained. Bison occur in several federal and state parks (as well as some private ownership) in the state, but additional effort should be made to expand conservation herds of bison on public lands or combinations of lands involving private/public partnerships.

Similarly, beaver likely occur on some federal lands, but some effort needs to be made to assess the amount of beaver-occupied stream miles and distribution across the state to determine whether this driver is meeting a significant part of its targets. The SDWAP will guide the state's conservation efforts for the next decade, and it is important that these species receive some additional mention in terms of SDWAP goals.

Conservation Actions and Opportunities

Defenders appreciates the Conservation Opportunities Analysis. However, again, the SDWAP falls short in tying an implementation strategy to this analysis. There are numerous actions that could be undertaken or suggested as an outcome of this analysis: the state could work with NRCS to target programs to private landowners specifically within the COA-identified areas, protected areas could be proposed, conservation easements purchased, regulatory limitations enacted, and so forth. None of these strategies seems to be suggested, let alone prioritized. As with many very good insights developed in the SDWAP, the “action” part of the plan is lacking here. The purpose of this document as a genuine blueprint for moving forward based on the information needs to be made explicit somewhere in the SDWAP.

Moreover, the conservation actions summary are simply too general. Taken together, the suggested summary is a list of bullets and not a comprehensive plan. This also makes it difficult to prioritize conservation actions, and no guidance for prioritizing conservation actions for SGCN appears to be provided in this document. Some level of guidance for how the SDWAP might prioritize its efforts given conservation actions would be useful, and this would likely involve measuring the extent of threats for each SGCN in a more systematic way, as some threats are much more dire depending on the species and/or habitat, yet those differences in magnitude are in no way offered in the SDWAP. This is especially important as the ultimate measure of the SDWAP is if the status of the SGCN species is stabilized or improves.

SGCN Species

The SDWAP lacks a discussion of goals for most of the SGCN. Some of these species have separate conservation plans which (presumably) set out goals, but these are not carried forward into the SDWAP. Goal setting is non-trivial, should be done with public and private partners, and at any rate is an important part of conservation planning that both AFWA (2011, 2012) recommendations and the Open Standards for the Practice of Conservation (CMP 2013) recommend. We recommend that goals should focus on restoration rather than numerical targets, which are notoriously difficult to determine and monitor. It would be useful if these were stated conspicuously in relation to the action items and if there were similar objective goal statements for each of the SGCN species so that the public is aware of where the SDWAP is headed.

It is also impossible to determine if the “results chain” (AFWA 2011) that is described under the action items have any meaningful relation to achieving some goal. Tracking progress toward the goals is as important a part of implementation as describing activities that may have positive outcomes for the species but are not directed at some measureable outcome. There should be a stated goal in the action matrix so it can be readily seen how the actions intend to meet the goal.

There is also very little discussion of relevant current conservation initiatives related to SGCN, as there are listed for monitoring initiatives. It would be valuable to include this information (if any), in the matrix, or at least reference Appendix P in the species descriptions for each species, as the SDWAP needs to integrate with existing plans and initiatives. Other suggestions include discussion of 'additional resources' under each issue and SCGN, which would help the public find additional information.

Funding

The plan (and narrative overview) only briefly discusses funding issues. If congressional funding is uncertain, where will the dollars come from to implement the plan? Is there some way to at least briefly outline the funding shortfalls/needs? Again, it would be useful if there were some type of prioritization for the 10-year life of the Plan to tie to funding priorities. The SDWAP should also include a section on policy options.

Additional comments

Appendix P. An additional initiative, and possible cross-reference with your Conservation Opportunities Analysis is the Northern Plains Conservation Network (NPCN), http://www.npcn.net/, and the Ocean of Grass Assessment: http://www.protectedareas.info/upload/document/ecoregionplan-northerngreatplainconservationassessmentsummary.pdf, (Forrest et al 2004).

Summary and Conclusion

Defenders appreciates the opportunity to comment on the SDWAP and further wishes to commend the SDWAP team for pulling together a tremendous amount of information in a highly accessible document. Our primary concern is that the plan, as such, has some additional work to make it useful for planning purposes. If the public is to use this document to get behind or contribute to conservation efforts, then a clearer set of goals and actions need to be articulated so that we are all pulling in the same direction. To the extent that this can be better defined in this or future revisions the more useful this plan will be. Thanks and Defenders looks forward to continuing to work with SDGFP on future wildlife planning and conservation in South Dakota.
Sincerely,

Steve Forrest

Steve Forrest
Senior Representative Rockies and Plains Program

References Cited:

Association of Fish and Wildlife Agencies. 2012. Best Practices for State Wildlife Action Plans. 66 pp. http://www.fishwildlife.org/files/SWAPBestPractices.pdf.

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Forrest, S.C., H. Strand, W.H. Haskins, C. Freese, J. Proctor and E. Dinerstein. 2004. Ocean of Grass: A Conservation Assessment for the Northern Great Plains. Northern Plains Conservation Network and Northern Great Plains Ecoregion, WWF-US, Bozeman, MT.

U.S. Fish and Wildlife Service. 2013. Recovery plan for the black-footed ferret (*Mustela nigripes*). U.S. Fish and Wildlife Service, Denver, Colorado. 157 pp. http://www.fws.gov/mountain-prairie/species/mammals/blackfootedferret/2013NovRevisedRecoveryPlan.pdf

Appendix W (continued). Comments received during Plan review period (May 7 – June 6, 2014) and associated resolution of suggested input.

SDGFP response to Defenders of Wildlife letter, listed by subject areas:

Range maps: An attempt was made to use a similar approach to represent species ranges for both terrestrial and aquatic species. However, the lack of a similar type of base map for terrestrial species did not allow us to map terrestrial species occurrences in the same way that aquatic species distributions were mapped. Species distribution maps will continue to be improved with additional data sources, and such updates will be included on the SDGFP website.

Conservation challenges severity/trends: To the extent that information exists, threat severity and trends are incorporated into the state and global heritage ranks. Particularly for rare species that are not state or federal listed, limited information exists for threat severity and trends. We will continue to identify and monitor threat severity and trends as information becomes available.

Ecological drivers:

Bison/cattle: Bison is not simply a wildlife species, but also a grazer owned by private individuals and a grazer managed by tribes and other government entities. The ecological driver is grazing by a multitude of herbivores, of which bison was the main historical ungulate. Managed grazing by livestock can simulate some of bison herds' grazing effects.

Prairie dogs: The background information presented in this comment letter implies that South Dakota is not meeting its prairie dog acreage goals related to multistate prairie dog planning and black-footed ferret recovery. Based on the most recent estimates in 2012, 526,641 acres were mapped in South Dakota, categorized by landownership as tribal (222,173 acres) or nontribal (304,468 acres). South Dakota has met its statewide and nontribal acreage goal as outlined in the state prairie dog management plan. As stated in the draft Wildlife Action Plan, existing approved management plans, whether state, tribal or federal, are not superseded by the Plan, which is a voluntary strategic framework to encourage partners to manage for native ecosystems.

We do not believe we possess the necessary background data to set beaver goals, but we support additional investigation into the historical amount of beaver-occupied habitat to help establish a historical frame of reference. In addition, we have worked with and encouraged Black Hills National Forest to allow beaver expansion in the Black Hills of South Dakota.

Conservation actions and opportunities: The suggested action that we work with NRCS to target funds or new or existing programs to correspond with conservation opportunity areas is an example we have used extensively in public open houses on this topic, and we will add that example to the text. The additional suggestions that are voluntary practices, such as conservation easements and land acquisition from willing sellers, are consistent with the Plan's voluntary approach. The COA maps can easily serve this function. The other suggestions that are regulatory are inconsistent with our preferred approach to encourage voluntary partnerships among individuals, tribes, organizations, and agencies to fulfill the goals of the Wildlife Action Plan.

Conservation actions summary, regarding suggested prioritization by SGCN: We have addressed the lack of information necessary to adequately prioritize threats by SGCN earlier in this response. In addition, the emphasis on habitat restoration to provide for the needs of many species will help address the needs of individual SGCNs. To address the point that the summary bullets are too general, we have added several points to this section.

SGCN species, regarding lack of identified goals: This comment appears to place greater emphasis on single species monitoring than is intended within the content of Wildlife Action Plans. The purpose of the coarse filter approach is to promote the importance of providing a diversity of habitats under appropriate disturbance regimes as contrasted with the traditional single-species approach. The single-species management approach is not feasible when trying to plan for the full array of fish, wildlife, and associated habitats, as is the directive for Wildlife Action Plans.

Reference to AFWA 2011 results chain: We agree that this system promotes better accountability and expect that future State Wildlife Grant projects will more fully incorporate these planning elements.

Current conservation initiatives as related to SGCN: We will follow this suggestion to better link these elements by adding existing management and recovery plans to Appendix P. We have not identified additional resources for each issue and each SGCN. We intend to use the SDGFP website as an information tool for potentially sharing such information in the future.

Funding issues: We chose not to describe the history of funding related to wildlife diversity or the current efforts to secure stable, long-term funding. We also chose not to include policy options because such information quickly becomes dated, and we believe it is more appropriate for interested members of the public to join the South Dakota Teaming with Wildlife Coalition (http://gfp.sd.gov/wildlife/funding/teaming.aspx) and to monitor this situation by that means or by monitoring AFWA's Teaming With Wildlife website (http://teaming.com/). We added a reference to the importance of securing funding to help meet representation goals to the Conservation Actions Summary. We remind the commenter that the Plan is a strategic framework for South Dakota, rather than an operational plan for SDGFP. For that reason, we chose not to include specific budgets or to estimate the amount of funding needed to fully implement the Plan.

Additional comments: We have added the recommended conservation initiative to our list.

Appendix W (continued). Comments received during Plan review period (May 7 – June 6, 2014) and associated resolution of suggested input.

SOUTH DAKOTA STOCKGROWERS ASSOCIATION

426 Saint Joseph Street
Rapid City, SD 57701

605-342-0429 (o)
605-342-0463 (f)

June 6, 2014

SD Dept of Game Fish and Parks
523 E. Capitol – Foss Building
Pierre, SD 57501

To whom it may concern,

The South Dakota Stockgrowers Association Wildlife committee submits the following comments to the South Dakota Wildlife Action Draft Plan Revision (2014).

A.

1. Action plan was written to meet standards and needs of Fed. agencies. to receive future funding. We believe the focus should be on the state's needs and the best interest of our state wildlife. We're concerned that this plan cedes control of management to the federal agencies by catering to their needs.
2. SD has a very short historical record compared to other parts of the nation and the world. While there may be climate trends, it is impossible to determine climate changes that are long term trends due to lack of historical data available for our state.
3. Using pre-European baselines is not realistic due to lack of documentation. Lewis and Clark traveled along waterways which were the source of water for animal life before man made impoundments and improvements were made. Wildlife was concentrated to several miles either side of these waterways. We should not be surprised they encountered wildlife in large numbers, however, the assumption that what they saw along the Missouri River is indicative of what all South Dakota looked like at that time may be flawed.

B.

1. Species "dependent" on BTPD for survival (burrowing owl, swift fox, ferrets) are now under more stress due to lack of BTPD management and control by govt. agencies with BTPD colonies on lands they control. Many of the colonies have encountered plague because of overpopulation.
2. SD GF&P should work to hold other government agencies and NGO's accountable for the wildlife management on properties under their management so that adjacent landowners are not negatively affected.

C.

1. How does GF&P intend to work with private landowners where the majority of wildlife occurs? The goal is admirable and appreciated but not defined.
2. While opinions of non-landowners should be considered, there is a significant element missing from this plan. There is no chapter describing the interface between GF&P and private landowners. Much of the habitat described occurs on private property. Emphasis

silvia.sdsga@midconetwork.com ■ www.southdakotastockgrowers.org

should be placed on collecting first hand observation from private landowners about species, habitat, short and long term trends those who are on the land are observing. We have been very frustrated about SD GFP's actions to write management plans that use survey data and input from non-landowners and individuals who do not have first-hand experience or consequences of decisions made. We strongly urge SD GFP to prioritize private landowners interests as this plan moves forward. The success of private landowners in managing wildlife is imperative for strong landowner relations to the agency and for the success of the wildlife populations being managed.

3. Managing for one particular "keystone" species does not magically create a healthy ecosystem. Example: BTPD. Overpopulation of BTPD has resulted in plague and sedimentation of watersheds. A more holistic approach should be taken to managing these populations.
4. SD GF&P should continue its work of monitoring and managing wildlife for South Dakotans, however, it is imperative to achieving a positive outcome in this endeavor that South Dakotans owning the land, managing the land, and caring for the land be consulted with at the beginning and throughout any management process by our state agencies.
5. SD GF&P should not enter into any cooperative agreements with any other governmental agency or non-governmental organization for the purpose of wildlife management if the interests of the private landowners, on whose land the majority of South Dakota's wildlife and fish species exist, are not solicited and protected. These cooperative agreements have provided little benefit to the populations and have worked to undermine private property rights and the ability of the state to defend private property against federally administered wildlife management plans.

Thank you for your consideration.

Respectfully submitted,

/s/

Mark DeVries
Wildlife Committee Chairman
South Dakota Stockgrowers Association

Silvia Christen

Silvia Christen
Executive Director
South Dakota Stockgrowers Association

SDGFP response: Our agency fully appreciates the critical importance of private landowners to the success of any effort to work cooperatively on wildlife and habitat management and restoration. This concept is communicated in many parts of the Wildlife Action Plan. Our agency partners with landowners in many programs and assists landowners in resolving issues dealing with wildlife. We will continue our best efforts to nurture and improve these relationships.

Appendix W (continued). Comments received during Plan review period (May 7 – June 6, 2014) and associated resolution of suggested input.

From: Cliff Wallis [mailto:deercroft@shaw.ca]
Sent: June-06-14 4:11 PM
To: 'wildinfo@state.sd.us'
Subject: South Dakota Wildlife Action Plan

The Alberta Wilderness Association supports the recommendations made today in a letter to you regarding the South Dakota Wildlife Action Plan.

We look forward to some integration of these recommendations into wildlife management in South Dakota. The Alberta Wilderness Association supports maintenance and restoration of grasslands and grassland species throughout the Northern Great Plains and appreciates the important role South Dakota could play in this regard.

Cliff Wallis P.Biol.
Vice-President, Alberta Wilderness Association
Box 6398, Station D
Calgary, AB T2P 2E1 CANADA
deercroft@shaw.ca
phone (403) 2711408 (direct); (403) 6071970 (cell); (403) 2832025 (office)

Sorry, the first line in the email below should have read:

"The Alberta Wilderness Association supports the recommendations made today in a letter to you by Defenders of Wildlife regarding the South Dakota Wildlife Action Plan."

Good luck with your efforts.

Cliff Wallis P.Biol.
Vice-President, Alberta Wilderness Association
Box 6398, Station D
Calgary, AB T2P 2E1 CANADA
deercroft@shaw.ca
phone (403) 2711408 (direct); (403) 6071970 (cell); (403) 2832025 (office)

SDGFP response: See response to Defenders of Wildlife comment letter earlier in this appendix.

Appendix W (continued). Comments received during Plan review period (May 7 – June 6, 2014) and associated resolution of suggested input.

Nancy Hilding
President
Prairie Hills Audubon Society
P.O. Box 788
Black Hawk, SD 57718

Nancy Hilding
6300 West Elm
Black Hawk, SD 57718
June 6th, 2014

Dear Game Fish and Parks Staff,

I attach 2 maps in a set that came from the BLM. Please scroll down to the second map in the set (Vegetation-Landfire 2010). It shows vegetation in SD. The legend includes "tree-dominated" color, which shows tree-dominated areas on the map.

Your map (Figure 3-2) shows similar values (forested ecosystems) but does not acknowledge areas of SD that contribute to the Pine Ridge Ecosystem of South Dakota, Nebraska and Wyoming. It does not acknowledge tree covered area on the Rosebud Reservation or a tree covered area along the sides of the Missouri in Gregory, Charles Mix and Tripp Counties.

We suggest you review this BLM data on trees and we suggest adding this BLM data on vegetation cover to your map on Figure 3-2 for forested ecosystems.

Why do the forests of Custer National Forest rate such designation, but not these areas I mention?
We have special concern for the Pine Ridge Ecosystem, which exists in three states, but in SD mostly on a Reservation. How much have you networked with Reservations about their ecosystems?

Species with short or no review

We are concerned that there is no mention of the grey wolf in this document. We did search for wolf and wolves and found nothing. The USFWS has yet to delist the wolf in SD. The delisting is stalled, because wolf experts don't agree on science issues, thus best science has not been used in the delisting effort. People occassionally report wolf sightings in the Black Hills - rumors of wolves.

We are also concerned for the Canadian Lynx, which is only mentioned in a chart on page 494.

We are concerned for the viability of the mountain lion given the aggressive hunting in Wyoming Black Hills and South Dakota. The lions have no idea where the boundaries are and the Wyoming seasons are fixed for 3 years. SD can't control what Wyoming does. We hope you have a larger section on mountain lions.

We did find change for "bear" and found no reference. I bear was found in Bearlodge Mtns by Wyoming and removed relocated.

Thanks,

Nancy Hilding
President
Prairie Hills Audubon Society,

For self and Society

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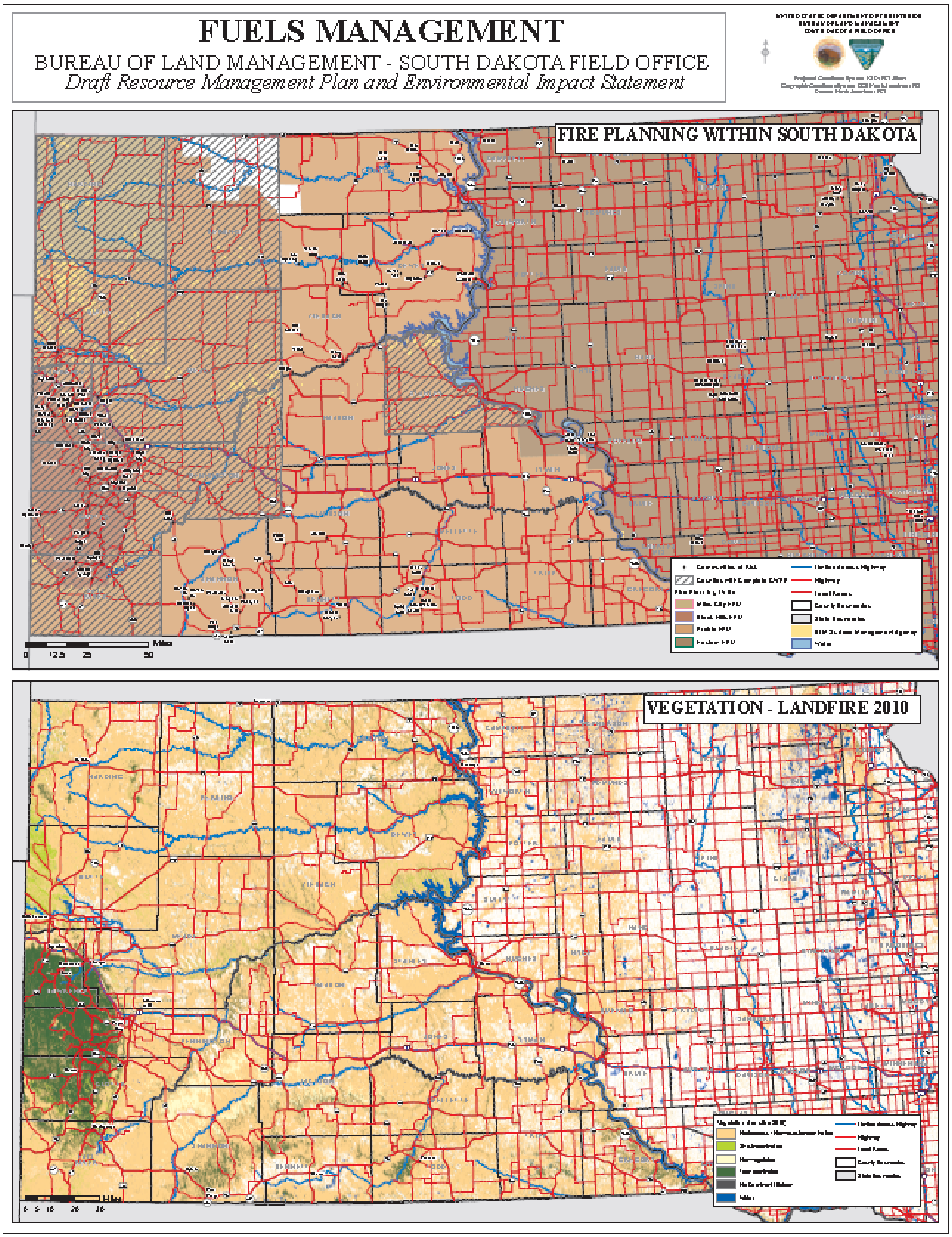
Nancy Hilding
6300 West Elm, Black Hawk, SD 57718
or
Prairie Hills Audubon Society
P.O. Box 788, Black Hawk, SD 57718
nhilshat@rapidnet.com
605-787-6779, 605-787-6466
www.phas-wsd
Skype phone -787-1248, nancy.hilding

SDGFP response: Regarding Figure 3-2 and reference to Pine Ridge Woodlands: Thank you for pointing out this area of confusion. This figure does not show the pine savanna vegetation on the Pine Ridge or many other small woodlands in South Dakota, partly because some of them are included in the riparian coverage, but also because this particular figure uses a base map of soils/ecological sites and not of existing vegetation. We have added a vegetation map (Figure 6-4) derived from the National Land Cover Dataset to show the location of some of the larger of these Ponderosa pine savannas and other wooded uplands and to show the current extent and distribution of other land cover types in South Dakota.

Regarding the comments related to the absence of mention of the gray wolf, Canada lynx, mountain lion, and bear, we assume these suggestions relate to the Plan's species of greatest conservation need list. Because so much of the Plan materials rely on the SGCN, that list was finalized earlier in the planning process, with specific agency, tribal, and public opportunities to comment. We did not receive these suggested additions during that comment period, and these species were not proposed as SGCN because the Planning Team and those consulted (species and taxa experts, tribes, agencies, and the public) did not recommend them as fitting the selection criteria.


FUELS MANAGEMENT
BUREAU OF LAND MANAGEMENT - SOUTH DAKOTA FIELD OFFICE
Draft Resource Management Plan and Environmental Impact Statement
FIRE PLANNING WITHIN SOUTH DAKOTA
VEGETATION - LANDFIRE 2010

Appendix W (continued). Comments received during Plan review period (May 7 – June 6, 2014) and associated resolution of suggested input.

Nancy Hilding
President
Prairie Hills Audubon Society
P.O. Box 788
Black Hawk, SD 57718
June 6th, 2014

To SD Game, Fish and Parks,

Our second comment letter on the Wildlife Action Plan (2014 Draft)

We attach Steve Forrest's Defenders of Wildlife's comments on the Wildlife Action Plan and concur and agree with Steve and incorporate by reference.

We also ask that SDGFP include Northern Plains Conservation Network (NPCN - http://www.npcn.net/) in the list of initiatives addressing conservation interests in South Dakota.
Prairie Hills Audubon Society has been a participant in NPCN for over 10 years and as one of the long term participants, we helped plan, review and approve the Ocean of
Grass Assessment: http://www.protectedareas.info/upload/document/ecoregionplan-northerngreatplainconservationassessmentsummary.pdf, (Forrest et al 2004).
We take pride in this document and hope you will review and include it. NPCN has various charts and interactive maps on the web site currently
- http://www.npcn.net/npcnWebmap/index.html

The National Audubon Society has been working on an Important Bird Area Progam for SD, which I think might be finished, or almost finished. I am not sure when the public release will be, but I hope some time soon.
Marshall Johnson the staff of Audubon Dakota will know about the release date (<mejohnson@audubon.org>)

I believe the National Audubon Society is also working on a model that predicts the effects of climate change on birds in three future climate scenarios.
I don't know when that will have a public release, the web site says maybe October, but I hope that will also be helpful to you once released.
I assume Marshall will have updates about the release date. But to read about it visit:
http://www.audubonaction.org/site/News2?abbr=aa_&page=NewsArticle&id=5717&pgwrap=n#skip_interests

Thanks,

Nancy Hilding.
President
Prairie Hills Audubon Society

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Nancy Hilding
6300 West Elm, Black Hawk, SD 57718
or
Prairie Hills Audubon Society
P.O. Box 788, Black Hawk, SD 57718
nhilshat@rapidnet.com
605-787-6779, 605-787-6466
www.phas-wsd
Skype phone -787-1248, nancy.hilding

SDGFP response:

- See response to Defenders of Wildlife comment letter earlier in this appendix.
- The Northern Plains Conservation Network has been added to the list of conservation initiatives in the Plan.
- The National Audubon Society's IBA program was already listed as a conservation initiative.
- Many organizations host climate change information on their sites, and we appreciate hearing about the NAS information. Rather than listing just one source of climate change impact predictions and neglecting to list others, we encourage the public to seek out information from websites, authorities, and organizations they trust.