South Dakota Comprehensive Wildlife Conservation Plan

South Dakota Department of Game, Fish, and Parks

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FOREWORD - STATEMENT FROM THE DIRECTOR

A recent 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 non-game 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 our management, but we know that each component of our natural world is a critical piece that cannot and should not be lost or squandered.

Many dedicated people continue to search for a long-term solution to fill these funding cracks. 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 Grants funding is one example, and our agency 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 this Comprehensive Plan, which also offered a great opportunity to take a critical look at where we are and where we should go from here.

All aspects of our agency are involved in developing and implementing this Plan. For instance, our Division of Parks and Recreation, using sound management practices and education, works to protect species and habitat at over 100 sites covering more than 100,000 acres while providing quality recreational opportunities for several million park visitors annually.

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 grab 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. 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 our commission and our department 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. My personal 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. My hope is that our commitment to making things better will assure that my grandkids and yours have the chance to create their own treasured memories and find their own special places in nature.

JOHN COOPER

SECRETARY, SD DEPARTMENT OF GAME, FISH AND PARKS

EXECUTIVE SUMMARY

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. 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, non-game 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 further species declines, more than 3000 groups came together in recent years 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 and has provided funding for the past several years. The State Wildlife Grants 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. In order to receive future federal funds through the State Wildlife Grants program, Congress charged each state and territory with developing a state Comprehensive Wildlife Conservation Plan (CWCP). The state wildlife plans will provide an essential foundation for the future of wildlife conservation and an opportunity for the states, federal agencies, and other conservation partners to strategically think about their individual and coordinated roles in conservation efforts across the nation.

To this end, Congress identified eight required elements of a state wildlife conservation strategy 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. These eight elements include: 1) describe the distribution and abundance of selected wildlife species that are indicative of the State's overall health and biological diversity, 2) describe locations and conditions of their key habitats, 3) describe problems which may adversely affect these species or their habitats, 4) describe conservation actions proposed to conserve these species and their habitats, 5) identify plans for monitoring these species and their habitat, 6) describe procedures to review the strategy, 7) identify plans for coordinating the CWCP with Federal, State, and local agencies and Indian tribes, 8) provide a mechanism for public participation in the development of this plan and projects resulting from this plan.

PURPOSE

The South Dakota Comprehensive Wildlife Conservation Plan serves as a strategic vision and plan of action for statewide wildlife conservation and funding, thereby making South Dakota eligible for Federal conservation funding. The CWCP identifies conservation needs and actions that can be implemented by any landowner, agency, partnership, or private organization. The CWCP 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 (SoGCN); however, the CWCP also describes the full array of ecosystems possible within South Dakota.

The purpose of the South Dakota CWCP 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 guide for prioritization of resources and activities to prevent the future decline of species and ecosystems in South Dakota
3. A framework for monitoring and research to improve the information available on ecosystems and species in South Dakota
4. A means for guiding, influencing and achieving coordination in public and private decision-making
5. 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 South Dakota Comprehensive Wildlife Conservation Plan 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 South Dakota Game, Fish, and Parks, but a cooperative effort to include landowners, other agencies, and organizations. It will emphasize the State's native biodiversity, but is not designed to detract from the value of important non-native species, and in fact, should provide many indirect benefits to many of these species such as Ring-necked Pheasants. The plan will not replace other planning efforts, such as those developed for deer management, but will address broader biodiversity objectives using complementary programs.

The Comprehensive Wildlife Conservation Plan will help guide voluntary and cooperative actions, and will not institute mandates or restrictions on uses of private land. It will use an historical reference to help characterize and understand biological diversity, but is not a plan to return to historical conditions. The programs and approaches it recommends 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 has been 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.

GOALS

The goals of the CWCP are strategic and designed to:

1. Identify a strategy for conservation of biological diversity in South Dakota;
2. Initiate a process for identifying and monitoring the status of biological diversity in South Dakota relative to this strategy;
3. Identify threats to biodiversity and establish a conservation action process for ecosystems and species of concern;
4. Develop objectives and action plans to achieve these goals.

SELECTED STRATEGY

Conservation of biological diversity can be approached through several strategies. Selection of a strategy is dependent on the unique objectives of an individual planning effort. Various strategies for conservation of biological diversity were evaluated and assessed. A strategy was selected that provides a strong scientific foundation for conservation of biological diversity as well as the flexibility to consider other land uses in the overall effort. This strategy evaluates ecosystem integrity and biological diversity relative to what has occurred historically at a specific site or location. There is strong scientific foundation for using an historical reference for defining ecosystem integrity and biological diversity. 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.

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. Ecosystem conversion to agriculture, urban, and suburban uses are the most obvious impacts. However, there are also less obvious, yet in some instances more pervasive, human-induced changes at the ecosystem level as well. We have only recently begun to understand the implications of a century of European alterations to and interruptions of historical disturbance regimes in the Great Plains. Recent studies have shown that the suppression or cessation of historical disturbance has gradually changed ecosystem processes and ultimately the composition, structure, and function of many ecosystems. 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 historical 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 South Dakota CWCP has incorporated a combined coarse filter and fine filter strategy for conservation of biological diversity. A description of ecosystem diversity that is based on historical references for plant community compositions, structures, and dynamic processes will represent the coarse filter component of this strategy. A description of problems and habitat needs for individual wildlife species of concern will represent the fine filter component. However, it is important to note that for most wildlife species, species diversity will be dependent on the ecosystem diversity provided by the coarse filter for characterization and description of habitat needs.

To date, most planning efforts to address biological diversity have been a result of regulatory requirements such as the Endangered Species Act, National Forest Management Act, Federal Land Policy Management Act, etc. These planning efforts have been largely reactionary to existing species concerns or management issues. In an effort to address biological diversity before problems are identified, many are advocating a comprehensive landscape planning approach that incorporates ecosystem diversity, in addition to species diversity, as a strategy for biodiversity conservation. The coarse-filter/fine filter strategy was developed to address this need. 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 species and their habitat (fine filter). 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 concern. Finally, for many SoGCN, 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.

APPLYING THE STRATEGY

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. 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 CWCP, however, is on the

landscape, ecosystem, and species level of scale. Genetic levels can be incorporated at future times to address specific questions such as connectivity within a population of a species.

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

1. Delineate ecoregions within the State of South Dakota to facilitate ecosystem diversity characterization and management,
2. Classify ecosystem diversity as it occurred under historical disturbance regimes within each ecoregion to describe the coarse filter,
3. Where existing information is available, use the coarse filter to quantify the historical range of variability or historical amounts of each ecosystem in an ecoregion to provide an historical reference.
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 those SoGCN
7. Evaluate the habitat needs/requirements of SoGCN 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 SoGCN.
10. Identify opportunities for collaborative partnerships to achieve the conservation goals.

A primary objective of the coarse filter strategy is to identify and characterize ecosystem diversity within the State of South Dakota based on the historical reference. To accomplish this requires identifying an appropriate classification system and applying it at the appropriate scale for biodiversity conservation efforts. The South Dakota CWCP has identified two objectives for landscape classification: 1) the ability to describe the full range of ecosystem conditions resulting from historical disturbance regimes, i.e., the coarse filter, and 2) the ability to evaluate and compare historical ecosystem diversity to existing conditions. Observed changes may be due to direct human alteration of species composition, structure, or function, or indirectly through changes to disturbance regimes, introduction of exotic species, or other factors. To meet the assumptions of the historical range of variability-based approach, ecosystems must be substantially similar to historical conditions to qualify for representation. The criteria for inclusion should include selected measures of community composition, structure, and process.

Understanding the role of historical disturbance and its influence on species composition, structure, etc., requires an ecological classification of site conditions. Typically this type of classification delineates the differences in abiotic conditions such as climate, soils, aspect, elevation, moisture, etc., that influence the disturbance patterns and plant communities that can occur on that site. While ecological site classifications provide valuable information on abiotic conditions, they do not, in and of themselves, identify the full range of successional conditions possible on that site as a result of disturbance events and processes. For this reason, it is important to combine an ecological site classification with a classification of successional stages and/or alternative states resulting from historical disturbance. To accomplish this, we have utilized the Ecosystem Diversity Matrix (EDM), a conservation-planning tool that provides the framework for combining ecological classification with a classification of successional stages and/or alternative states. Further, the EDM can be linked to a GIS and used to quantitatively evaluate the coarse filter relative to existing conditions.

HISTORICAL DISTURBANCE

For the purposes of this Plan, we define historical reference as the ecosystem conditions that resulted from natural (i.e., fire, grazing, etc.) and human-influenced (i.e., native American) disturbance that created the dynamic conditions species were and are dependent upon. Historical disturbance regimes are the patterns of frequency and intensity that can be quantified using ecological evidence. 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 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.

Historical reference is usually confined to a period less than 1000 years prior to European settlement, as these reflect the habitat conditions most relevant to the species that are present today. 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 ecoregion in South Dakota, specific types of historical information can be available to help reconstruct the historical range of variability. However, in some ecosystems historical information is less available, and historical ecosystem dynamics require use of models based on best available information.

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.

Six primary historical disturbance regimes were identified for South Dakota and discussed relative to their influence on ecosystem diversity and landscape patterns. These six disturbance types include: climate, fire, grazing, black-tailed prairie dogs, beaver, and flood events. The normal Northern Great Plains climatic pattern is cyclical between wet and dry periods that can cause changes in plant species composition and structure between years. Fire was a relatively common disturbance event prior to European settlement and as a result, most ecosystems in South Dakota exhibit a number of characteristic and strategies that are well suited to a fire prone landscape. Grazing, particularly by bison, also contributed to shaping the grassland ecosystems of South Dakota. The sheer numbers and grazing activities of black-tailed prairie dogs had profound influences on the structure and species composition of grassland ecosystems where they occurred. High numbers of beavers and their dam building activities were also responsible for influencing the structure and species composition of the majority of perennial streams and creeks. Finally, the power of annual flood events was an integral force in shaping and renewing the riparian and wetland ecosystems throughout South Dakota.

The state of South Dakota is a diverse, highly complex area that has been influenced by a multitude of factors including the interaction of soils, aspect, elevation, climate, and disturbance. All of these influences have shaped the vegetative composition and spatial patterns across the landscapes and these in turn, have influenced the distribution of biodiversity. For this reason, the state was divided into four primary ecoregions and two subregions to capture these differences. These four ecoregions include the Great Plains Steppe Ecoregion, the Black Hills Ecoregion, the Missouri River Ecoregion, and the Eastern Plains Ecoregion. In addition, the Eastern Plains Ecoregion was further sub-divided into the Tallgrass and Mixedgrass Subregions.

ECOSYSTEM DIVERSITY MATRIX

To adequately describe the coarse filter for each ecoregion or subregion, an ecosystem diversity matrix was developed for each of the primary ecosystem groups occurring within an ecoregion, including grass/shrub ecosystems, riparian/wetland ecosystems, aquatic ecosystems and forest ecosystems (upland only). The ecosystems contained in each of the ecosystem diversity matrices represent only historical ecosystems for the purposes of the coarse filter.

The CWCP describes the methodology used in developing the EDM's for each of the four ecosystem groups and presents the results for each EDM by Ecoregion/Subregion. The EDM framework identifies the diversity of ecosystems that occurred as influenced by historical disturbance regimes. However, detailed information on plant and animal species compositions relative to historical disturbance is identified as a significant knowledge gap that will require additional research and studies to obtain this

information, particularly for riparian/wetland and aquatic ecosystems. In the interim, the CWCP demonstrates how the EDM is used to describe ecosystem diversity with the understanding that additional work will be required to capture the full spectrum of ecosystem detail and information possible with this tool.

SPECIES OF GREATEST CONSERVATION NEED

In addition to ecosystem diversity, 90 SoGCN were identified for South Dakota. Twenty-eight of these were bird species, in addition to 10 mammal species, 7 species of mussel, 4 species of gastropods, 9 species of insects, 20 species of fish, and 12 species of amphibians and reptiles. Each of the 90 species are discussed relative to: 1) their current protection status that is based on their expected abundances within South Dakota, 2) their distribution historically and currently within the state, 3) their key habitat description and their link to the historical ecosystems of the EDM's based on known key habitat descriptors, and 4) known or expected causes of concern based on our best knowledge of a species. In addition, any pre-existing recovery plans or conservation strategies were identified for each species.

PROBLEMS AND CONCERNS

There are many problems and causes of concern associated with maintaining and conserving the biological diversity of a state the size of South Dakota. The goal of a strategic plan is not to specifically address all problems and concerns occurring at a single point in time, but rather to provide a framework under which current and future problems and concerns can be identified and addressed.

The primary focus of the South Dakota CWCP is to provide for ecosystem diversity across all delineated ecoregions within South Dakota. The CWCP focuses on a process to identify and provide the appropriate diversity of ecosystems that in turn support the diversity of wildlife and fish species in South Dakota. This allows land managers, landowners, and stakeholders to focus on providing specific ecosystem conditions that benefit many species rather than focusing entirely on what is impacting a single species. However, some problems may not be addressed through an ecosystem diversity approach. Problems not addressed by the ecosystem diversity approach should be identified and a parallel framework should be developed to address the problems in the planning process.

There are three primary problems and causes of concern associated with maintaining ecosystem diversity within South Dakota including: 1) the direct alteration or conversion of species compositions, structures, or functions; 2) the indirect alteration and/or suppression of historical disturbance processes; and 3) the indirect alteration of species compositions, structures, or functions through the introduction and spread of non-native species.

Direct alteration/conversion of ecosystems - The primary causative agents for alteration/conversion of ecosystems within South Dakota include agriculture, and to a lesser degree urbanization (including roads and other infrastructure). For riparian/wetland and aquatic ecosystems, additional causative agents include draining, surface water diversion, water impoundments, dams, ponds for water supply, and stream channelization.

Indirect alteration and/or suppression of historical disturbances processes - The primary causative agents for alteration and/or suppression of historical disturbance processes include fire suppression and altered grazing regimes in grass/shrub and forested ecosystems, prairie dog control in grass/shrub ecosystems, and flood control and beaver control/dam removal in riparian/wetland and aquatic ecosystems.

Indirect alteration caused by human activities - Non-native species: The accidental or intentional introduction of non-native species that are invasive can have major impacts on native species and ecosystems. Non-native 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 historical ecosystems. Non-native 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 non-native invasive plants occur, many of the habitat values of that ecosystem will be converted to conditions no longer favorable to native wildlife.

An assessment and discussion of problems and causes of concern associated with both direct and indirect alteration/conversion of ecosystem diversity is provided for each of the four ecoregions. The results of the assessment indicate that all ecoregions suffer from various levels of direct ecosystem conversion. Grass/shrub ecosystems were the easiest to evaluate and the results indicate that the amounts of ecosystem conversion are greatest in the eastern half of the state and lowest in the western half. The Tallgrass Subregion is characterized by an average of 65% overall conversion of grass/shrub ecosystems with as high as 78% conversion on some ecological sites. The Black Hills Ecoregion is characterized by the lowest amount of grass/shrub ecosystems conversion with an overall average of 6%. Quantifying the conversion of riparian/wetland and aquatic ecosystems relative to the ecological sites described in the coarse filter is problematic, as existing information limits the ability to adequately map these sites. However, the greatest amount of riparian/wetland and aquatic ecosystem conversion has occurred in a pattern similar to the grass/shrub ecosystems with the greatest amount occurring in the east and decreasing as you proceed west. Forest ecosystems have received the least amount of direct conversion relative to the other ecosystem types.

Indirect alteration or ecosystem conversion has occurred across all ecoregions and ecosystem types. Fire suppression over the last 100+ years and loss of migratory bison grazing have had profound impacts on the grass/shrub ecosystems throughout South Dakota. Fire suppression in forested ecosystems has also changed the species composition, structure and landscape patterns, particularly in the Black Hills Ecoregion. The reduction in the number of black-tailed prairie dog colonies has reduced the heterogeneity of grass/shrub ecosystems, particularly in the Great Plains Steppe and Mixedgrass Ecoregions. The significant reduction in the number of beaver and beaver dams has reduced the diversity of riparian/wetland and aquatic ecosystems throughout the state as well. The construction of dams and levees on many rivers and streams to control flooding, provide transportation, and/or provide water storage has reduced the frequency and intensity of annual flood events, thereby reducing the diversity of riparian/wetland and aquatic ecosystems across the state. An example of the possible impacts of both direct and indirect alteration/conversion of ecosystems is the combined direct conversion of 65% of the grass/shrub ecosystems in the Tallgrass Subregion with the functional loss of 26% of the total acres, resulting in greater than a 90% total loss of the functional historical ecosystems.

There are two primary problems and concerns associated with the persistence of species in South Dakota: 1) the loss or degradation of habitat, and 2) non-habitat related impacts. The loss/degradation of habitat is directly influenced by direct and indirect impacts to ecosystem diversity. These impacts have been discussed previously. Loss of habitat was illustrated by the number of SoGCN associated with the historical ecosystems identified in the EDM's. As an example, the riparian/wetland EDM for the Tallgrass Subregion has 14 SoGCN associated with a disturbance pathway of the low gradient, perennial river system. The ability to link species habitat needs and the number of species impacted, with historical ecosystems, was used to help prioritize conservation actions for ecosystem diversity. A number of SoGCN have additional, non-habitat related impacts. Non-habitat related impacts are typically characterized by direct human influences on a species' normal life cycles or existence. Examples of the types of non-habitat related impacts discussed and identified include land and water management impacts such as agricultural practices (e.g., nest destruction, poisons/pesticides, etc.), grazing (e.g., nest trampling, stock tanks, feedlot run-off, etc.), forest management (e.g., disturbance from logging activities, soil erosion, etc.), mining (contaminant, cave closure, etc.), energy development (contaminants, wind generators, etc.), and water level management. In addition, movement barriers, exotic/introduced non-native species, human disturbance, and diseases were discussed relative to non-habitat related impacts.

CONSERVATION GOALS AND ACTIONS

Using an appropriate classification system and accompanying analyses, the coarse filter strategy should function to identify appropriate objectives for conserving ecosystem diversity. However, the ecosystem representation that is sufficient to meet these objectives still remains a question. This CWCP does not attempt to return South Dakota to an "historical" condition. The plan focuses on providing sufficient amounts of functionally similar ecosystems represented across the ecoregions in order for native species to continue to persist in South Dakota. The term used to describe this sufficient level of representation is "adequate ecological representation". Adequate ecological representation under an historical range of variability-based approach identifies an estimate of the threshold level to "represent" each ecological community that occurred under historical disturbance regimes. This threshold level identifies the minimum amount of all ecological communities needed to maintain biological diversity and ecosystem integrity within an acceptable level of risk.

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 adequate representation from a habitat standpoint also requires thorough evaluation of location, juxtaposition, and size of ecosystems selected for representation. 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.

A goal for adequate ecological representation was identified as maintaining more than or restoring at least 10% of the historical occurrence for all ecosystems in each of South Dakota's five ecoregions for illustrative purposes. 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 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. 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 is also 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.

The results of the 10% assessment coupled with a prioritization weighting that incorporates the number of SoGCN associated with and the direct/indirect impacts to an ecosystem, were used to develop examples of conservation goals and priorities that were assigned to each of the historical ecosystems identified through the coarse filter framework. While these goals and priorities are considered preliminary with expectations for improving them as better information is developed, they demonstrate how the EDM framework can be used to develop conservation goals in terms of acres or stream miles for representation of historical ecosystems. Priority levels of high, medium, or low were further assigned based on the results of the weighting criteria. When evaluated against an EDM representing the amounts of current ecosystems, it will be easy to assess cumulative impacts and the needs for maintenance or restoration of historical ecosystem conditions to ensure adequate representation in the landscape. The conservation action steps identified for ecosystem diversity identify the priority research to ensure these results. In addition, conservation actions are identified that will allow land managers to develop the tools and methodologies to restore historical ecosystem conditions. With this information, voluntary partnerships can be established with South Dakota landowners and incentive programs identified that will ensure progress toward the goal of maintaining/restoring adequate representation. An important component of the landowner and public's participation in this process will be the strength of SDGFPs' public education

and outreach program, therefore priority conservation actions include this step as well. In addition, special habitat features (e.g., caves, springs) that are not included in the coarse filter will need to be identified, mapped, and prioritized for additional conservation actions.

To illustrate the possible habitat benefits of a 10% goal of representation for SoGCN, acreages and stream miles are summarized relative to their priority level (e.g., high, medium, and low). As an example of this, the Baird's Sparrow would benefit from the following amounts of sustained or improved habitat in the Great Plains Steppe Ecoregion: high priority = 1,046,817 acres, medium priority = 26,479 acres, and low priority = 9,271 acres. With the majority of SoGCN key habitat requirements provided through adequate representation of historical ecosystems, additional conservation actions identified are primarily associated with non-habitat related concerns. These actions are described for each species and primarily address the non-habitat related concerns discussed earlier (e.g., land and water management practices, mining, forest management, etc.).

PUBLIC PARTICIPATION

South Dakota Game, Fish, and Parks sought public input and participation in the development of the CWCP. To that end, an advisory team was initiated early in the process to incorporate a broad spectrum of interests. The purpose of the Advisory Team was to review the project plan and road map for defining the CWCP and identify citizen involvement needs and methods. Four town meetings were also held across the state. The purpose of the town meetings was to provide information about the CWCP process to the general public and generate a list of question concerning the CWCP process. The list of questions was used to provide additional information about the CWCP process via a list of frequently asked questions and responses. In addition, a special effort was made to keep SDGFP staff and Commissioners informed of the CWCP process and encourage their input. A webpage was also established to provide updated relevant information throughout the entire process. Press releases were used to provide general information about the CWCP process, announce public meetings, and solicit input on the draft CWCP.

Coordination with Other Agencies and Tribes - South Dakota has many Federal, State and local agencies that have various levels of management authority or influence over land and water resources. An open list of such agencies was identified and notified by letter of the CWCP process in its early phase of development in South Dakota (approximately May 2004). Each agency has its own mission and expectations. As part of this planning effort the agencies were briefed on the process and encouraged to become important partners in this new effort by aligning their conservation actions directed by their missions with that of CWCP. Some of these agencies were members of the CWCP Advisory Team.

Tribes were given special consideration since they are large landowners or have influence on more than a million acres in South Dakota. They were specifically, directly, and individually notified of the planning, invited to participate in public meetings, invited to provide technical expertise, invited to the Advisory Team meeting, invited to be involved prior to drafting and again invited to comment on the draft plan. Assistance in communicating with tribes was provided by tribal coordinators in Bureau of Indian Affairs in Aberdeen, South Dakota. Tribal members or representatives participated in public meetings, providing technical input, were briefed by the SDGFP staff, and reviewed the draft documents.

Review of the Draft Comprehensive Wildlife Conservation Plan - A 30-day comment period was provided. The draft CWCP was available via the Internet and copies were provided at SDGFP regional offices and upon request. Announcements concerning opportunities to review the draft were made in news releases and the Advisory Team members and others were specifically contacted by e-mail. In addition, an open-house meeting for the public was requested and provided to collect additional comments.

Future Public Involvement - The next step will be to implement the CWCP, referred to as the South Dakota Wildlife Action Plan. Information from our publics and research by the International Association of Fish and Wildlife Agencies suggests that the public will be especially interested in the on-the-ground actions that result from implementing this next phase. SDGFP recognizes the critical importance of

providing public involvement opportunities and continuing to work with our advisory team and other interested agencies, parties and tribes to the success of this plan. SDGFP will continue to providing public involvement opportunities and working with our partners throughout the implementation and revision phases of South Dakota's Wildlife Action Plan as outlined in this document.

MONITORING AND ADAPTIVE MANAGEMENT

Monitoring and inventory is recognized as an important component of the South Dakota CWCP. For the purpose of the CWCP, monitoring and inventory are described strategically, with most specific monitoring and inventory methods and protocols to be determined in implementation phases. Monitoring and inventory are different but related activities. The purpose of monitoring is to check on the status of specific resources and progress towards stated goals or objectives. Inventory has a more basic purpose of determining the occurrence or abundance of specific resources, not necessarily in regards to stated goals or objectives. Monitoring is a key component of the CWCP 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.

Monitoring Framework - The South Dakota CWCP emphasizes ecosystem diversity as the primary means to address habitat needs for the State's biodiversity, with a secondary focus on non-habitat concerns of SoGCN. The proposed monitoring follows this same approach. Monitoring of ecosystem diversity addresses objectives at both ecoregion and community levels of biological organization. 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.

Monitoring of Ecosystem Diversity - The goal of ecosystem diversity is to maintain or increase levels of representation of 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. The goal of the ecoregion monitoring is to track the amounts of each identified ecosystem from the ecosystem diversity descriptions that are present relative to historical amounts and the stated conservation 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 of sites at the ecosystem level will track progress in addressing specific problems such as compositions, structures, functions, or processes. Structural characteristics may also be important criteria for some sites. 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.

Adaptive Management for Ecosystem Diversity - Because the dynamics of many ecosystems are poorly 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. Adaptive management helps address uncertainties by continually checking and evaluating the results of actions relative to the goals of the CWCP and making the appropriate adjustments.

Monitoring and Inventory Programs for Species - Various monitoring and inventory programs currently exist and will be tracked for the information they provide on the status of species. For example, the Breeding Bird Survey provides standardized, long-term trend information for many species of birds. A summary of these current monitoring programs and any additional pertinent monitoring efforts reported by cooperators or the public are included in the CWCP.

ACKNOWLEDGEMENTS

This document benefited from the input and effort of many people from government agencies, tribes, and organizations plus individuals too numerous to list. South Dakota Game, Fish and Parks (SDGFP) appreciates all the help and critical review provided during this planning process and hopes this dialogue will continue during the implementation phase.

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TABLE OF CONTENTS

FOREWORD – STATEMENT FROM THE DIRECTOR i

EXECUTIVE SUMMARY iii

ACKNOWLEDGMENTS xiii

1.0 INTRODUCTION 1
BACKGROUND 1
KEY ELEMENTS 2
PURPOSE 2
GOALS OF CWCP 3
ORGANIZATION OF CWCP – WHERE TO FIND KEY ELEMENTS 3
EXISTING STATE OR REGIONAL CONSERVATION PLANS/STRATEGIES 4

2.0 CONSERVATION STRATEGY 8
SELECTED STRATEGY 8
APPLICATION OF THE STRATEGY 9

3.0 ECOSYSTEM DIVERSITY 10
CLASSIFICATION SYSTEMS 10
HISTORICAL DISTURBANCE 11
SOUTH DAKOTA ECOREGIONS 18
ECOSYSTEM DIVERSITY MATRIX 19
Great Plains Steppe Ecoregion 23
Black Hills Ecoregion 33
Missouri River Ecoregion 41
Eastern Prairie Ecoregion 46
Mixedgrass Subregion 46
Tallgrass Subregion 53

4.0 SPECIES OF GREATEST CONSERVATION NEED 60
BIRDS 63
MAMMALS 101
FRESHWATER MUSSELS 122
GASTROPODS 132
INSECTS 137
FISHES 154
REPTILES AND AMPHIBIANS 179

5.0 PROBLEMS AND CAUSES OF CONCERN 198
ECOSYSTEM DIVERSITY 198
Great Plains Steppe Ecoregion 199
Black Hills Ecoregion 201
Missouri River Ecoregion 203
Mixedgrass Subregion 204
Tallgrass Subregion 206
SPECIES OF GREATEST CONSERVATION NEED (SOGCN) 207
NON-HABITAT BASED PROBLEMS AND CONCERNS 208

6.0 CONSERVATION GOALS AND ACTIONS 228
ECOSYSTEM DIVERSITY 229
CONSERVATION GOALS 230
CONSERVATION PRIORITIES 231
Great Plains Steppe Ecoregion 233
Black Hills Ecoregion 233
Missouri River Ecoregion 234
Mixedgrass Subregion 234
Tallgrass Subregion 234
GENERAL CONSERVATION ACTIONS FOR ECOSYSTEM DIVERSITY 234
MANAGEMENT 235
RESEARCH 235
EDUCATION 235
CONSERVATION ACTIONS FOR SPECIES OF GREATEST CONSERVATION NEED 252

7.0 AGENCY COORDINATION, COOPERATOR INTERACTIONS, AND PUBLIC INVOLVEMENT IN PLAN AND ACTIONS 288
ORGANIZATIONAL STRUCTURE OF SOUTH DAKOTA'S PROCESS 288
PUBLIC INVOLVEMENT AND PARTNERSHIP PROCESS 289
COORDINATION WITH OTHER AGENCIES AND TRIBES 291
REVIEW OF THE DRAFT COMPREHENSIVE WILDLIFE CONSERVATION PLAN 291
UNDERSTANDING SOUTH DAKOTA CITIZENS – WILDLIFE VALUES 292
SOUTH DAKOTA WILDLIFE ACTION PLAN – AGENCY COORIDINATION, COOPERATOR INTERACTIONS AND PUBLIC INVOLVEMENT 293

8.0 MONITORING OF CWCP AND ADAPTIVE MANAGEMENT 294
MONITORING FRAMEWORK 294
Monitoring of Ecosystem Diversity 294
Monitoring and Inventory Programs for Species 296
Future Research Needs 299

9.0 REVIEW SCHEDULE 300

10.0 CITATIONS 301

LIST OF TABLES

Table 3.1. Approximate number of historical acres for ecological sites representing grass/shrub ecosystems of the Great Plains Steppe Ecoregion. 26

Table 3.2. Approximate historical amounts for ecological sites representing riverine riparian/wetland ecosystems of the Great Plains Steppe Ecoregion. 27

Table 3.3. Existing amounts for ecological sites representing riparian/wetland ecosystems of the Great Plains Steppe Ecoregion. 29

Table 3.4. Approximate number of historical stream miles for ecological sites representing riverine aquatic ecosystems of the Great Plains Steppe Ecoregion. 29

Table 3.5. Existing amounts for ecological sites representing aquatic ecosystems of the Great Plains Steppe Ecoregion. 31

Table 3.6. Approximate number of historical acres for ecological sites representing forest ecosystems of the Great Plains Steppe Ecoregion. 31

Table 3.7. Approximate number of historical acres for ecological sites representing grass/shrub ecosystems of the Black Hills Ecoregion. 34

Table 3.8. Approximate historical amounts for ecological sites representing riverine riparian/wetland ecosystems of the Black Hills Ecoregion. 37

Table 3.9. Existing amounts for ecological sites representing riparian/wetland ecosystems of the Black Hills Ecoregion. 37

Table 3.10. Approximate number of historical stream miles for ecological sites representing riverine aquatic ecosystems of the Black Hills Ecoregion. 39

Table 3.11. Existing amounts for ecological sites representing aquatic ecosystems of the Black Hills Ecoregion. 39

Table 3.12. Approximate number of historical acres for ecological sites representing forested ecosystems of the Black Hills Ecoregion. 41

Table 3.13. Approximate predicted amounts for ecological sites representing riverine riparian/wetland ecosystems of the Missouri River Ecoregion. 42

Table 3.14. Existing amounts for ecological sites representing riparian/wetland ecosystems of the Missouri River Ecoregion. 44

Table 3.15. Approximate number of historical stream miles for ecological sites representing riverine aquatic ecosystems of the Missouri River Ecoregion. 44

Table 3.16. Existing amounts for ecological sites representing aquatic ecosystems of the Missouri River Ecoregion. 46

Table 3.17. Approximate number of historical acres for ecological sites representing grass/shrub ecosystems of the Mixedgrass Subregion. 47

Table 3.18. Approximate historical amounts for ecological sites representing riverine riparian/wetland ecosystems of the Mixedgrass Subregion. 49

Table 3.19. Existing amounts for ecological sites representing riparian/wetland ecosystems of the Mixedgrass Subregion. 51

Table 3.20. Approximate number of historical stream miles delineated and mapped for ecological sites representing riverine aquatic ecosystems of the Mixedgrass Subregion. 51

Table 3.21. Existing amounts for ecological sites representing aquatic ecosystems of the Mixedgrass Subregion. 53

Table 3.22. Approximate number of historical acres delineated and mapped for ecological sites representing grass/shrub ecosystems of the Tallgrass Subregion. 54

Table 3.23. Approximate historical amounts (stream miles) for ecological sites representing riverine riparian/wetland ecosystems of the Tallgrass Subregion. 56

Table 3.24. Existing amounts for ecological sites representing riparian/wetland ecosystems of the Tallgrass Subregion. 56

Table 3.25. Approximate number of historical stream miles delineated and mapped for ecological sites representing riverine aquatic ecosystems of the Tallgrass Subregion. 58

Table 3.26. Existing amounts for ecological sites representing aquatic ecosystems of the Tallgrass Subregion. 58

Table 4.1. List of species of greatest conservation need developed for the South Dakota Comprehensive Wildlife Plan. 60

Table 5.1. Number of acres and percentage of each grass/shrub ecological site converted for agricultural, urbanization, and mining/gravel purposes in the Great Plains Steppe Ecoregion. 199

Table 5.2. Number of acres and percentages of each forested ecological site converted for agricultural, urbanization, and mining/gravel purposes in the Great Plains Steppe Ecoregion. 200

Table 5.3. Number of acres and percentage of each grass/shrub ecological site converted for agricultural, urbanization, and mining/gravel purposes in the Black Hills Ecoregion. 201

Table 5.4. Number of acres and percentages of each forested ecological site converted for agricultural, urbanization, and mining/gravel purposes in the Black Hills Ecoregion. 202

Table 5.5. Number of acres and percentage of each grass/shrub ecological site converted for agricultural, urbanization, and mining/gravel purposes in the Mixedgrass Subregion. 205

Table 5.6. Number of acres and percentage of each grass/shrub ecological site converted for agricultural, urbanization, and mining/gravel purposes in the Tallgrass Subregion. 206

Table 5.7. Summary of problems and concerns associated with South Dakota's Species of Greatest Conservation Need. 211

Table 8.1 Summary of current monitoring programs in South Dakota 296

LIST OF FIGURES

Figure 3.1. Map of four primary ecoregions and two sub-regions delineated for the State of South Dakota. 18

Figure 3.2. Primary components of the ecosystem diversity matrix (EDM). 19

Figure 3.3. Map of the Great Plains Steppe Ecoregion. 23

Figure 3.4. EDM for grass/shrub ecosystems of the Great Plains Steppe Ecoregion. 25

Figure 3.5. Sample map of ecological site classification representing a small subset of the Great Plains Steppe Ecoregion. 26

Figure 3.6. EDM for riparian ecosystems of the Great Plains Steppe Ecoregion. 28

Figure 3.7. EDM for aquatic ecosystems of the Great Plains Steppe Ecoregion. 30

Figure 3.8. EDM for forested ecosystems of the Great Plains Steppe Ecoregion.. 32

Figure 3.9. Map of the Black Hills Ecoregion. 33

Figure 3.10. EDM for grass/shrub ecosystems of the Black Hills Ecoregion. 35

Figure 3.11. EDM for riparian/wetland ecosystems of the Black Hills Ecoregion. 36

Figure 3.12. EDM for aquatic ecosystems of the Black Hills Ecoregion. 38

Figure 3.13. EDM for forested ecosystems of the Black Hills Ecoregion. 40

Figure 3.14. Map of the Missouri River Ecoregion. 41

Figure 3.15. EDM for riparian/wetland ecosystems of the Missouri River Ecoregion. 43

Figure 3.16. EDM for aquatic ecosystems of the Missouri River Ecoregion. 45

Figure 3.17. Map of the Mixedgrass Subregion. 46

Figure 3.18. EDM for grass/shrub ecosystems of the Mixedgrass Subregion. 48

Figure 3.19. EDM for riparian/wetland ecosystems of the Mixedgrass Subregion. 50

Figure 3.20. EDM for aquatic ecosystems of the Mixedgrass Subregion. 52

Figure 3.21. Map of the Tallgrass Subregion. 53

Figure 3.22. EDM for grass/shrub ecosystems of the Tallgrass Subregion. 55

Figure 3.23. EDM for riparian/wetland ecosystems of the Tallgrass Subregion. 57

Figure 3.24. EDM for aquatic ecosystems of the Tallgrass Subregion. 59

Figure 4.1.1.1. Bird species of greatest conservation need occurring in grass/shrub ecosystems of the Tallgrass Subregion. 91

Figure 4.1.2.1. Bird species of greatest conservation need occurring in riparian/wetland ecosystems of the Tallgrass Subregion. 92

Figure 4.2.1.1. Bird species of greatest conservation need occurring in grass/shrub ecosystems of the Mixedgrass Subregion. 93

Figure 4.2.2.1. Bird species of greatest conservation need occurring in riparian/wetland ecosystems of the Mixedgrass Subregion. 94

Figure 4.3.2.1. Bird species of greatest conservation need occurring in riparian/wetland ecosystems of the Missouri River Ecoregion. 95

Figure 4.4.1.1. Bird species of greatest conservation need occurring in grass/shrub ecosystems of the Great Plains Steppe Ecoregion. 96

Figure 4.4.2.1. Bird species of greatest conservation need occurring in riparian/wetland ecosystems of the Great Plains Steppe Ecoregion. 97

Figure 4.5.1.1. Bird species of greatest conservation need occurring in grass/shrub ecosystems of the Black Hills Ecoregion. 98

Figure 4.5.2.1. Bird species of greatest conservation need occurring in riparian/wetland ecosystems of the Black Hills Ecoregion. 99

Figure 4.5.4.1. Bird species of greatest conservation need occurring in forested ecosystems of the Black Hills Ecoregion. 100

Figure 4.1.1.2. Mammal species of greatest conservation need occurring in grass/shrub ecosystems of the Tallgrass Subregion. 111

Figure 4.1.2.2. Mammal species of greatest conservation need occurring in riparian/ Wetland ecosystems of the Tallgrass Subregion. 112

Figure 4.2.1.2. Mammal species of greatest conservation need occurring in grass/shrub ecosystems of the Mixedgrass Subregion. 113

Figure 4.2.2.2. Mammal species of greatest conservation need occurring in riparian/ Wetland ecosystems of the Mixedgrass Subregion. 114

Figure 4.3.2.2. Mammal species of greatest conservation need occurring in riparian/ Wetland ecosystems of the Missouri River Ecoregion. 115

Figure 4.4.1.2. Mammal species of greatest conservation need occurring in grass/shrub ecosystems of the Great Plains Steppe Ecoregion. 116

Figure 4.4.2.2. Mammal species of greatest conservation need occurring in riparian/ Wetland ecosystems of the Great Plains Steppe Ecoregion. 117

Figure 4.4.4.2. Mammal species of greatest conservation need occurring in forested ecosystems of the Great Plains Steppe Ecoregion..... 118

Figure 4.5.1.2. Mammal species of greatest conservation need occurring in grass/shrub ecosystems of the Black Hills Ecoregion. 119

Figure 4.5.2.2. Mammal species of greatest conservation need occurring in riparian/ Wetland ecosystems of the Black Hills Ecoregion. 120

Figure 4.5.4.2. Mammal species of greatest conservation need occurring in forested ecosystems of the Black Hills Ecoregion. 121

Figure 4.1.3.3. Mussel species of greatest conservation need occurring in aquatic ecosystems of the Tallgrass Subregion. 129

Figure 4.2.3.3. Mussel species of greatest conservation need occurring in aquatic ecosystems of the Mixedgrass Subregion. 130

Figure 4.3.3.3. Mussel species of greatest conservation need occurring in aquatic ecosystems of the Missouri River Ecoregion. 131

Figure 4.5.4.4. Gastropod species of greatest conservation need occurring in aquatic ecosystems of the Black Hills Ecoregion. 136

Figure 4.1.1.5. Insect species of greatest conservation need occurring in grass/shrub ecosystems of the Tallgrass Subregion. 146

Figure 4.1.2.5. Insect species of greatest conservation need occurring in riparian/wetland ecosystems of the Tallgrass Subregion. 147

Figure 4.2.1.5. Insect species of greatest conservation need occurring in grass/shrub ecosystems of the Mixedgrass Subregion. 148

Figure 4.2.2.5. Insect species of greatest conservation need occurring in riparian/wetland cosystems of the Mixedgrass Subregion. 149

Figure 4.3.2.5. Insect species of greatest conservation need occurring in riparian/wetland ecosystems of the Missouri River Ecoregion. 150

Figure 4.4.1.5. Insect species of greatest conservation need occurring in grass/shrub ecosystems of the Great Plains Steppe Ecoregion..... 151

Figure 4.4.2.5. Insect species of greatest conservation need occurring in riparian/wetland Ecosystems of the Great Plains Steppe Ecoregion. 152

Figure 4.5.2.5. Insect species of greatest conservation need occurring in riparian/wetland Ecosystems of the Black Hills Ecoregion. 153

Figure 4.1.3.6. Fish species of greatest conservation need occurring in aquatic ecosystems of the Tallgrass Subregion. 174

Figure 4.2.3.6. Fish species of greatest conservation need occurring in aquatic ecosystems of the Mixedgrass Subregion. 175

Figure 4.3.3.6. Fish species of greatest conservation need occurring in aquatic ecosystems of the Missouri River Ecoregion. 176

Figure 4.4.3.6. Fish species of greatest conservation need occurring in aquatic ecosystems of the Great Plains Steppe Ecoregion..... 177

Figure 4.5.3.6. Fish species of greatest conservation need occurring in aquatic ecosystems of the Black Hills Ecoregion. 178

Figure 4.1.1.7. Amphibian and reptile species of greatest conservation need occurring in grass/shrub ecosystems of the Tallgrass Subregion. 191

Figure 4.1.2.7. Amphibian and reptile species of greatest conservation need occurring in riparian/wetland of the Tallgrass Subregion..... 192

Figure 4.2.1.7. Amphibian and reptile species of greatest conservation need occurring in grass/shrub ecosystems of the Mixedgrass Subregion. 193

Figure 4.2.2.7. Amphibian and reptile species of greatest conservation need occurring in riparian/wetland ecosystems of the Mixedgrass Subregion..... 194

Figure 4.3.2.7. Amphibian and reptile species of greatest conservation need occurring in riparian/wetland ecosystems of the Missouri River Ecoregion..... 195

Figure 4.4.1.7. Amphibian and reptile species of greatest conservation need occurring in grass/shrub ecosystems of the Great Plains Steppe Ecoregion..... 196

Figure 4.5.2.7. Amphibian and reptile species of greatest conservation need occurring in riparian/wetland ecosystems of the Black Hills Ecoregion..... 197

Figure 5.1.1. Total number of species of greatest conservation need within each disturbance influenced pathway of the EDM for grass/shrub ecosystems of the Tallgrass Subregion 212

Figure 5.1.2. Total number of species of greatest conservation need within each habitat descriptor of the EDM for riparian/wetland ecosystems of the Tallgrass Subregion. 213

Figure 5.1.3. Total number of species of greatest conservation need within each habitat Descriptor of the EDM for aquatic ecosystems of the Tallgrass Subregion.... 214

Figure 5.2.1. Total number of species of greatest conservation need within each disturbance influenced pathway of the EDM for grass/shrub ecosystems of the Mixedgrass Subregion. 215

Figure 5.2.2. Total number of species of greatest conservation need within each habitat descriptor of the EDM for riparian/wetland ecosystems of the Mixedgrass Subregion. 216

Figure 5.2.3. Total number of species of greatest conservation need within each habitat descriptor of the EDM for aquatic ecosystems of the Mixedgrass Subregion. 217

Figure 5.3.1. Total number of species of greatest conservation need within each habitat descriptor of the EDM for riparian/wetland ecosystems of the Missouri River Ecoregion. 218

Figure 5.3.2. Total number of species of greatest conservation need within each habitat descriptor of the EDM for aquatic ecosystems of the Missouri River Ecoregion. 219

Figure 5.4.1. Total number of species of greatest conservation need within each disturbance influenced pathway of the EDM for grass/shrub ecosystems of the Great Plains Steppe Ecoregion. 220

Figure 5.4.2. Total number of species of greatest conservation need within each habitat descriptor of the EDM for riparian/wetland ecosystems of the Great Plains Steppe Ecoregion. 221

Figure 5.4.3. Total number of species of greatest conservation need within each habitat descriptor of the EDM for aquatic ecosystems of the Great Plains Steppe Ecoregion. 222

Figure 5.4.4. Total number of species of greatest conservation need within each disturbance influenced pathway of the EDM for forested ecosystems of the Great Plains Steppe Ecoregion 223

Figure 5.5.1. Total number of species of greatest conservation need within each disturbance influenced pathway of the EDM for grass/shrub ecosystems of the Black Hills Ecoregion. 224

Figure 5.5.2. Total number of species of greatest conservation need within each habitat descriptor of the EDM for riparian/wetland ecosystems of the Black Hills Ecoregion. 225

Figure 5.5.3. Total number of species of greatest conservation need within each habitat descriptor of the EDM for aquatic ecosystems of the Black Hills Ecoregion. 226

Figure 5.5.4. Total number of species of greatest conservation need within each Disturbance influenced pathway of the EDM for the forested ecosystems of the Black Hills Ecoregion. 227

Figure 6.1. Conservation goals for grass/shrub ecosystems of the Great Plains Steppe Ecoregion. 236

Figure 6.2. Conservation goals for riparian/wetland ecosystems of the Great Plains Steppe Ecoregion. 237

Figure 6.3. Conservation goals for aquatic ecosystems of the Great Plains Steppe Ecoregion. 238

Figure 6.4. Conservation goals for forested ecosystems of the Great Plains Steppe Ecoregion. 239

Figure 6.5. Conservation goals for grass/shrub ecosystems of the Black Hills Ecoregion. 240

Figure 6.6. Conservation goals for riparian/wetland ecosystems of the Black Hills Ecoregion. 241

Figure 6.7. Conservation goals for aquatic ecosystems of the Black Hills Ecoregion. 242

Figure 6.8. Conservation goals for forested ecosystems of the Black Hills Ecoregion. 243

Figure 6.9. Conservation goals for riparian/wetland ecosystems of the Missouri River Ecoregion. 244

Figure 6.10. Conservation goals for aquatic ecosystems of the Missouri River Ecoregion. 245

Figure 6.11. Conservation goals for grass/shrub ecosystems of the Mixedgrass Subregion. 246

Figure 6.12. Conservation goals for riparian/wetland ecosystems of the Mixedgrass Subregion. 247

Figure 6.13. Conservation goals for aquatic ecosystems of the Mixedgrass Subregion. 248

Figure 6.14. Conservation goals for grass/shrub ecosystems of the Tallgrass Subregion. 249

Figure 6.15. Conservation goals for riparian/wetland ecosystems of the Tallgrass Subregion. 250

Figure 6.16. Conservation goals for aquatic ecosystems of the Tallgrass Subregion. 251

Figure 7.1. Diagram of South Dakota's process for developing their CWCP 288

Figure 7.2. Wildlife value orientation types for South Dakota (2004) 293

APPENDICES

APPENDIX A: Background on the SIMPPLLE Model 329

APPENDIX B. Maps of Ecological Sites of South Dakota 331

APPENDIX C: GIS methodology used in the CWCP 336

APPENDIX D: Protection status of each species in the CWCP 338

APPENDIX E: Species codes used in the CWCP 339

APPENDIX F: Common or increasing non-native plant species occurring in South Dakota 341

APPENDIX G: Existing programs to assist in maintaining and restoring ecosystem diversity in South Dakota. 342

APPENDIX H: Public comments on the draft CWCP 345

1.0 INTRODUCTION

Background

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.

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, non-game 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 3000 groups came together in recent years 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 and has provided funding for the past several years. The State Wildlife Grants 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. In order to receive future federal funds through the State Wildlife Grants program, Congress charged each state and

territory with developing a state Comprehensive Wildlife Conservation Plan (CWCP). The state wildlife plans will provide an essential foundation for the future of wildlife conservation and an opportunity for the states, federal agencies, and other conservation partners to strategically think about their individual and coordinated roles in conservation efforts across the nation.

Key Elements

Congress identified eight required elements of a state wildlife conservation strategy 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 CWCP 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.

Purpose

The South Dakota Comprehensive Wildlife Conservation Plan serves as a strategic vision and plan of action for statewide wildlife conservation and funding, thereby making South Dakota eligible for Federal conservation funding. The CWCP identifies conservation needs and actions that can be implemented by any landowner, agency, partnership, or private organization. The CWCP 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; however, the CWCP also describes the full array of ecosystems possible within South Dakota.

The purpose of the South Dakota CWCP 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 guide for prioritization of resources and activities to prevent the future decline of species and ecosystems in South Dakota
3. A framework for monitoring and research to improve the information available on ecosystems and species in South Dakota
4. A means for guiding, influencing and achieving coordination in public and private decision-making
5. 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 South Dakota Comprehensive Wildlife Conservation Plan 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 South Dakota Game, Fish, and Parks, but a cooperative effort to include landowners, other agencies, and organizations. It will emphasize the State's native biodiversity, but is not designed to detract from the value of important non-native species, and in fact, should provide many indirect benefits to many of these species such as Ring-necked Pheasants. The plan will not replace other planning efforts, such as those developed for deer management, but will address broader biodiversity objectives using complementary programs.

The Comprehensive Wildlife Conservation Plan will help guide voluntary and cooperative actions, and will not institute mandates or restrictions on uses of private land. It will use an historical reference to help characterize and understand biological diversity, but is not a plan to return to historical conditions. The programs and approaches it recommends 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 has been 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.

Goals of CWCP

The goals of the CWCP are strategic and designed to:

1. Identify a strategy for conservation of biological diversity in South Dakota;
2. Initiate a process for identifying and monitoring the status of biological diversity in South Dakota relative to this strategy;
3. Identify threats to biodiversity and establish a conservation action process for ecosystems and species of concern;
4. Develop objectives and action plans to achieve these goals.

Organization of CWCP – where to find key elements

The following table identifies the Sections and Sub-sections in the South Dakota CWCP that address the eight key elements required by Congress:

ELEMENT	SUB-ELEMENT	SECTION	SUB-SECTION
1 - Species			
	Species of greatest conservation need	**4**	Species tables
2 - Key Habitats			
	Descriptions	**3**	Ecosystem diversity
	Locations	**3, App. 2**	Ecological site maps
	Relative Conditions	**3**	Ecosystem diversity
		5	Ecosystem diversity
3 - Problems			
	Problems/causes of concern - species	**4**	Species tables
		5	Species diversity
	Problems/causes of concern - key habitats	**5**	Ecosystem diversity
	Priority research/survey efforts - species	**5**	Species diversity
	Priority research/survey efforts - habitats	**5**	Ecosystem diversity
4 - Conservation actions			
	Conservation goals - key habitats	**6**	Ecosystem diversity
	Conservation actions - species	**6**	Species diversity
	Conservation actions - key habitats	**6**	Ecosystem diversity
	Priorities for implementation	**6**	Ecosystem diversity
5 - Monitoring			
	Monitoring - species	**8**	Monitoring species diversity
	Monitoring - key habitats	**8**	Monitoring ecosystem diversity
	Monitoring - effectiveness of strategy	**8**	Monitoring ecosystem diversity
	Adaptive management	**8**	Adaptive management
6 - Strategy review			
	Procedures	**9**	
7 - Coordination			
	Plan development	**7**	Public Involvement/Partnership
	Plan implementation	**7**	SD Wildlife Action Plan
	Plan review	**7**	Review of the draft….
	Plan revision	**9**	
8 - Public participation			
	Plan development	**7**	Public Involvement/Partnership
	Plan implementation	**7**	SD Wildlife Action Plan

Existing State or Regional Conservation Plans/Strategies

Several conservation plans have been developed that include South Dakota in their scope. Some of these plans have a narrower focus than the CWCP. Other broad conservation plans have been prepared by various agencies and organizations for different, albeit related purposes. Other ecoregional planning efforts relevant to South Dakota include the following:

1. The Northern Tallgrass Prairie Ecoregion: A River and Stream Conservation Portfolio, The Nature Conservancy[1].
2. Ecoregional Planning in the Northern Great Plains Steppe, The Nature Conservancy[2]
3. Ecoregional Conservation in the Black Hills, The Nature Conservancy[3]
4. Partners in Flight Bird Conservation Plan for the Tallgrass Prairie (Physiographic Area 40) [4]
5. Partners in Flight Bird Conservation Plan for the Northern Mixed-grass Prairie (Physiographic Area 37)[5]
6. Northern Great Plains Assessment, U.S. Forest Service[6].
7. Northern Plains Conservation Network's Conservation Assessment of the Northern Great Plains ecoregion[7].
8. South Dakota Dept. of Game, Fish and Parks, Wildlife Division Strategic Plan[8]

9. Prairie Management Plan of the Cheyenne River Sioux Reservation, Cheyenne River Sioux Tribe[9]

Glossary of key terms

AQUATIC ECOSYSTEMS – areas that contain plants and animals that predominantly depend on water to be present for all or most of the year

BIOLOGICAL DIVERSITY – the variety of life and its processes at levels of landscape, ecosystem, species, and genetic organization

CLASSIFICATION SYSTEM – refers to categorizing areas into similar groupings, such that conditions within one category of a classification are more uniform than compared to conditions in other classification categories.

CONSERVATION STRATEGY – an approach to planning and management that provides for the maintenance or enhancement of identified ecological objectives.

ECOLOGICAL COMMUNITY – the biotic components of an ecosystem

ECOLOGICAL SITE – Developed by USDA/NRCS, it is a system of dividing the landscape into units for the purposes of inventory, evaluation, management and study. An ecological site is a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation.

ECOREGION – large geographic areas with similar climate and landform "within which local ecosystems reoccur more or less throughout the region in a predictable pattern" [10]; no particular scale is associated with an ecoregion but they are typically assumed to encompass enough area to contain a range of identifiable ecosystems

ECOSYSTEM – a discrete area that can be characterized by its plant and animal communities as well as the associated abiotic conditions

ECOSYSTEM DIVERSITY MATRIX – a conservation-planning tool used to characterize ecosystem diversity within a landscape

FILTER – refers to a type of strategy for conservation planning

Coarse Filter – a strategy that is based on identifying the array of ecosystems that can occur and that if properly represented in the planning area will provide for the conservation of biological diversity

Fine Filter – a strategy that is based on identifying the habitat needs of 1) a single species or groupings of species, such as guilds or 2) a categorization of species such as indicator species, keystone species, ecological engineer species, etc.

FOREST ECOSYSTEMS – terrestrial areas that have 10% or more cover by trees

GRASS/SHRUB ECOSYSTEMS – terrestrial areas dominated by herbaceous and/or shrub vegetation and maintained or removed by fire, grazing, and/or drought

HISTORICAL DISTURBANCE REGIME - the pattern and distribution of disturbance processes, such as fire, grazing, flooding, etc., occurring within a landscape prior to European settlement

HISTORICAL RANGE OF VARIABILITY – the variance of ecological parameters (i.e., ecological communities) over a past time period

HISTORICAL REFERENCE – the ecosystem conditions that resulted from natural (i.e., fire, grazing, etc.) and human-influenced (i.e., native American) disturbance processes occurring in a landscape; usually confined to a period less than 1000 years prior to European settlement in an area

LANDSCAPE – an area containing a number and variety of ecosystems; no particular scale is associated with a landscape but they are typically assumed to encompass enough area to contain a range of identifiable ecosystems

NATURAL – the compositions, structures, functions, and processes of ecosystems as defined by an historical reference

RIPARIAN/WETLAND ECOSYSTEMS – the interface between the terrestrial and aquatic ecosystems

Riparian - areas contiguous to perennial and intermittent rivers, streams, or drainage ways; they often have one or both of the following characteristics: 1) distinctively different vegetative species than adjacent areas, and/or 2) species similar to adjacent areas but exhibiting more vigorous or robust growth forms

Wetland – areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions

SCALE – refers to the size of the area included in the conservation effort, such as broad-scale (2 million acres) vs. fine-scale (10,000 acres); or the resolution of the mapping used, such as coarse scale (1 km pixels) vs. fine scales (1 m pixels); or the level of detail in describing conditions

SPECIES OF GREATEST CONSERVATION NEED – includes State and Federally listed species for which the State of South Dakota has a mandate for recovery, species for which South Dakota represents a significant portion of the species' overall range, and species that are indicative of or depend upon a declining or unique habitat in South Dakota

Acronyms and Abbreviations used in this report

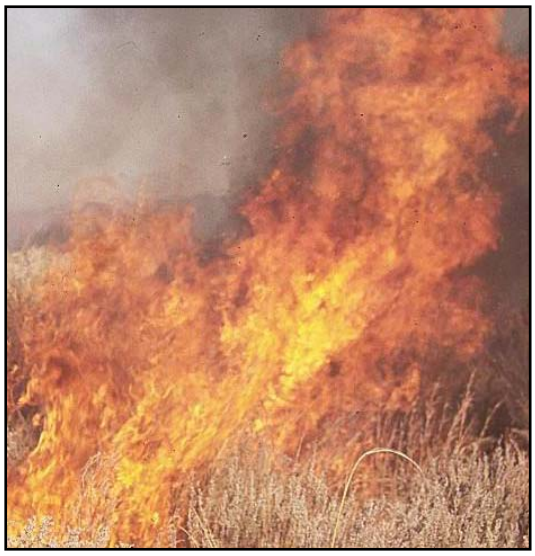
AC – Acres
CCRP – Continuous Conservation Reserve Program
CRP – Conservation Reserve Program
CSP – Conservation Security Programs
CWCP – Comprehensive Wildlife Conservation Plan
EDM – Ecosystem Diversity Matrix
EMRI – Ecosystem Management Research Institute
EQIP – Environmental Quality Incentives Program
ESA – Endangered Species Act
FLP – Forest Legacy Program
FSA – Farm Service Agency
FSP – Forest Stewardship Program
GAP – Gap Analysis Program
GIS – Geographic Information System
GRP – Grassland Reserve Program
HRV – Historic Range of Variability
LIP – Landowner Incentive Program
LRR – Land Resource Region
MLRA – Major Land Resource Area
MUSYM – Map Unit Symbol
NA – Information Not Available
NPS – National Park Service

NWI – National Wetland Inventory
SDGFP – South Dakota Game, Fish, and Parks
SIMPPLLE – Simulating Patterns and Processes at Landscape Scales
SM – Stream Miles
SoGCN – Species of Greatest Conservation Need
SSURGO – Soil Survey Geographic Database
USDA/NRCS – United States Department of Agriculture, Natural Resources Conservation Service
WHIP – Wildlife Habitat Incentives Program
WRP – Wetlands Reserve Program

2.0 CONSERVATION STRATEGY

Selected Strategy

Conservation of biological diversity can be approached through several strategies[1]. Selection of a strategy is dependent on the unique objectives of an individual planning effort. The South Dakota CWCP requires a conservation strategy that can effectively and efficiently meet its stated goals. Various strategies for conservation of biological diversity were evaluated and assessed. A strategy was selected that provides a strong scientific foundation for conservation of biological diversity as well as the flexibility to consider other land uses in the overall effort. 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 strong scientific foundation for using an historical reference for defining ecosystem integrity and biological diversity[2,3]. 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.



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. Ecosystem conversion to agriculture, urban, and suburban uses are the most obvious impacts. However, there are also less obvious, yet in some instances more pervasive, human-induced changes at the ecosystem level as well. We have only recently begun to understand the implications of a century of European alterations to and interruptions of historical disturbance regimes in the Great Plains. Recent studies have shown that the suppression or cessation of historical disturbance has gradually changed ecosystem processes and ultimately the composition, structure, and function of many ecosystems[4,5]. 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 historical 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 South Dakota CWCP will incorporate a combined coarse filter and fine filter strategy for conservation of biological diversity[6]. A description of ecosystem diversity that is based on historical references for plant community compositions, structures, and dynamic processes will represent the coarse filter component of this strategy. A description of threats and habitat needs for individual wildlife species of concern will represent the fine filter component. However, it is important to note that for most wildlife species, species diversity will be dependent on the ecosystem diversity provided by the coarse filter for characterization and description of habitat needs. The South Dakota CWCP 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. For a more detailed description of the coarse filter/fine filter strategy that is

based on the historical reference, refer to The Wildlife Society Technical Review 02-1, Performance Measures for Ecosystem Management and Ecological Sustainability[6].

To date, most planning efforts to address biological diversity have been a result of regulatory requirements such as the Endangered Species Act, National Forest Management Act, Federal Land Policy Management Act, etc. These planning efforts have been largely reactionary to existing species concerns or management issues. In an effort to address biological diversity before problems are identified, many are advocating a comprehensive landscape planning approach that incorporates ecosystem diversity, in addition to species diversity, as a strategy for biodiversity conservation[7,8]. The coarse-filter/fine filter strategy was developed to address this need.

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 species and their habitat (fine filter). 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 species of greatest conservation need, 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 of the Strategy

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[6,8,9]. 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 CWCP, however, is on the landscape, ecosystem, and species level of scale. Genetic levels can be incorporated at future times to address specific questions such as connectivity within a population of a species.

For the purposes of the CWCP, we will apply the coarse filter/fine filter strategy in the following sequence:

1. Delineate ecoregions within the State of South Dakota to facilitate ecosystem diversity characterization and management,
2. Classify ecosystem diversity as it occurred under historical disturbance regimes within each ecoregion to describe the coarse filter,
3. Where existing information is available, use the coarse filter to quantify the historical range of variability or historical amounts of each ecosystem in an ecoregion to provide an historical reference.
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 those species of greatest conservation need (SoGCN).
7. Evaluate the habitat needs/requirements of species of greatest conservation need 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 SoGCN.
10. Identify opportunities for collaborative partnerships within the state to achieve the conservation goals.

3.0 ECOSYSTEM DIVERSITY

A primary objective of the coarse filter strategy is to identify and characterize ecosystem diversity within the State of South Dakota based on the historical reference. To accomplish this requires identifying an appropriate classification system and applying it at the appropriate scale for biodiversity conservation efforts. Understanding both classification and scale is important to discussions of appropriate classifications used in a coarse filter/fine filter strategy. For this reason the following section will present a brief overview of classification systems and discuss their application relative to the South Dakota CWCP.

Classification Systems

The importance of a landscape classification system for defining ecosystem diversity cannot be overstated. To describe an historical reference for use in conservation planning, a classification system should have the ability to describe the complex of communities that occurred under historical disturbance regimes, as developed for a specific landscape. This classification must delineate communities in sufficient detail to allow the full array of biological diversity at the ecosystem and species levels to be addressed, yet still provide a mechanism to quantify and evaluate the distribution of ecosystems at the landscape level. In addition to identifying different communities, for a classification system to support an approach that strives to provide representation of appropriate ecosystems, it must provide for the development of specific evaluation criteria at the ecosystem level for determining whether a particular stand meets minimum representation conditions. As discussed previously, the classification system of the coarse filter should identify the complex of ecosystems that occurred under historical disturbance regimes. With this information, the existing conditions of ecosystems within the landscape can be evaluated against the conditions that occurred historically. Observed changes may be due to direct human alteration of species composition, structure, or function, or indirectly through changes to disturbance regimes, introduction of exotic species, or other factors. To meet the assumptions of the historical range of variability-based approach, ecosystems must be substantially similar to historical conditions to qualify for representation. The criteria for inclusion should include selected measures of community composition, structure, and process.

The purpose of a classification system is to group like elements into units that can be defined and characterized. While some classification systems are designed for a specific purpose, most attempt to provide a better description of the pattern of vegetation or ecosystems in an area. When using classification systems for conservation planning, consideration of the interaction of scales, hierarchies, and resolution of classifications is important. Specific classification systems may emphasize terrestrial systems, riparian/wetland systems, or aquatic systems. One group of classification systems has been developed for delineating regions with greater similarity of ecosystems within a region than among other regions, i.e., ecoregion classifications. Other classifications are designed for more specific ecosystem classifications applicable to specific sites on the ground. Classification systems can be hierarchical or single level. Some classification systems classify ecological sites that may be the same in terms of the abiotic environment or potential vegetation that can occur at a site, while others classify existing dominant vegetation regardless of the underlying abiotic conditions. Some classification systems are based on a single factor or variable while others use multiple factors for classification. The variability in types of classification systems is the result of classifications that are: 1) developed for different purposes or scales, 2) based on different ecological or conservation strategies, and 3) based on different assumptions or interpretation of ecological information.

The South Dakota CWCP has identified two objectives for landscape classification: 1) the ability to describe the full range of ecosystem conditions resulting from historical disturbance regimes, i.e., the coarse filter, and 2) the ability to evaluate and compare historical ecosystem diversity to existing conditions. Many of the more commonly used classification systems for biodiversity conservation efforts base their classification on existing dominant vegetation. An example of this type of classification is the National Vegetation Classification System1. However, classifications of existing vegetation typically do not provide information on historical conditions and disturbance responses, and therefore have limited utility in the development of a coarse filter based on an historical reference.

Understanding the role of historical disturbance and its influence on species composition, structure, etc., requires an ecological classification of site conditions. Typically this type of classification delineates the differences in abiotic conditions such as climate, soils, aspect, elevation, moisture, etc., that influence the disturbance patterns and plant communities that can occur on that site. Examples of ecological site classifications include Daubenmire's "habitat types"2 and the Natural Resources Conservation Service's "ecological sites"3.

While ecological site classifications provide valuable information on abiotic conditions, they do not, in and of themselves, identify the full range of successional conditions possible on that site as a result of disturbance events and processes. For this reason, it is important to combine an ecological site classification with a classification of successional stages and/or alternative states (sometimes also referred to as state and transitional models) resulting from historical disturbance. To accomplish this, we have utilized the Ecosystem Diversity Matrix (EDM)4, a conservation planning tool that provides the framework for combining ecological classification with a classification of successional stages and/or alternative states. Further, the EDM can be linked to a GIS and used to quantitatively evaluate the coarse filter relative to existing conditions. The EDM and its development in South Dakota are more fully described in a later section.

Historical Disturbance

The South Dakota CWCP selected a strategy that is based on the historical reference and understanding of historical disturbance regimes. But what do we mean by the terms historical reference and historical disturbance and why are they important?

We define historical reference as the ecosystem conditions that resulted from natural (i.e., fire, grazing, etc.) and human-influenced (i.e., native American) disturbance that created the dynamic conditions species were dependent upon. Historical disturbance regimes are the patterns of frequency and intensity that can be quantified using ecological evidence. 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 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[5].

Historical reference is usually confined to a period less than 1000 years prior to European settlement, as these reflect the habitat conditions most relevant to the species that are present today[6]. 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 ecoregion in South Dakota, specific types of historical information can be available to help reconstruct the historical range of variability[7]. However, in some ecosystems historical information is less available, and historical ecosystem dynamics require use of models based on best available information. This will be discussed further in individual Ecoregions of the CWCP.

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.

Climate: The normal Northern Great Plains climatic pattern is cyclical between wet and dry periods[8]. 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[9]. The cycle of wet and dry periods can

also influence periodic increases and decreases in the tall and short grasses[10], as well as in woody plants[11].

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[12]. 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[12].

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[13]. 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[13,14].

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[13]. 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[15]. 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[16,17,18]. Yet, it is important to note that even in a single landscape, the differences between abiotic conditions characterizing ecological sites contributes to different fire regime characteristics in terms of frequency, severity, and patch size.

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 natural occurring wildfire events in South Dakota. Higgins[19] reviewed lightning-caused fire records (1940-1981) 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 south-central North Dakota, 25 per year per 10,000 km2 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[19]. 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 can 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 increases the dominance of tall-

statured bunchgrasses and reduces the cover of short-statured sodgrasses[20]. Fires occurring during the growing season generally limit spread or occurrence of woody vegetation outside of riparian/wetland areas[20]. 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[21].

Forest Ecosystems – Based on historical accounts[22,23] and recent studies[24], 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 is predominantly characterized by relatively frequent, non-lethal, low to moderate intensity fires that burn along the ground and remain within the forest understory. The frequency of these fires, influences both the species composition and vegetation structure within these forests. Fire tolerant species such as ponderosa pine and bur oak become dominant in the overstory and bunch grasses become dominant in the understory. The potential for destructive wildfire, insect, or disease events are 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[25]. 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 is characterized by infrequent, lethal, high-intensity fire that consumes both the forest understory and overstory as it moves across the landscape. Stand replacing fire regimes result in a short term, catastrophic effect on stand conditions, in contrast to the persistent, yet less obvious effects of the short-interval fire regime. The result of this impact is to set the stand back to an early successional stage and release plant species stimulated by severe fire events. Then the stand proceeds along an undisturbed successional trajectory for many years, depending on the ecological site.

A “mixed severity” fire regime also typically occurs in landscapes with both short- and long-interval fire regimes. That is, depending on site conditions or position on the landscape, both non-lethal and lethal fires could occur within a mosaic of diverse stand conditions. This is typically common through the transitional portion of the environmental gradient where the lower elevation, drier sites are dominated by non-lethal fire regimes and higher elevation, moister sites are dominated by the lethal fire regime. Consequently, where a transitional site occurs primarily adjacent to the low elevation types, it is predominantly influenced by a short-interval fire regime with pockets of long-interval fire influences. Where it occurs primarily adjacent to the high elevation types, it is predominantly influenced by a long-interval fire regime with pockets of short-interval fire influences. Topographic features can also influence the occurrence of a “mixed” fire regime as well. For example, dry south aspect slopes and ridges within an ecological site (e.g., cool, moist white spruce) can be 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 was 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[26]. 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[26]. In fact, grazing ecosystems around the world are dominated by migratory herbivores[27,28]. 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" [29]. At the landscape level, location and seasonal extent of the "green wave" is 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" are 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 will receive a disproportionate amount of heavy grazing due to the congregating herd of animals. Those sites farthest from water sources will receive the least amount of grazing[30]. Many researchers have also found that a recent burn site will attract bison[31,32,33]. The release of soil nutrients and the corresponding rapid new growth represents 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. On native grasslands throughout the world, it is a rare event for herbaceous re-growth to go un-grazed following a fire[34]. The amount of forage removed from a site and its distribution in the landscape determines 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[35].

Ecologists frequently characterize grassland ecosystems of the Great Plains by the un-grazed height or stature of the dominant grass species (e.g., tallgrass, mixed-grass, and short-grass ecosystems). The dominant grass species, and consequently grass height, is a function of both precipitation and grazing[10]. 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 vs. mixed-grass vs. short-grass 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 influences the grassland community in many ways[35,36,37]. 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 mixed-grass 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, 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 are distributed throughout uplands sites across much of South Dakota but are much less common in the Tallgrass Subregion and the forested portions of the Black Hills Ecoregion. Prairie dogs are highly social animals and can live in colonies that range in size from one acre to thousands of acres[38]. They have been estimated to occupy several million acres of grasslands prior to European settlement in South Dakota. Nationwide, they are currently estimated to occupy only a fraction of their former range.

Black-tailed prairie dogs are considered an historical 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[39,40]. 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[38]. 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[41].

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[42,43]. The endangered black-footed ferret is dependent on prairie dogs and prairie dog colonies for both food and shelter, as it is the primary historical predator in the prairie dog ecosystem[44]. Numerous bird species have been found to prefer the open, bare ground of the prairie dog colony for nesting[43,45].

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[46]. 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[47]. 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)[48]. 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[47,49,50,51]. 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[47]. 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[52]. 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[47]. Beaver preferentially select areas for dam building that create the largest ponds with the greatest potential for expansion[52]. 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[53,54,55,56]. Dam building and feeding activities 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[57]. 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[47].

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[57]).

Flood disturbance has been an important part of the natural cycle of riparian/wetland and aquatic 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[58,59,60,61]. 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 both riparian and aquatic ecosystems promotes successional stages, overall biodiversity, and complex food webs[61]. 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[57,62]. Flood events play a critical role in ecological succession and determining the structure and composition of the effected ecosystem[63].

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[64]. 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[65] 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[65]. 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[57]. 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[57,65,66]. 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 bar. 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[66]. 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[61,67].

South Dakota Ecoregions

While these historical disturbance events were occurring throughout South Dakota, their influences were often constrained by the underlying physical features of soils and topography characterizing a region. South Dakota represents a diversity of landscapes, ecosystems and wildlife species. To support the objectives of the South Dakota CWCP, the state is divided into 4 primary ecoregions and two subregions (Figure 3.1):

1. Eastern Prairie
   - Mixedgrass
   - Tallgrass
2. Missouri River
3. Great Plains Steppe
4. Black Hills

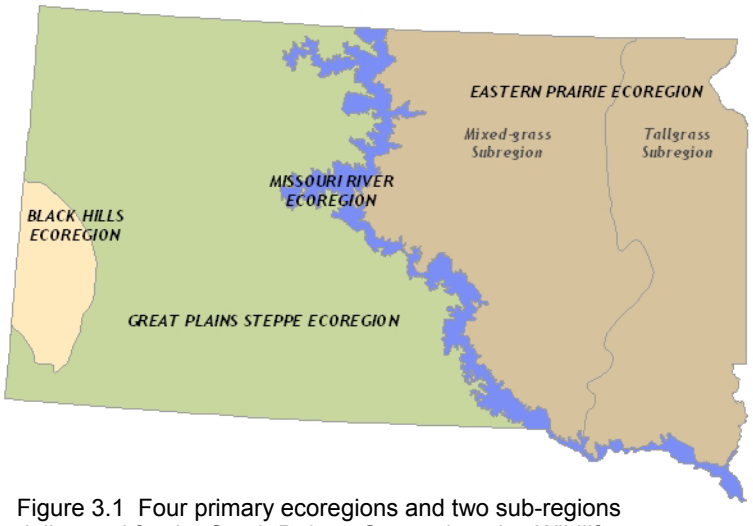


Figure 3.1 Four primary ecoregions and two sub-regions delineated for the South Dakota Comprehensive Wildlife Conservation Plan.

The method for delineating the ecoregion boundaries was based on both ecological and administrative considerations. Ecoregional boundaries are based primarily on aggregations of Major Land Resource Areas (MLRA) developed by the U.S.D.A, Natural Resource and Conservation Service[68]. MLRA's are geographic areas that are characterized by a particular pattern of soils, climate, vegetation, water resources and land uses. The MLRA classification is relatively well developed and is supported at greater resolutions by ecological site information and soils data. For this reason, MLRA's were selected as the primary classification system to derive ecoregion boundaries. MLRA's were aggregated to the Land Resource Region (LRR) level in most instances and considered relative to existing administrative programs within the state.

The portion of South Dakota lying east of the Missouri River contains two primary Land Resource Regions when aggregating MLRA's. However, for administrative purposes, these two LRR's have been combined into one ecoregion, the Eastern Prairie Ecoregion. However, for development of the coarse filter classification, these two LRR's will be tracked and discussed as Subregions. For administration of the plan, they will be combined into the Eastern Prairie Ecoregion. The two Subregions will be referred to as the Tallgrass Subregion and Mixedgrass Subregion.

Administratively it also made sense to consider the Missouri River floodplain as an individual ecoregion. Many existing management programs within South Dakota consider the Missouri River and its associated floodplain in a holistic manner. To accomplish this and identify an appropriate boundary, a second classification was used - the U.S. Environmental Protection Agency's South Dakota ecoregions[69]. This classification system incorporates hydrological influences in its delineation of ecoregion boundaries. The River Breaks and Southern River Breaks ecoregions were slightly modified, merged, and incorporated to include only those portions directly associated with the Missouri River. While this boundary includes some of the upland areas adjacent to the river, for the purposes of the coarse filter only riparian/wetland and aquatic ecosystems are considered in the Missouri River Ecoregion. The adjacent upland sites are incorporated in the appropriate adjacent ecoregion.

To adequately describe the coarse filter for each ecoregion/subregion, an ecosystem diversity matrix was developed as follows:

1) Great Plains Steppe Ecoregion
    a. Grass/shrub ecosystems
    b. Riparian/wetland ecosystems
    c. Aquatic ecosystems
    d. Forest ecosystems
2) Black Hills Ecoregion
    a. Grass/shrub ecosystems
    b. Riparian/wetland ecosystems
    c. Aquatic ecosystems
    d. Forest ecosystems
3) Missouri River Ecoregion
    a. Riparian/wetland ecosystems
    b. Aquatic ecosystems
4) Eastern Prairie Ecoregion
    a. Mixedgrass Subregion
        i. Grass/shrub ecosystems
        ii. Riparian/wetland ecosystems
        iii. Aquatic ecosystems
    b. Tallgrass Subregion
        i. Grass/shrub ecosystems
        ii. Riparian/wetland ecosystems
        iii. Aquatic ecosystems

In addition to the primary grass/shrub, riparian/wetland, forest, and aquatic ecosystems, every ecoregion may also possess special features that are important to some wildlife species. These special features might include rock outcrops, cliffs, caves, talus, etc., or rare ecosystems such as hot springs. While these special features are not characterized in the ecosystem diversity matrices, their value to biodiversity is important and is recognized relative to species of greatest conservation need within the conservation plan.

Ecosystem Diversity Matrix

The ecosystem diversity matrix (EDM) provides the framework for characterizing the coarse filter. The EDM characterizes only historical ecosystems for the purpose of the coarse filter. In most landscapes, four ecosystem diversity matrices are required:

1) Grassland/Shrub Ecosystems
2) Forested Ecosystems (upland only)
3) Riparian/Wetland Ecosystems
4) Aquatic Ecosystems

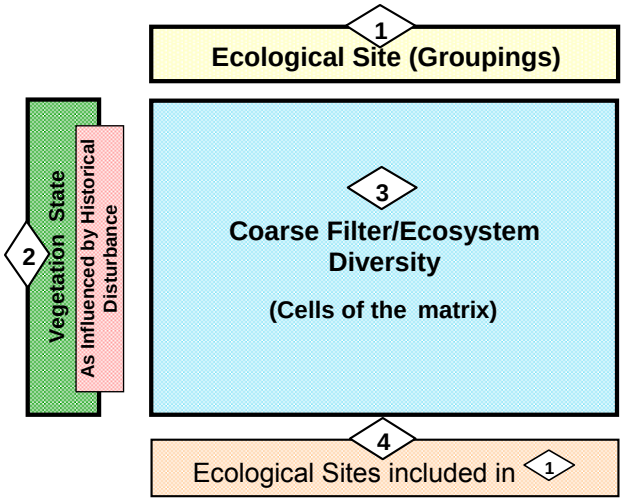


Figure 3.2. Primary components of the ecosystem diversity matrix.

Grass/shrub ecosystems throughout most of South Dakota, historically dominated the landscape. With a few small exceptions, forested ecosystems were not a primary component of the terrestrial environment outside of the Black Hills and Great Plains Steppe Ecoregions. Riparian/wetland ecosystems and aquatic ecosystems occur throughout the South Dakota landscape.

The state of South Dakota is a diverse, highly complex area that has been influenced by a multitude of

factors including the interaction of soils, aspect, elevation, climate, and disturbance. All of these influences have shaped the vegetative composition and spatial patterns across the landscapes and these in turn, have influenced the distribution of biodiversity.

Making sense of this level of complexity is a primary challenge in biodiversity conservation efforts. However, the framework for the ecosystem diversity matrix (EDM) aids in this regard through the use of two primary components for classification. The first component is the ecological site. The second component is the vegetation state as influenced by historical disturbance. The components of the EDM are identified by numbers as indicated in figure 3.2. The X-axis of the EDM represents Component 1 - ecological sites that occur within an ecoregion. The Y-axis represents Component 2 – vegetation states as influenced by historical disturbance regimes. The intersection of these two components represents specific ecosystems that in total comprise the ecosystem diversity within the designated ecoregion. All of the cells contained in the EDM framework represent the range of historical ecosystem diversity identified for a landscape. This range of conditions also represents the coarse filter for the purposes of the conservation strategy described in Section 2.

The ecosystem diversity matrices were developed using existing classification systems for ecological site and available information on ecosystem response to historical disturbance regimes. The following is a description of the methodology used in development of each of the four EDM's.

Grass/shrub ecosystems: Although grass/ shrub ecosystems may appear relatively homogeneous at a quick glance, important differences in species composition and structure occur across ecological sites, particularly in response to historical disturbance regimes. The EDM's for grass/shrub ecosystems in South Dakota incorporated the Natural Resources Conservation Service's ecological site classification that uses soils as the basic mapping unit. Ecological sites are defined by NRCS as "a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation." An ecological site is recognized and described on the basis of the characteristics that differentiate it from other sites in its ability to produce and support characteristic plant communities. For the purposes of this Plan, ecological sites were grouped in some instances where describing ecosystem diversity and species habitat did not require additional resolution to achieve this goal. Soils data[70] were used to spatially delineate the boundaries of each ecological site within each of South Dakota's ecoregions.

The primary disturbance mechanisms historically operating in the grass/shrub ecosystems of South Dakota included fire, grazing, and prairie dog colonies. Climate, while an important factor in the development and maintenance of grass/shrub ecosystems, is not incorporated in the EDM as a disturbance factor but its importance is recognized as a stochastic process. Fire and grazing are incorporated as disturbances in each of the ecoregions, whereas prairie dog colonies were much less common in the Tallgrass Subregion of the Eastern Prairie Ecoregion and are therefore omitted as a disturbance influence. Fire, grazing, and prairie dog disturbance transitions were predicted using the best available information on ecosystem and plant species response for each ecological site. For the purpose of describing the effects of fire on ecosystem diversity within each of the ecoregions, a short-interval fire regime was characterized by return intervals of less than 8 years in the Tallgrass Subregion, 10 years in the Mixedgrass Subregion, 15 years in the Great Plains Steppe Ecoregion, and 25 years in the Black Hills Ecoregion. A long-interval fire regime was characterized by return intervals of greater than or equal to 8 years in the Tallgrass Subregion, 10 years in the Mixedgrass Subregion, 15 years in the Great Plains Steppe Ecoregion, and 25 years in the Black Hills Ecoregion using information developed for the fire regime condition class Interagency Handbook reference conditions[71]. Grazing disturbance was divided into 3 levels of influence: low, moderate, and high. Low grazing is defined by less than 10% canopy removal, moderate grazing is defined by 10 to 60% canopy removal, and high grazing is defined by greater than 60% canopy removal. Prairie dog disturbance is characterized by active or in-active colonies.

The resulting grass/shrub ecosystem diversity matrices for each of South Dakota's ecoregions (except Missouri River) are presented in later sections. The intersection of ecological sites with disturbance influenced vegetation states represents the coarse filter for the purpose of describing grass/shrub

ecosystem diversity within each ecoregion. Each "cell" is characterized by the dominant vegetation or vegetation most likely to be an indicator of those disturbance conditions, for an ecological site. While just a few species are used to describe an ecosystem for the purpose of the EDM, it should be understood that each cell represents a diverse community of interacting plant and animal species. In some instances, NRCS ecological site descriptions can be used to more fully characterize each cell for plant species compositions and densities. Where this information is unavailable, it should be a primary goal of future research efforts to obtain this information for characterizing baseline ecosystem diversity conditions and meeting the objectives of the coarse filter.

Riparian/wetland ecosystems: The ecosystem diversity matrix for riparian/wetland ecosystems in South Dakota incorporates a hydrogeomorphic-based classification, similar to Brinson's[72], as the ecological site component. The riparian/wetland ecological sites are defined by four geomorphic settings including: 1) Lake Systems, 2) Depressional Systems, 3) Riverine Systems, and 4) Slope Systems. Lake Systems represent naturally occurring lakes and their surrounding zone of vegetation (fringe wetland) that is influenced by the shoreline hydrology and wave action. Depressional Systems, as the label suggests, represent wetlands that occur in a depression and are hydrologically influenced by surface runoff and/or groundwater. Examples of Depressional Systems in South Dakota include the potholes, ponds, and sloughs of the Eastern Prairie Ecoregion and "playas" of the Great Plains Steppe Ecoregion. Riverine Systems represent the riparian zone adjacent to rivers, streams, and drainages that are influenced by increased surface run-off, soil moisture, and/or floodwaters. Slope Systems represent areas influenced by groundwater that "breaks" to the soils surface and are more commonly referred to as seeps and fens. Additional sub-classes are also delineated based on further geomorphic influences (e.g., gradient) and hydrological influences (e.g., temporary, semi-permanent, and permanent or perennial and intermittent water regimes).

The classification emphasis is placed on the functional characteristics of riparian/wetland ecosystems and with the objective of characterizing historical ecosystem diversity as influenced by historical disturbance regimes. The primary historical disturbance mechanisms operating in riparian/wetland ecosystems included flooding, fire, beaver, and grazing. The influence of flooding and fire disturbance events on succession are incorporated through the "time since major disturbance" pathway, defined simply as early and late successional stages. Beaver disturbance is characterized by the presence or absence of beaver activity/modification to a riparian/wetland ecosystem. To reduce complexity somewhat, grazing influences are characterized by only two levels, low to moderate (0 to 60% canopy removal) and high (>60% canopy removal) levels of grazing. Soils data combined with the National Wetland Inventory (NWI) data[73] were then used to spatially define the boundaries of the riparian/wetland ecological sites for South Dakota. In addition to the ecological site component and disturbance influenced pathways, the riparian/wetland EDM incorporates descriptors used at the CLASS level of the "Classification of Wetlands and Deepwater Habitats of the United States" [74]. The CLASS level descriptors provide information on dominant vegetation types and structures and will aid in the evaluation of habitat conditions for selected species, as well as provide a link to the National Vegetation Classification System[75] that is widely used for mapping existing conditions.

The resulting riparian/wetland ecosystem diversity matrices for each of South Dakota's ecoregions/subregions are presented in later sections. The intersection of ecological sites with disturbance influenced vegetation states represents the coarse filter for the purpose of describing riparian/wetland ecosystem diversity within each ecoregion. Due to scope of this project and relative lack of information available on the influence of historical disturbance regimes on riparian/wetland plant species and ecosystems in South Dakota, we have limited ability to provide more detailed descriptions of plant communities beyond the possible dominant vegetation. However, developing the coarse filter framework for riparian/wetland ecosystems is the first step toward describing and recognizing historical ecosystem diversity and developing goals for restoration or maintenance. It should be a primary goal of future ecosystem diversity efforts to obtain more site-specific information on plant species and ecosystem response to disturbance for characterizing baseline ecosystem diversity conditions and meeting the objectives of the coarse filter.

In various parts of this document, ecological sites may have been grouped as part of this coarse filter approach. However, such grouping does not diminish the importance of distinct natural community types. For example, temporary and seasonal wetland basins were lumped for ease of analysis, but this does not lessen the ecological importance of each wetland type. On-the-ground conservation actions will continue to target all wetland types and group them for the purposes of monitoring progress toward ecosystem diversity goals.

Aquatic ecosystems: The ecosystem diversity matrix for aquatic ecosystems in South Dakota incorporates a hydrogeomorphic-based classification, similar to Brinson's, as the ecological site component. The aquatic ecological sites are defined by three geomorphic settings including: 1) Lake Systems, 2) Depressional Systems, and 3) Riverine Systems. Lake Systems represent the water environment of naturally occurring lakes. Depressional Systems represent the water environment of potholes, ponds, playas, etc. Riverine Systems represent the in-channel water environment of rivers, streams, creeks, and headwaters (as delineated by drainage basin size). Additional sub-classes are also identified based on geomorphic (e.g., gradient) and hydrological influences (e.g., semi-permanent and permanent water regimes).

The classification emphasis is placed on the functional characteristics of aquatic ecosystems and with the objective of characterizing historical ecosystem diversity as influenced by historical disturbance regimes. The primary disturbance mechanisms that influenced aquatic ecosystems included flooding and beaver. The influences of flooding on aquatic communities are incorporated through the "time since major disturbance" pathway, defined simply as early and late successional stages. Beaver disturbance is characterized by the presence or absence of beaver activity/modification to an aquatic ecosystem. In addition to the ecological site component and disturbance influenced pathways, the aquatic EDM incorporates descriptors used at the CLASS level of the "Classification of Wetlands and Deepwater Habitats of the United States". The CLASS level descriptors provide information on habitat structures and will aid in the evaluation of habitat conditions for selected species, as well as provide a link to the National Vegetation Classification System that is widely used for mapping existing aquatic conditions.

The resulting aquatic ecosystem diversity matrices for each of South Dakota's ecoregions/subregions are presented in later sections. The intersection of ecological sites with disturbance influenced the specific site conditions such as substrate, vegetation, aquatic macroinvertebrates, and other community components that represent the coarse filter for the purpose of describing aquatic ecosystem diversity within each ecoregion. Due to the scope of this project and the relative lack of information available on the influence of historical disturbance regimes on aquatic ecosystems in South Dakota, we were unable to describe each cell of the aquatic ecosystems EDM by the dominant community characteristics at this time. However, developing the coarse filter framework for aquatic ecosystems is the first step toward describing historical ecosystem diversity and developing goals for restoration or maintenance. It should be a primary goal of future ecosystem diversity efforts to obtain more site-specific information on aquatic ecosystem response to disturbance for characterizing baseline ecosystem diversity conditions and meeting the objectives of the coarse filter.

Forested ecosystems: The ecosystem diversity matrix for forest ecosystems in South Dakota incorporates both NRCS ecological site descriptions and habitat type classification developed by Hoffman and Alexander[75], as the ecological site component of the EDM. Soils data were used to spatially define the boundaries of the ecological sites within South Dakota by using soil type information and elevation, mean range of precipitation, and dominant overstory and understory forest/woodland vegetation. Some soil map units include multiple soils and thereby incorporate variability in mapping specific ecological sites. Bur oak and xeric ponderosa pine habitat types at the transition between grass/shrub dominated and forested dominated conditions have been included in some grass/shrub ecological sites that contain multiple sites in their mapping. Aspen habitat types were likely inclusions with the more common ponderosa pine habitat types. The utilized information also lacks sufficient detail on vegetation characteristics to differentiate specific quaking aspen habitat types from other types.

The primary disturbance mechanism operating in the forest ecosystems of the Black Hills Ecoregion was fire. Fire-influenced disturbance transitions were predicted using the best available information on

ecosystem and plant species response for each ecological site[75,76,77]. The resulting ecosystem diversity matrices for forested ecosystems are presented in later sections. The intersection of ecological sites/habitat types with disturbance influenced vegetation states, represents the "cells" of the EDM. Each cell is characterized by the dominant vegetation and/or species most likely to indicate or provide evidence for specific disturbance types and regimes for that ecological site/habitat type. While just a few species are used to characterize a cell for the purpose of the EDM, it should be understood that the cell represents a diverse ecosystem/community of interacting plant and animal species. All of the cells of the EDM represent the coarse filter or the range of ecosystem diversity that occurred within forested ecosystems of South Dakota, in response to historical disturbance regimes.

GREAT PLAINS STEPPE ECOREGION

Landscape description: The Great Plains Steppe Ecoregion encompasses most of South Dakota west of the Missouri River flood plain and east and north of the Black Hills (Figure 3.3). This Ecoregion represents approximately 25 million acres in South Dakota. The topography of the area is gently sloping to rolling with well drained to moderately well drained, dissected shale plains. Some badlands with eroded escarpments are present in this Ecoregion as well. Soils are deep to shallow with dominantly fine textures over most of the Ecoregion. The soils in the Southern part of the ecoregion are deep to shallow, with dominantly medium and course textures. Elevation ranges from 1300 feet in the lowlands to 4000 feet in the uplands. The Great Plains Steppe Ecoregion receives average annual precipitation ranging from 12 to 23 inches, with half of this occurring during the growing season. Winters are extremely cold and windy, while summers are relatively hot and dry. The mean annual temperature ranges from 39 to 52° F and the average freeze-free period is approximately 110 to 160 days.

The Great Plains Steppe Ecoregion includes 8 MLRA's including 54 – Rolling Soft Shale Plain, 58D – Northern Rolling High Plains – Eastern Part, 60A – Pierre Shale Plains and Badlands, 63A – Northern Rolling Pierre Shale Plains, 63B- Southern Rolling Pierre Shale Plains, 64-Mixed Sandy and Silty Tableland, 65-Nebraska Sand Hills, and 66-Dakota-Nebraska Eroded Tableland.

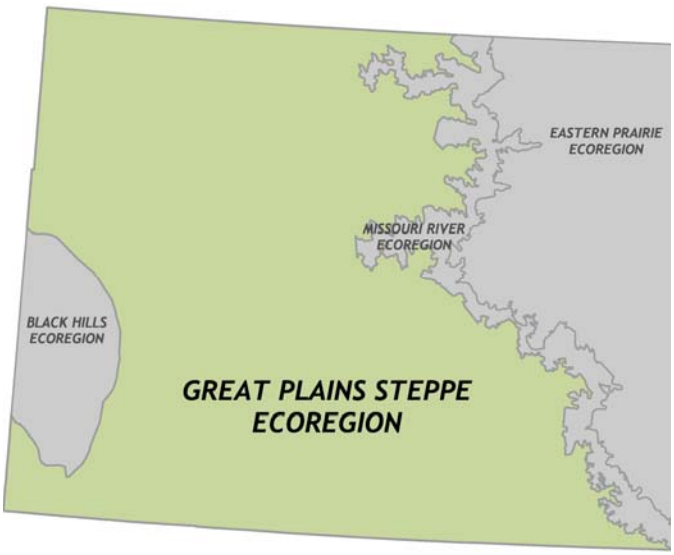


Figure 3.3. South Dakota Comprehensive Wildlife Conservation Plan - the Great Plains Steppe Ecoregion.

Historical Vegetation: The vegetation of the pre-settlement Great Plains Steppe Ecoregion was dominated by grass/shrub ecosystems. Grasses were dominant as shrubs were a relatively minor component of the upland vegetation due to the frequency of fire. Where shrubs did occur, it was primarily on protected sites. Forest ecosystems were rare in the upland areas of the Great Plains Steppe Ecoregion and occurred in small pockets where fire and grazers were unable to access or influence the site. These relatively rare sites were predominantly characterized by ponderosa pine occurring on scattered buttes and pockets in the northwest corner (Harding County) and along the south central (Bennett and Todd Counties) boundary of the Ecoregion. Riparian/wetland ecosystems were primarily treeless and associated with streams and moist draws (e.g., riparian zones). Natural depressions (e.g., wetlands) were rare in the landscape but where they did occur they were usually only temporarily inundated in the spring and early summer in normal precipitation years. Aquatic ecosystems were primarily limited to perennial streams, rivers and beaver ponds.

Approximate acreages:

Grass/shrub ecosystems – 21,818,662 acres
Riparian/wetland ecosystems – 1,360,240 acres
Aquatic ecosystems – 399,120 acres (based on current/modified conditions)
Forest ecosystems – less than 1,000,000 acres
Rock Outcrops – 94,231 acres
Slick Spots – 67,034 acres
Blown out areas – 316 acres

Wildlife: Wildlife species observed at the time of Lewis and Clark included American bison, black-tailed prairie dogs, pronghorn, elk, mule deer, Audubon's bighorn sheep, sharp-tailed grouse, sage grouse, grizzly bear, wolf, swift fox, and meadowlark. Several of the species present at that time have since been extirpated from this Ecoregion including the American bison, Audubon's bighorn sheep, grizzly bear, wolf, river otter, trumpeter swan, common raven, black-footed ferret, and McCown's longspur.

Land use and management: The major land uses in the Great Plains Steppe Ecoregion are ranching and farming. Much of the rangeland is native grass used mainly for livestock grazing. Less sloping areas may be farmed to small grains or alfalfa for supplemental or winter livestock feeding. Land management objectives are dependent on the landowner. Private landowners typically manage to maximize grazing opportunities for cattle, sheep, and horses. The U.S. Forest Service manages three National Grasslands for multiple-uses that include grazing, recreation, and energy development. Tribal lands have been managed with multiple objectives over the years, with more recent objectives emphasizing restoration of ecosystem health.

GRASS/SHRUB ECOSYSTEMS

Coarse Filter: The ecosystem diversity matrix for grass/shrub ecosystems of the Great Plains Steppe Ecoregion incorporates NRCS ecological sites developed for MLRA 54, 60A, and 64. The primary disturbance mechanisms that historically operated in this Ecoregion included fire, grazing, and prairie dog colonies. The grass/shrub ecosystem diversity matrix for the Great Plains Steppe Ecoregion is presented in figure 3.4.

Historical amounts: The development of a coarse filter based on the historical reference, provides the framework to quantify the historical range of variability (HRV) for each grass/shrub ecosystem. Quantifying the historical amounts of grass/shrub ecosystems allows us to set appropriate goals for ecosystem restoration and maintenance. The first step in this process is to delineate and map ecological sites. NRCS soils data were used to map ecological sites identified by the EDM, and quantify the diversity of ecosystems as influenced by site factors. To demonstrate this mapping capability, figure 3.5 represents ecological sites for a small portion of the Great Plains Steppe Ecoregion. Table 3.1 identifies an estimate of the number of historical acres in each of the nine ecological sites developed from the mapped soils information. It is important to note that due to soil mapping resolutions, some delineated polygons may contain inclusions of other ecological sites. See Appendix B-1 for a map of grass/shrub ecosystems in the Great Plains Steppe Ecoregion.

Figure 3.4. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for grass/shrub ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

GRASS/SHRUB ECOSYSTEMS

Ecological Site Class

Disturbance Influenced Pathways	Porous Clay		Dense Clay		Clayey		Claypan		Loamy		Shallow		Badlands		Sandy		Saline Upland	
	Potential Dominant Species	HRV	Potential Dominant Species	HRV	Potential Dominant Species	HRV	Potential Dominant Species	HRV	Potential Dominant Species	HRV	Potential Dominant Species	HRV	Potential Dominant Species	HRV	Potential Dominant Species	HRV	Potential Dominant Species	HRV
Early Seral		na	*Western yarrow* *Six-weeks fescue*	na	*Needle-and-thread* *Fendler threeawn* *Curly-cup gumweed*	na	*Needle-and-thread* *Prairie junegrass* *Curly-cup gumweed*	na	*Needle-and-thread* *Fendler threeawn* *Curly-cup gumweed*	na	*Fendler threeawn* *Needle-and-thread* *Little bluestem*	na	*Fendler threeawn* *Needle-and-thread* *Sand dropseed*	na	*Fendler threeawn* *Needle-and-thread* *Sand dropseed*	na		na
Prairie Dog Town, active		0		0	*Threeawn* *Six-weeks fescue* *Fetid marigold*	na	*Threeawn* *Six-weeks fescue* *Curly-cup gumweed*	na	*Threeawn* *Blue grama* *Fetid marigold*	na		0		0		0	*Inland saltgrass* *Prairie junegrass* *Threadleaf sedge*	na
Prairie Dog Town, inactive		0		0	*Blue grama* *Threadleaf sedge* *Western wheatgrass*	na	*Blue grama* *Western wheatgrass*	na	*Blue grama* *Western wheatgrass*	na		0		0		0	*Western wheatgrass* *Inland saltgrass*	na
Vegetative composition/structure primarily influenced by short-interval fire regimes (<15 yrs.)																		
Light Grazing	*Little bluestem* *Prairie sandreed* *Western wheatgrass*	na	*Western wheatgrass* *Green needlegrass*	Min 7% Max 12%	*Green needlegrass* *Western wheatgrass* *Needleandthread* *Porcupine grass*	Min 20% Max 39%	*Western wheatgrass* *Green needlegrass* *Needle-and-thread* *Prairie sandreed*	Min 27% Max 46%	*Green needlegrass* *Western wheatgrass* *Needle-and-thread* *Big bluestem*	Min 22% Max 44%	*Needle-and-thread* *Little bluestem* *Green needlegrass* *Sideoats grama*	Min 32% Max 62%	*Prairie sandreed* *Little bluestem* *Western wheatgrass* *Big bluestem*	Min 45% Max 77%	*Sand bluestem* *Prairie sandreed* *Needle-and-thread* *Little bluestem*	Min 54% Max 76%	*Western wheatgrass* *Inland saltgrass* *Alkali sacaton* *Indian ricegrass*	na
Moderate Grazing	*Prairie sandreed* *Little bluestem* *Western wheatgrass* *Sun sedge*	na	*Western wheatgrass* *Green needlegrass* *Sideoats grama* *Blue grama*	Min 29% Max 43%	*Western wheatgrass* *Green needlegrass* *Sideoats grama* *Blue grama*	Min 33% Max 41%	*Western wheatgrass* *Blue grama* *Needleandthread*	Min 29% Max 40%	*Western wheatgrass* *Needleand-hread* *Sideoats grama* *Blue grama*	Min 12% Max 25%	*Little bluestem* *Needle-and-thread* *Sideoats grama* *Blue grama*	Min 13% Max 28%	*Western wheatgrass* *Little bluestem* *Prairie sandreed* *Inland saltgrass*	Min 4% Max 4%	*Western wheatgrass* *Needle-and-thread* *Sand dropseed* *Blue grama*	Min 9% Max 31%	*Western wheatgrass* *Inland saltgrass* *Alkali sacaton* *Threadleaf sedge*	na
Heavy Grazing	*Sun sedge* *Prairie junegrass* *Blue grama*	na	*Western wheatgrass* *Blue grama*	Min 16% Max 35%	*Blue grama* *Buffalograss* *Threadleaf sedge*	Min 23% Max 43%	*Blue grama* *Buffalograss* *Plains prickleypear* *Threadleaf sedge*	Min 18% Max 36%	*Blue grama* *Buffalograss* *Threadleaf sedge*	Min 16% Max 30%	*Blue grama* *Hairy grama* *Threadleaf sedge*	Min 24% Max 45%	*Inland saltgrass* *Western wheatgrass* *Bare ground*	Min 10% Max 46%	*Blue grama* *Hairy grama* *Threadleaf sedge*	Min 4% Max 16%	*Inland saltgrass* *Threadleaf sedge* *Prairie junegrass* *Blue grama*	na
Vegetative composition/structure primarily influenced by long-interval fire regimes (>15 yrs.)																		
Light Grazing	*Little bluestem* *Prairie sandreed* *Juniper* *Leadplant*	na	*Green needlegrass* *Western wheatgrass* *Wyoming big sagebrush* *Winterfat*	Min 0.3% Max 2%	*Green needlegrass* *Western wheatgrass* *Needleandthread* *Western snowberry*	Min 0.3% Max 1%	*Western wheatgrass* *Green needlegrass* *Needle-and-thread* *Silver/big sagebrush*	Min 1% Max 3%	*Green needlegrass* *Western wheatgrass* *Needle-and-thread* *Wyoming big sagebrush*	Min 25% Max 28%	*Little bluestem* *Needle-and-thread* *Winterfat* *Wyoming big sagebrush*	Min 0.6% Max 1%	*Prairie sandreed* *Little bluestem* *Western wheatgrass* *Silver/big sagebrush*	Min 3% Max 16%	*Sand bluestem* *Prairie sandreed* *Yucca* *Silversagebrush*	Min 3% Max 13%	*Western wheatgrass* *Inland saltgrass* *Alkali sacaton* *Gardner's saltbush*	na
Moderate Grazing	*Little bluestem* *Western wheatgrass* *Leadplant* *Juniper*	0	*Western wheatgrass* *Green needlegrass* *Blue grama* *Wyoming big sagebrush*	0	*Western wheatgrass* *Green needlegrass* *Blue grama* *Western snowberry*	0	*Western wheatgrass* *Blue grama* *Green needlegrass* *Silver/big sagebrush*	0	*Western wheatgrass* *Needle-and-thread* *Sideoats grama* *Wyoming big sagebrush*	0	*Needle-and-thread* *Little bluestem* *Sideoats grama* *Wyoming big sagebrush*	0	*Western wheatgrass* *Little bluestem* *Inland saltgrass* *Silver/big sagebrush*	0	*Western wheatgrass* *Needle-and-thread* *Yucca* *Silver sagebrush*	0	*Western wheatgrass* *Inland saltgrass* *Gardner's saltbush* *Greasewood*	0
Heavy Grazing	*Sun sedge* *Blue grama* *Juniper*	0	*Western Wheatgrass* *Blue grama* *Birdfoot sagebrush* *Wyoming big sagebrush*	0	*Blue grama* *Western wheatgrass* *Sandberg bluegrass* *Western snowberry*	0	*Blue grama* *Buffalograss* *Plains prickleypear* *Silver/big sagebrush*	0	*Blue grama* *Buffalograss* *Threadleaf sedge* *Wyoming big sagebrush*	0	*Blue grama* *Hairy grama* *Threadleaf sedge* *Wyoming big sagebrush*	0	*Inland saltgrass* *Western wheatgrass* *Bare ground* *Silver/big sagebrush*	0	*Blue grama* *Hairy grma* *Silver sagebrush* *Yucca*	0	*Inland saltgrass* *Threadleaf sedge* *Prairie junegrass* *Greasewood*	0
TOTAL ACRES IN EACH ECOLOGICAL SITE	**2,632**		**1,189,816**		**7,279,882**		**2,464,738**		**4,418,962**		**2,916,133**		**389,420**		**3,004,394**		**38,244**	

NRCS ECOLOGICAL/RANGE SITES

Porous Clay	Dense Clay	Clayey	Claypan	Loamy	Shallow	Badlands	Sandy	Saline Upland
R060 Porous Clay R060 Shallow Porous Clay	R058D, R060A, R063A, R064 Dense Clay R058D, R060A Shallow Dense Clay	R054, R058D, R060A R063A, R064 Clayey 058D, 063A, R064 Shallow Clay R054, R060A Shallow Clayey	058D, 063A, R054, R060A, R064 Claypan 058D, 063A, R054, R060A, R064 Thin Claypan	R054, R060A, R064 Loamy 058D, 063A, R054, R060A, R064 Loamy Terrace	R054, R060A Shallow Loamy 058D, 063A, R054, R060A, R064 Very Shallow R054 Thin Loamy 058D, 063A, R060A, R064 Thin Upland 058D, 063A, R064 Shallow 058D, 063A Shallow to Gravel	R064 Badlands Terrace	058D, 063A, R054, R060A, R064 Sands 058D, 063A, R054, R060A, R064 Sandy R054, R060A Shallow Sandy 065 Choppy Sands R054 Sandy Claypan	058D, R060A Saline Upland

KEY

Ecosystems that do not occur

na - information not available at this time

HRV - Historical range of variability

References

Ecosystem Diversity Matrix concept described in:

1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes derived from:

1) Natural Resources Conservation Service, Ecological Site Descriptions

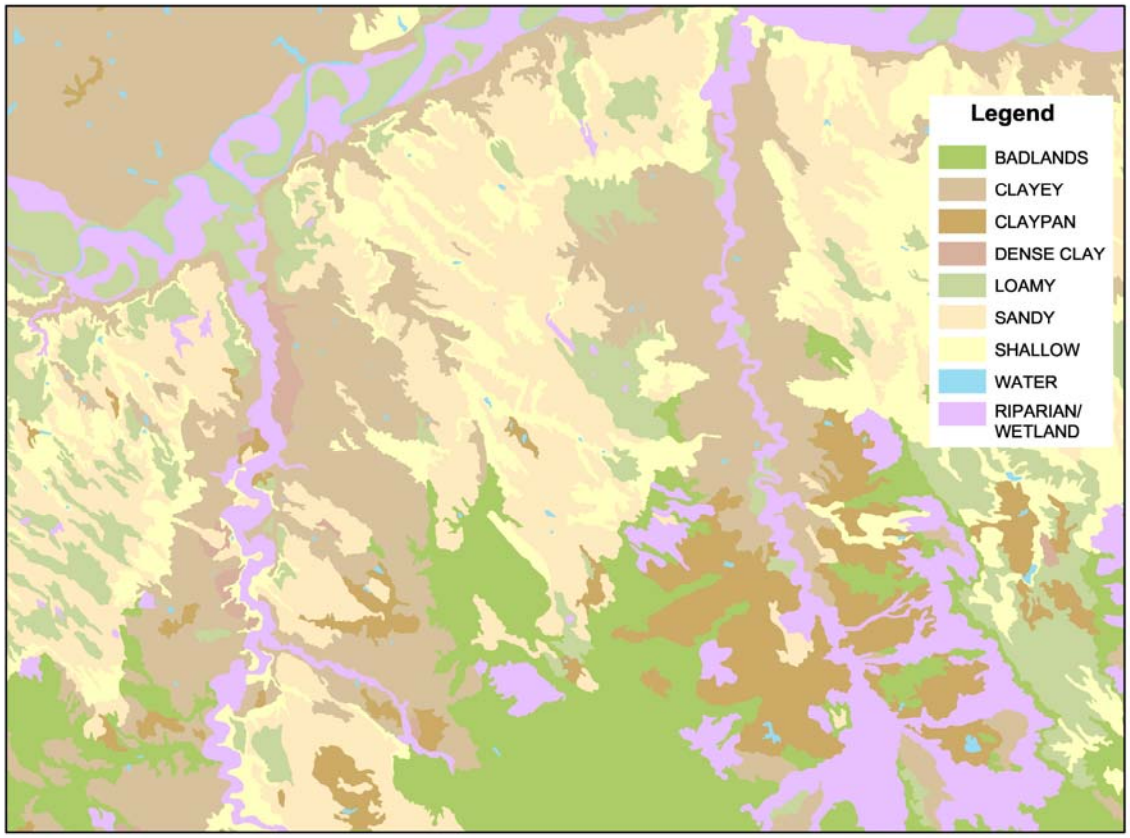


Figure 3.5. Sample map of ecological site classification that was developed from soils data (NRCS SSURGO) and used to conduct landscape assessments in support of the South Dakota CWCP objectives. The map represents a small subset of the Great Plains Steppe Ecoregion.

Table 3.1. Approximate number of historical acres for ecological sites representing grass/shrub ecosystems of the Great Plains Steppe Ecoregion.

Porous Clay	Dense Clay	Clayey	Claypan	Loamy	Shallow	Badlands	Sandy	Saline Upland
2,632	1,189,816	7,279,882	2,464,738	4,418,962	2,916,133	389,420	3,004,394	38,244

Estimating historical amounts relative to the disturbance categories of the EDM requires an understanding of plant community responses within each ecological site to historical disturbance regimes. Grass/shrub ecosystems are particularly challenging to reconstructing and quantifying historical ecology, as little physical evidence remains today of the effects of historical disturbance. For this reason, landscape models have been developed that use the best available information and science to reconstruct plant community response to historical disturbance processes. For the purposes of this Plan, we used a landscape model called SIMPPLLE developed by the USDA Forest Service[78]. SIMPPLLE is a spatially explicit vegetation dynamics management tool that provides the user with the ability to simulate vegetative changes across a defined landscape as influenced by disturbance events. It identifies a range of conditions for grass/shrub ecosystems that can result from the interaction between landscape elements, climate, and disturbance processes. SIMPPLLE tracks the location of each ecological site and uses stochastic probabilities to assign disturbance events and weather patterns and then tracks the responses by key plant species. The parameters for disturbance and plant species response included in the model are based on scientific literature and the input of a team of range ecologists (see Appendix A

for a detailed description of SIMPPLLE and the assumptions used in applying the model). Results of the SIMPPLLE simulation for the Great Plains Steppe Ecoregion provides an estimate of the historical range of variability for each of the grass/shrub ecosystems identified in the EDM, except Dense Clay and Saline Upland. Due to time constraints, SIMPPLLE was used to model only a portion of the Great Plains Steppe Ecoregion (approximately 2 million acres, centrally located). Dense Clay and Saline Upland did not occur in this subset of the overall Ecoregion. See figure 3.4 for a summary of the minimum and maximum values for each of the cells of the EDM included in the simulation.

The results of the SIMPPLLE historical range of variability simulation indicate that the majority of the grass/shrub ecosystems were in the conditions described by the high frequency fire regime and all grazing levels. None of the conditions described by the low frequency fire regime at moderate to heavy grazing levels were found to occur in this landscape. While low frequency fire and light grazing levels were observed across all ecological sites, these conditions were relatively rare, except for loamy ecological sites where it could occur on as much as 24% of the total acres. SIMPPLLE could be improved to include the dynamics of prairie dog populations but that capability is not available at this time.

Existing conditions: Information on the current condition of grass/shrub ecosystems relative to disturbance categories of the coarse filter/EDM, is not available at this time. More generalized results of the South Dakota GAP assessment indicate that 79% of the Great Plains Steppe Ecoregion is currently covered by grass/shrub ecosystems. Of these, 55% were classified as low cover grasslands, 27% as medium cover grasslands, and 18% as high cover grasslands. (See Appendix C for a description of the methodology used to derive these numbers.)

RIPARIAN/WETLAND ECOSYSTEMS

Coarse filter: The ecosystem diversity matrix for riparian/wetland ecosystems of the Great Plains Steppe Ecoregion is presented in figure 3.6. The primary disturbance mechanisms that historically operated in riparian/wetland ecosystems included flood, fire, beaver, and grazing.

Historical amounts: Estimating the historical amounts of riparian/wetland ecosystems relative to the disturbance categories of the coarse filter/EDM, requires an understanding of plant community response within each ecological site to historical disturbance regimes. At this time, insufficient information is available on the species composition and structure of aquatic ecosystems in response to historical disturbance regimes, thereby limiting our ability to reconstruct or model historical range of variability. In addition, providing estimates of the historical amounts for ecological sites is problematic using existing information as many sites have been modified since European settlement. However, a more generalized estimate of ecological sites for riverine systems was mapped using Aquatic GAP GIS data to quantify the number of stream miles for each of the eight riverine subclasses (see Appendix C for a description of the methodology), as stream size and gradient are less easily modified. Table 3.2 identifies the number of stream miles for each riverine system ecological site that is assumed to approximate the historical amounts. See Appendix B-1 for a map of riparian/wetland ecosystems in the Great Plains Steppe Ecoregion.

Table 3.2. Approximate historical amounts (stream miles) for ecological sites representing riverine riparian/wetland ecosystems of the Great Plains Steppe Ecoregion.

RIVERINE SYSTEMS			
Perennial		*Intermittent*	
Low Gradient ≤ 2% slope	Mid-High Grad. > 2% slope	Low Gradient ≤ 2% slope	Mid-High Grad. > 2% slope
5290 miles	38 miles	43960 miles	8916 miles

Figure 3.6. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for riparian ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

RIPARIAN ECOSYSTEMS

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways			Habitat Descriptor	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS				SLOPE SYSTEMS
				Geomorphic →									
				Water Regime →	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*		*Intermittent*		
				Slope →					Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing		Rocky Shore									
				Unconsolidated Shore									
				Emergent									
				Scrub-Shrub									
				Forested									
		Heavy Bison Grazing		Rocky Shore									
				Unconsolidated Shore									
				Emergent									
				Scrub-Shrub									
				Forested									
	Beaver Unmodified System	Low to Moderate Bison Grazing		Rocky Shore									
				Unconsolidated Shore									
				Emergent									
				Scrub-Shrub									
				Forested									
		Heavy Bison Grazing		Rocky Shore									
				Unconsolidated Shore									
				Emergent									
				Scrub-Shrub									
				Forested									
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing		Rocky Shore									
				Unconsolidated Shore									
				Emergent									
				Scrub-Shrub									
				Forested									
		Heavy Bison Grazing		Rocky Shore									
				Unconsolidated Shore									
				Emergent									
				Scrub-Shrub									
				Forested									
	Beaver Unmodified System	Low to Moderate Bison Grazing		Rocky Shore									
				Unconsolidated Shore									
				Emergent									
				Scrub-Shrub									
				Forested									
		Heavy Bison Grazing		Rocky Shore									
				Unconsolidated Shore									
				Emergent									
				Scrub-Shrub									
				Forested									

Information on plant species distributions relative to disturbance categories is not available at this time

KEY

Ecosystems that do not occur

References

Ecosystem Diversity Matrix concept described in:
1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes similar to 1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Corp of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

Existing conditions: Information on the current condition of riparian/wetland ecosystems relative to disturbance categories of the coarse filter/EDM, is not available at this time. However, soils data (SSURGO) and National Wetland Inventory (NWI) data were used to present a more generalized overview of existing conditions relative to ecological sites and habitat descriptors of the riparian/wetland EDM. The results are presented in Table 3.3 for the Great Plains Steppe Ecoregion. The NWI data were also used to provide information on the level of human-modification in riparian/wetland ecosystems and is also presented in the table. (See Appendix C for a description of the methodology used to derive these estimates).

Table 3.3. Existing amounts (acres) for ecological sites representing riparian/wetland ecosystems of the Great Plains Steppe Ecoregion. Developed from an assessment of soils (SSURGO) and NWI data. First number indicates un-modified acres/second number indicates human-modified acres. na = information not available.

	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS		SLOPE SYSTEMS
	Littoral	*Temporary*	*Semi-perm.*	*Permanent*	*Perennial*	*Intermittent*	
Rocky Shore	0 / 0	0 / 0	0 / 0		5,986 / 0	0 / 0	na
Unconsol. Shore	1,927 / 2,347	3,968 / 2,606	0 / 0		73 / 190	12,200 / 0	na
Emergent	na	106,128 / 45,143	1,980 / 5,353		1,765 / 2,572	na	na
Scrub-Shrub	na	5,271 / 520	0 / 0		485 / 70	na	na
Forested	na	5,535 / 668	0 / 0		567 / 145	na	na
UNDEFINED	na	175,736	43,213		213,924	701,387	na
Total	**4,274**	**345,575**	**50,546**		**225,777**	**713,587**	

AQUATIC ECOSYSTEMS

Coarse filter: The ecosystem diversity matrix for aquatic ecosystems of the Great Plains Steppe Ecoregion is presented in figure 3.7. The primary disturbance mechanisms that historically operated in aquatic ecosystems included flood events and beaver.

Historical amounts: Estimating the historical amounts of aquatic ecosystems relative to the disturbance categories of the coarse filter/EDM, requires an understanding of aquatic community response within each ecological site to historical disturbance regimes. At this time, insufficient information is available on the species composition and structure of aquatic ecosystems in response to historical disturbance regimes, thereby limiting our ability to reconstruct or model historical range of variability. In addition, providing estimates of the historical amounts for ecological sites is problematic using existing information as many sites have been modified since European settlement. However, a more generalized estimate of ecological sites for riverine systems were mapped using Aquatic GAP GIS data to quantify the number of stream miles for each of the eight riverine subclasses (see Appendix C for a description of the methodology), as stream size and gradient are less easily modified. Table 3.4 identifies the number of stream miles for each riverine system ecological site that is assumed to approximate the historical amounts. See Appendix B-1 for a map of aquatic ecosystems in the Great Plains Steppe Ecoregion.

Table 3.4. Approximate number of historical stream miles for ecological sites representing riverine aquatic ecosystems of the Great Plains Steppe Ecoregion.

RIVERINE SYSTEMS							
Perennial (miles)							
Large River		*Small Rivers*		*Creeks*		*Headwater Stream*	
Low Gradient (≤ 2% slope)	Mid-High Grad. (>2% slope)	Low Gradient (≤ 2% slope)	Mid-High Grad. (>2% slope)	Low Gradient (≤ 2% slope)	Mid-High Grad. (>2% slope)	Low Gradient (≤ 2% slope)	Mid-High Grad. (>2% slope)
1010	**9**	**2007**	**12**	**1626**	**7**	**647**	**9**

Figure 3.7. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for aquatic ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

AQUATIC ECOSYSTEMS

Disturbance Influenced Pathways			Habitat Descriptor	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS							
Geomorphic Setting				Limnetic	Littoral	Semi-permanent	Permanent	Perennial							
Water Regime								Large River		Small Rivers		Creeks		Headwater Stream	
Sizeclass															
Gradient								Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)
Time Since Major Disturbance (i.e., flood)	EARLY SUCCESSIONAL	Beaver Influenced System	Streambed												
			Unconsolidated Bottom												
			Aquatic Bed												
		Beaver Absent	Streambed												
			Unconsolidated Bottom												
			Aquatic Bed												
	LATE SUCCESSIONAL	Beaver Influenced System	Streambed												
			Unconsolidated Bottom												
			Aquatic Bed												
		Beaver Absent	Streambed												
			Unconsolidated Bottom												
			Aquatic Bed												

Information on macroinvertebrate distributions relative to disturbance categories is not available at this time

References

Ecosystem Diversity Matrix concept described in:
1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes similar to:
1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Corp of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

Existing conditions: Information on the current condition of aquatic ecosystems relative to disturbance categories of the coarse filter/EDM, is not available at this time. However, soils data (SSURGO) and National Wetland Inventory (NWI) data were also used to present a more generalized overview of existing conditions relative to ecological sites and habitat descriptors of the aquatic EDM. The results of this analysis are presented in table 3.5 for the Great Plains Steppe Ecoregion. The NWI data was also used to provide information on the amount of human modification to aquatic ecosystems.

Table 3.5. Existing amounts (acres) for ecological sites representing aquatic ecosystems of the Great Plains Steppe Ecoregion. Developed from an assessment of soils (SSURGO) and NWI data. First number indicates unmodified acres/second number indicates human-modified acres. na = information not available.

	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS
	Limnetic	*Littoral*	*Semi-permanent*	*Permanent*	*Perennial*
Stream Bottom	0 / 0	0 / 0	0 / 0	0 / 0	2,943 / 0
Unconsolidated Bottom	0 / 16,318	153 / 1904	43 / 1603	0 / 103	14,800 / 142
Aquatic Bed	0 / 0	3,259 / 8,794	830 / 73,510	0 / 2,864	53 / 2,651
TOTAL ACRES	**16,318**	**14,110**	**75,986**	**2,967**	**20,589**
Undefined	**1,397,580**				

FOREST ECOSYSTEMS

Coarse filter: The Great Plains Steppe ecosystem diversity matrix for forest ecosystems incorporates both NRCS range site descriptions for MLRA's 64 and 54, as well as habitat type classification developed by Hoffman and Alexander (1987), as the ecological site component of the EDM. The primary disturbance mechanism that historically operated in forest ecosystems was fire. The resulting forest ecosystem diversity matrix for the Great Plains Steppe Ecoregion is presented in Figure 3.8.

Historical amounts: Information on the historical amounts of forest ecosystems relative to disturbance categories of the coarse filter/EDM, is not available at this time. As a more generalized estimate of historical amounts, NRCS soils data were used to map forest ecological sites defined in the EDM. However, soils data usually overestimate the actual number of forest acres in the Great Plains Steppe Ecoregion, as soils supporting forest conditions are frequently inclusions with adjacent grass/shrub soil types. To ensure that ecological sites that can support forested conditions are identified, we have delineated the entire soil complex as a forested ecosystem. It is important to note that this delineation has likely overestimated the actual acres of forest ecosystems by 50% or more, depending on the soil complex. Table 3.6 identifies the number of acres of the Great Plains Steppe Ecoregion in each of the three ecological sites. See Appendix B-1 for a map of forested ecosystems in the Great Plains Steppe Ecoregion.

Table 3.6. Approximate number of historical acres for ecological sites representing forest ecosystems of the Great Plains Steppe Ecoregion.

Dry Bur Oak	Xeric Ponderosa Pine	Warm, Dry Ponderosa Pine
23,161	**839,790**	**222,875**

Estimating historical amounts relative to historical disturbance categories identified in the coarse filter/EDM requires an understanding of forest ecosystem response to historical disturbance regimes. Information is available to apply a landscape model such as SIMPPLLE to quantify the historical range of variability for forested ecosystems; however, this activity was outside the scope of this Plan.

Figure 3.8. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for forested ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

FORESTED ECOSYSTEMS

VEGETATION STRUCTURAL STAGES	Warm, Dry Bur Oak Potential Dominant Spp.	Acres	Xeric Ponderosa Pine Potential Dominant Spp.	Acres	Warm, Dry Ponderosa Pine Potential Dominant Spp.	Acres
SEEDLING/ SHRUB	*Bur oak* *Green ash* *American elm* *Ponderosa pine*		*Ponderosa pine* *Rocky Mountain juniper* *Bur oak*		*Ponderosa pine* *Rocky Mountain juniper* *Bur oak*	
SAPLING	*Bur oak* *Green ash* *American elm* *Ponderosa pine*		*Ponderosa pine* *Rocky Mountain juniper* *Bur oak*		*Ponderosa pine* *Rocky Mountain juniper* *Bur oak*	
Stand conditions/structure PREDOMINANTLY influenced by short-interval fire regimes	**Non-lethal 10 yr. Mean Fire Interval**		**Non-lethal 3-23 yr. return interval**		**Non-lethal & Mix. Severity 10-43 yr. return interval**	
SMALL TREES	*Bur oak* *Ponderosa pine*		*Ponderosa pine*		*Ponderosa pine*	
MEDIUM TREES	*Bur oak* *Ponderosa pine*		*Ponderosa pine*		*Ponderosa pine*	
LARGE TREES	*Bur oak* *Ponderosa pine*		*Ponderosa pine*		*Ponderosa pine*	
% Habitat Type Class by Historical Disturbance Regime	Non-lethal Mixed Severity Stand Replacing	98% 2% 0%	Non-lethal Mixed Severity Stand Replacing	90% 10% 0%	Non-lethal Mixed Severity Stand Replacing	90% 10% 0%
Stand conditions/structure PREDOMINANTLY influenced by long-interval fire regimes	**Rarely Occurred**		**Rarely Occurred**		**Rarely Occurred**	
SMALL TREES	*Bur oak* *Paper birch* *Ironwood* *Ponderosa pine*		*Ponderosa pine* *Rocky Mountain juniper* *Bur oak*		*Ponderosa pine* *Rocky Mountain juniper* *Bur oak* *Paper birch*	
MEDIUM TREES	*Bur oak* *Paper birch* *Ponderosa pine* *Ironwood*		*Ponderosa pine* *Bur oak*		*Ponderosa pine* *Bur oak*	
LARGE TREES	*Bur oak* *Ponderosa pine*		*Ponderosa pine*		*Ponderosa pine*	
TOTAL ACRES IN EACH ECOLOGICAL SITE	**100,410**		**406,903**		**157,996**	

HABITAT TYPES

QUMA/OSVI QUMA/SYOC	PIPO/JUSC PIPO/CAHE PIPO/SCSC PIPO/PASM	PIPO/SYAL PIPO/PHMA PIPO/PRVI

LEGEND

Successional Pathways

TREE CODES

QUMA = Bur oak
PIPO = Ponderosa pine
POTR = Populus tremuloides
PIGL = Picea glauca

References

Ecosystem Diversity Matrix concept described in:

1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Existing conditions: Information on the current condition of forest ecosystems relative disturbance categories of the coarse filter/EDM, is not available at this time. Results of the South Dakota GAP assessment indicate that approximately 1% of the Great Plains Steppe Ecoregion is currently covered by forest ecosystems. The majority of these acres were classified as ponderosa pine dominated communities. Information on structure and size classes is not currently available.

BLACK HILLS ECOREGION

Landscape description: The Black Hills Ecoregion is characterized by the most diverse topography within South Dakota and has strong ties to four nearby biomes including the Rocky Mountain forest, the Great Plains grasslands, the eastern deciduous forest, and the northern coniferous forest. It represents approximately 1.5 million acres in southwest South Dakota (Figure 3.9). Slopes range from moderate on high plateaus to very steep along drainages and on peaks and ridges. Narrow valleys can range from mostly gently sloping to strongly sloping. Drainages are well defined. Soils are deep to shallow with fine to medium textures. Elevations range from 3000 feet on the foot slopes to 7200 feet on Harney Peak within the Black Hills. Temperatures are considered relatively extreme with hot, dry summers and cold, moderately wet winters. The average annual precipitation ranges from 12 inches in the Foot Slopes to 26 inches at higher elevations within the Black Hills.

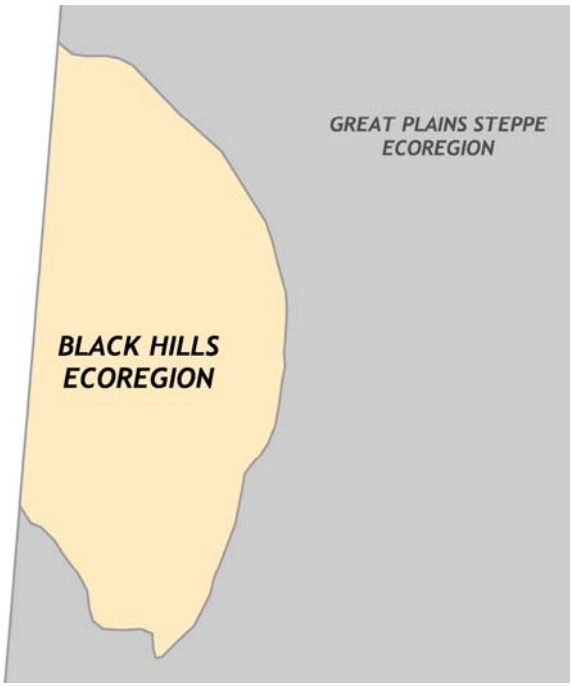


Figure 3.9. South Dakota Comprehensive Wildlife Conservation Plan - the Black Hills Ecoregion.

The Black Hills Ecoregion incorporates MLRA's 61-Black Hills Foot Slopes and 62 – Black Hills.

Historical vegetation: The Foot Slopes MLRA supports a mosaic of grass/shrub ecosystems and forested ecosystems, while the Black Hills MLRA is characterized by primarily forest ecosystems. The Black Hills represent an ecoregion uniquely different from the other grassland-dominated ecoregions of South Dakota. Black Hills forested ecosystems have been described as the place where "east meets west," and presents characteristics of both eastern and western forests. Western species like ponderosa pine and limber pine exhibit the eastern-most extension of their range and eastern species, like bur oak and American elm, reach the western extent of their natural range. Forest canopy conditions range from open to dense depending on the ecological site. Riparian/wetland and aquatic ecosystems are more commonly associated with streams.

Before European settlement, the Black Hills ecosystem looked quite different than it does today. Open, park-like pine areas were created by relatively frequent, low-intensity wildfire. Large devastating fires did occur, but are believed to have been fairly infrequent. A more patchy pattern, or mosaic, of small openings emerged, caused by insect epidemics, disease, and fire. Riparian areas were more extensive, and old growth areas were in larger blocks.

Approximate acreages:
Grass/shrub ecosystems – 265,625
Forested ecosystems – 1,126,062
Riparian/wetland ecosystems – 60,707
Aquatic ecosystems – 3,525 (based on current/modified conditions)
Rock Outcrops – 11,840

Wildlife: Wildlife species observed at the time of Lewis and Clark included American bison, black-tailed prairie dogs, pronghorn, elk, mule deer, Audubon's bighorn sheep, blue grouse, grizzly bear, wolf, swift fox, and lake chub. Several of the species present at that time were extirpated from this Ecoregion including the American bison, Audubon's bighorn sheep, wolf, sandhill crane, river otter, blue grouse, and black-footed ferret. Several of these species have been brought back into the Ecoregion through management.

Land use and management: Timber, agriculture, mining, recreation and tourism are considered the most dominant land uses in the Black Hills today. The majority of land within the Black Hills is owned and managed by the Black Hills National Forest. The State of South Dakota, the National Park Service and the Bureau of Land Management own and manage additional lands near or adjacent to the National Forest. Private land is also scattered throughout the Black Hills. Small to moderately large tracts of conservation lands are also held by private organizations within the Black Hills as well. Cattle ranching is the primary land use at lower elevations. Gold mining camps were the initial settlements within the Black Hills and evidence of historical mining is still present today. Mining has been an important industry since the late 1800's but has decreased in more recent years. Recreational use has been steadily increasing in recent years with use by both the local citizens and an increase in tourists during the summer months.

GRASS/SHRUB ECOSYSTEMS

Coarse filter: The Black Hills Ecoregion ecosystem diversity matrix for grass/shrub ecosystems incorporates NRCS range site descriptions for MLRA 61 and 62. The majority of the grass/shrub ecosystems are located within the low elevation zone or MLRA 61. The primary disturbance mechanisms that historically operated in grass/ecosystems of the Black Hills included fire, grazing, and prairie dog colonies, although prairie dogs were less common in the Black Hills than in other Ecoregions. The resulting grass/shrub ecosystem diversity matrix for the Black Hills Ecoregion is presented in Figure 3.10.

Historical amounts: Information on the historical amounts of grass/shrub ecosystems in the Black Hills Ecoregion relative to disturbance categories of the coarse filter/EDM, is not available at this time. As a more generalized estimate of historical amounts, NRCS soils data were used to map ecological sites defined in the EDM. Table 3.7 identifies the number of acres of the Black Hills Ecoregion in each of the eight ecological sites. See Appendix B-2 for a map of grass/shrub ecosystems in the Black Hills Ecoregion.

Table 3.7. Approximate number of historical acres for ecological sites representing grass/shrub ecosystems of the Black Hills Ecoregion.

Clayey	Claypan	Loamy	Shallow	Thin Upland	Sandy	High Country Loamy	Mountain Prairie
16,088	1377[a]	91,272	74,420	51,235	4,921	5,661	20,650

[a] Frequently occurs as an inclusion in other delineated sites under-representing the actual number of acres in this ecological site.

Existing conditions: Information on the current condition of grass/shrub ecosystems relative to disturbance categories identified by the coarse filter/EDM, is not available at this time. More generalized results of the South Dakota GAP assessment indicate that 27% of the Black Hills Ecoregion is currently covered by grass/shrub ecosystems. Of these, 52% were classified as low cover grasslands, 12% as medium cover grasslands, and 32% as high cover grasslands.

Riparian/Wetland Ecosystems

Coarse filter: The ecosystem diversity matrix for riparian/wetland ecosystems of the Black Hills Ecoregion is presented in figure 3.11. The primary disturbance mechanisms that historically operated in riparian/wetland ecosystems of the Black Hills included flood, fire, beaver, and grazing.

Figure 3.10. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for grass/shrub ecosystems of the Black Hills Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

GRASS/SHRUB ECOSYSTEMS

Disturbance Influenced Pathways	**Clayey** (Potential Dominant Species / Acres)	**Claypan** (Potential Dominant Species / Acres)	**Loamy** (Potential Dominant Species / Acres)	**Shallow** (Potential Dominant Species / Acres)	**Thin Upland** (Potential Dominant Species / Acres)	**Sandy** (Potential Dominant Species / Acres)	**High Country Loamy** (Potential Dominant Species / Acres)	**Mountain Prairie** (Potential Dominant Species / Acres)
Early Seral								
Prairie Dog Town, active	*Blue grama* *Buffalograss*	*Blue grama* *Buffalograss*	*Blue grama* *Buffalograss* *Threadleaf sedge*				*Bluegrasses* *Sedges*	*Blue grama* *Bluegrasses*
Prairie Dog Town, inactive	*Blue grama* *Sidoats grama* *Western wheatgrass*	*Blue grama* *Western wheatgrass*	*Blue grama* *Sideoats grama* *Western wheatgrass*				*Western wheatgrass* *Bluegrasses*	*Western wheatgrass* *Sideoats grama*
Vegetative composition/structure primarily influenced by short-interval fire regimes (<25 yrs.)								
Light Grazing	*Green needlegrass* *Western wheatgrass* *Little bluestem* *Big bluestem*	*Green needlegrass* *Needle-and-thread* *Western wheatgrass* *Prairie sandreed*	*Green needlegrass* *Little & Big bluestem* *Indiangrass* *Switchgrass*	*Big bluestem* *Little bluestem* *Prairie sandreed* *Needle-and-thread*	*Needle-and-thread* *Western wheatgrass* *Prairie sandreed* *Little bluestem*	*Prairie sandreed* *Sand bluestem* *Big bluestem* *Little bluestem*	*Columbia needlegrass* *Green needlegrass* *Bearded wheatgrass* *Prairie dropseed*	*Little bluestem* *Big bluestem* *Prairie dropseed* *Needle-and-thread*
Moderate Grazing	*Western wheatgrass* *Little & Big bluestem* *Sideoats grama* *Blue grama*	*Western wheatgrass* *Green needlegrass* *Needle-and-thread* *Blue grama*	*Western wheatgrass* *Needle-and-thread* *Sideoats grama* *Blue grama*	*Western wheatgrass* *Needle-and-thread* *Sideoats grama* *Blue grama*	*Needle-and-thread* *Western wheatgrass* *Sideoats grama* *Blue grama*	*Western wheatgrass* *Needle-and-thread* *Little & Big bluestem* *Blue grama*	*Western wheatgrass* *Bearded wheatgrass* *Prairie dropseed* *Bluegrasses*	*Western wheatgrass* *Needle-and-thread* *Sideoats grama* *Blue grama*
Heavy Grazing	*Blue grama* *Buffalograss* *Plains prickleypear* *Threadleaf sedge*	*Blue grama* *Buffalograss* *Sedges*	*Blue grama* *Threadleaf sedge*	*Blue grama* *Hairy grama* *Bluegrasses* *Sedges*	*Blue grama* *Hairy grama* *Sedges*	*Blue grama* *Bluegrasses* *Sedges*	*Bluegrasses* *Sedges*	*Blue grama* *Sedges* *Bluegrasses*
Vegetative composition/structure primarily influenced by long-interval fire regimes (>25 yrs.)								
Light Grazing	*Green needlegrass* *Western wheatgrass* *Little & Big bluestem* *Wyoming big sagebrush*	*Green needlegrass* *Needle-and-thread* *Western wheatgrass* *Wyoming big sagebrush*	*Green needlegrass* *Little & Big bluestem* *Indiangrass* *Woody vegetation*	*Little & Big bluestem* *Prairie sandreed* *Rocky Mountain juniper* *Mountain mahogany*	*Needle-and-thread* *Western wheatgrass* *Prairie sandreed* *Woody vegetation*	*Prairie sandreed* *Sand bluestem* *Big bluestem* *Woody vegetation*	*Columbia needlegrass* *Green needlegrass* *Bearded wheatgrass* *Woody vegetation*	*Little bluestem* *Big bluestem* *Prairie dropseed* *Woody vegetation*
Moderate Grazing	*Western wheatgrass* *Little & Big bluestem* *Sideoats grama* *Wyoming big sagebrush*	*Western wheatgrass* *Green needlegrass* *Needle-and-thread* *Wyoming big sagebrush*	*Western wheatgrass* *Needle-and-thread* *Sideoats grama* *Woody vegetation*	*Western wheatgrass* *Needle-and-thread* *Rocky Mountain juniper* *Mountain mahogany*	*Needle-and-thread* *Western wheatgrass* *Little bluestem* *Woody vegetation*	*Western wheatgrass* *Needle-and-thread* *Little bluestem* *Woody vegetation*	*Western wheatgrass* *Bearded wheatgrass* *Prairie dropseed* *Woody vegetation*	*Western wheatgrass* *Needle-and-thread* *Sideoats grama* *Woody vegetation*
Heavy Grazing	*Blue grama* *Buffalograss* *Plains prickleypear* *Wyoming big sagebrush*	*Blue grama* *Buffalograss* *Sedges* *Wyoming big sagebrush*	*Blue grama* *Threadleaf sedge* *Woody vegetation*	*Blue grama* *Hairy grama* *Rocky Mountain juniper* *Mountain mahogany*	*Blue grama* *Hairy grama* *Sedges* *Woody vegetation*	*Blue grama* *Bluegrasses* *Sedges* *Woody vegetation*	*Bluegrasses* *Sedges* *Woody vegetation*	*Blue grama* *Sedges* *Bluegrasses* *Woody vegetation*
TOTAL ACRES IN EACH ECOLOGICAL SITE	**16,088**	**1,377**	**91,272**	**74,420**	**51,235**	**4,921**	**5,661**	**20,650**
	061 Clayey 061 Dense Clay	061 Thin Claypan	061, 062 Silty 061 Loamy Terrace	061, 062 Shallow 061 Shallow Clay	061 Thin Upland	061 Sandy	062 High Country Overflow 062 High Country Silty	062 Mountain Prairie

KEY

Ecosystems that do not occur

References

Ecosystem Diversity Matrix concept described in:
1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes derived from:
1) Natural Resources Conservation Service, Ecological Site Descriptions

Figure 3.11. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for riparian/wetland ecosystems of the Black Hills Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways			Habitat Descriptor	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS				SLOPE SYSTEMS
				Geomorphic →								
				Water Regime →	Temporary	Semi-permanent	Permanent	Perennial		Intermittent		
				Slope →				Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								
		Heavy Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								
	Beaver Unmodified System	Low to Moderate Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								
		Heavy Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								
		Heavy Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								
	Beaver Unmodified System	Low to Moderate Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								
		Heavy Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								

Information on plant species distributions relative to disturbance categories was not available at this time

KEY

Ecosystems that do not occur

References

Ecosystem Diversity Matrix concept

1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes based

1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Corp of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

Historical amounts: Estimating the historical amounts of riparian/wetland ecosystems relative to the disturbance categories of the coarse filter/EDM, requires an understanding of community response within each ecological site to historical disturbance regimes. At this time, insufficient information is available on the species composition and structure of riparian/wetland ecosystems in response to historical disturbance regimes, thereby limiting our ability to reconstruct or model historical range of variability. In addition, providing estimates of the historical amounts for ecological sites is problematic using existing information as many sites have been modified since European settlement. However, a more generalized estimate of ecological sites for riverine systems was mapped using Aquatic GAP GIS data to quantify the number of stream miles for each of the four riverine subclasses, as stream size and gradient are less easily modified. Table 3.8 identifies the number of stream miles for each riverine system ecological site that is assumed to approximate the historical amounts. See Appendix B-2 for a map of riparian/wetland ecosystems in the Black Hills Ecoregion.

Table 3.8. Approximate historical amounts (stream miles) for ecological sites representing riverine riparian/wetland ecosystems of the Black Hills Ecoregion.

RIVERINE SYSTEMS			
Perennial		*Intermittent*	
Low Gradient ≤ 2% slope	Mid-High Grad. > 2% slope	Low Gradient ≤ 2% slope	Mid-High Grad. > 2% slope
474 miles	211 miles	798 miles	2650 miles

Existing conditions: Information on the current condition of riparian/wetland ecosystems relative to disturbance categories of the coarse filter/EDM are not available at this time. The results of an analysis of soils data (SSURGO) and National Wetland Inventory (NWI) data are presented in table 3.9 for the Black Hills Ecoregion. The NWI data were also used to provide information on the level of human-modification in riparian/wetland ecosystems and are also presented in the table.

Table 3.9. Existing amounts (acres) for ecological sites representing riparian/wetland ecosystems of the Black Hills Ecoregion. Developed from an assessment of soils (SSURGO) and NWI data. First number indicates unmodified acres/second number indicates human-modified acres. na = information not available.

	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS		SLOPE SYSTEMS
	Temporary	*Semi-perm.*	*Permanent*	*Perennial*	*Intermittent*	
Rocky Shore	0 / 0	0 / 0		0 / 0	0 / 0	na
Unconsol. Shore	5 / 55	0 / 0		0 / 0	142 / 9	na
Emergent	479 / 130	1 / 14		373 / 110	na	na
Scrub-Shrub	29 / 1	0 / 0		69 / 74	na	na
Forested	2 / 2	0 / 0		31 / 41	na	na
UNDEFINED	62	4,110		40,454	17,921	na
Total	**765**	**4,129**		**41,152**	**17,442**	

AQUATIC ECOSYSTEMS

Coarse filter: The ecosystem diversity matrix for aquatic ecosystems of the Black Hills Ecoregion is presented in figure 3.12. The primary disturbance mechanisms that historically operated in aquatic ecosystems included flood events and beaver.

Figure 3.12. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for aquatic ecosystems of the Black Hills Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

AQUATIC ECOSYSTEMS

Disturbance Influenced Pathways			Habitat Descriptor	DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS							
Geomorphic Setting						*Perennial*							
Water Regime				*Semi-permanent*	*Permanent*	*Large River*		*Small Rivers*		*Creeks*		*Headwater Stream*	
Sizeclass						Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)
Gradient													
Time Since Major Disturbance (i.e., flood)	EARLY SUCCESSIONAL	Beaver Influenced System	Streambed										
			Unconsolidated Bottom										
			Aquatic Bed										
		Beaver Absent	Streambed										
			Unconsolidated Bottom										
			Aquatic Bed										
	LATE SUCCESSIONAL	Beaver Influenced System	Streambed										
			Unconsolidated Bottom										
			Aquatic Bed										
		Beaver Absent	Streambed										
			Unconsolidated Bottom										
			Aquatic Bed										

Information on macroinvertebrate distributions relative to disturbance categories was not available at this time

References

Ecosystem Diversity
1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes
1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Corp of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

Historical amounts: Estimating the historical amounts of aquatic ecosystems relative to the disturbance categories of the coarse filter/EDM, requires an understanding of aquatic community response within each ecological site to historical disturbance regimes. At this time, insufficient information is available on the species composition and structure of aquatic ecosystems in response to historical disturbance regimes, thereby limiting our ability to reconstruct or model historical range of variability. In addition, providing estimates of the historical amounts for ecological sites is problematic using existing information as many sites have been modified since European settlement. However, a more generalized estimate of ecological sites for riverine systems was mapped using Aquatic GAP GIS data to quantify the number of stream miles for each of the eight riverine subclasses. Table 3.10 identifies the number of stream miles for each riverine system ecological site that is assumed to approximate the historical amounts. See Appendix B-2 for a map of aquatic ecosystems in the Black Hills Ecoregion.

Table 3.10. Approximate number of historical stream miles for ecological sites representing riverine aquatic ecosystems of the Black Hills Ecoregion.

RIVERINE SYSTEMS							
Perennial (miles)							
Large River		*Small Rivers*		*Creeks*		*Headwater Stream*	
Low Gradient (≤ 2% slope)	Mid-High Grad. (>2% slope)	Low Gradient (≤ 2% slope)	Mid-High Grad. (>2% slope)	Low Gradient (≤ 2% slope)	Mid-High Grad. (>2% slope)	Low Gradient (≤ 2% slope)	Mid-High Grad. (>2% slope)
21	**2**	**66**	**12**	**227**	**61**	**160**	**135**

Existing conditions: Information on the current condition of aquatic ecosystems relative to disturbance categories of the coarse filter/EDM, is not available at this time. The results of an analysis of soils data (SSURGO) and National Wetland Inventory (NWI) data are presented in table 3.11 for the Black Hills Ecoregion. The NWI data were also used to provide information on the level of human modification in aquatic ecosystems and are also presented in the table.

Table 3.11. Existing amounts (acres) for ecological sites representing aquatic ecosystems of the Black Hills Ecoregion. Developed from an assessment of soils (SSURGO) and NWI data. First number indicates unmodified acres/second number indicates human-modified acres. na = information not available.

	DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS
	Semi-permanent	*Permanent*	*Perennial*
Stream Bottom	0 / 16	0 / 0	0 / 27
Unconsolidated Bottom	2 / 417	0 / 6	194 / 1
Aquatic Bed	0 / 0	0 / 48	0 / 0
TOTAL ACRES	**435**	**54**	**222**
Undefined			

FOREST ECOSYSTEMS

Coarse filter: The Black Hills Ecoregion ecosystem diversity matrix for forest ecosystems incorporates both NRCS range site descriptions for MLRA 62 and habitat type classification developed by Hoffman and Alexander (1987), as the ecological site component of the EDM. The primary disturbance mechanism that historically operated in forest ecosystems was fire. The resulting forest ecosystem diversity matrix for the Black Hills Ecoregion is presented in Figure 3.13.

Historical amounts: Information on the historical amounts of forest ecosystems relative to disturbance categories of the coarse filter/EDM, is not available at this time. As a more generalized estimate of historical amounts, NRCS soils data were used to map forested ecological sites defined in the EDM. Table 3.12 identifies the number of acres of the Black Hills Ecoregion in each of the seven ecological sites. See Appendix B-2 for a map of forested ecosystems in the Black Hills Ecoregion.

Figure 3.13. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for forested ecosystems of the Black Hills Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

FORESTED ECOSYSTEMS

Disturbance Influenced Pathways	Warm, Dry Bur Oak (Potential Dominant Spp.)	Acres	Xeric Ponderosa Pine (Potential Dominant Spp.)	Acres	Warm, Dry Ponderosa Pine (Potential Dominant Spp.)	Acres	Warm, Moist Ponderosa Pine (Potential Dominant Spp.)	Acres	Warm, Moist Quaking Aspen (Potential Dominant Spp.)	Acres	Cool, Moist White Spruce (Potential Dominant Spp.)	Acres	High Elevation Limber Pine (Potential Dominant Spp.)	Acres
SEEDLING/ SHRUB	*Bur oak, Green ash, American elm, Ponderosa pine*		*Ponderosa pine, Rocky Mountain juniper, Bur oak*		*Ponderosa pine, Rocky Mountain juniper, Bur oak, Paper birch*		*Ponderosa pine, Quaking aspen, Bur oak, Paper birch*		*Quaking aspen, Ponderosa pine, Paper birch, Bur oak*		*Ponderosa pine, Quaking aspen, Paper birch*		*Not available*	
SAPLING	*Bur oak, Green ash, American elm, Ponderosa pine*		*Ponderosa pine, Rocky Mountain juniper, Bur oak*		*Ponderosa pine, Rocky Mountain juniper, Bur oak, Paper birch*		*Ponderosa pine, Quaking aspen, Bur oak, Paper birch*		*Quaking aspen, Ponderosa pine, Paper birch, Bur oak*		*Ponderosa pine, Quaking aspen, Paper birch*		*Not available*	
Stand conditions/structure PREDOMINANTLY influenced by short-interval fire regimes	**Non-lethal 10 yr. Mean Fire Interval**		**Non-lethal 3-23 yr. return interval**		**Non-lethal & Mix. Severity 10-43 yr. return interval**		**Non-lethal & Mix. Severity 11-74 yr. return interval**		**Rarely Occurred**		**Rarely Occurred**		**Mixed-Severity ? yr. return interval**	
SMALL TREES	*Bur oak, Ponderosa pine*		*Ponderosa pine*		*Ponderosa pine*		*Ponderosa pine, Quaking aspen*				*Ponderosa pine, Quaking aspen*		*Not available*	
MEDIUM TREES	*Bur oak, Ponderosa pine*		*Ponderosa pine*		*Ponderosa pine*		*Ponderosa pine, Quaking aspen*				*Ponderosa pine, Quaking aspen*		*Not available*	
LARGE TREES	*Bur oak, Ponderosa pine*		*Ponderosa pine*		*Ponderosa pine*		*Ponderosa pine*				*Ponderosa pine*		*Not available*	
% Habitat Type Class by Historical Disturbance Regime	Non-lethal	98%	Non-lethal	90%	Non-lethal	90%	Non-lethal	7%	Non-lethal	0%	Non-lethal	0%	Non-lethal	0%
	Mixed Severity	2%	Mixed Severity	10%	Mixed Severity	10%	Mixed Severity	7%	Mixed Severity	65%	Mixed Severity	33%	Mixed Severity	7%
	Stand Replacing	0%	Stand Replacing	0%	Stand Replacing	0%	Stand Replacing	7%	Stand Replacing	35%	Stand Replacing	67%	Stand Replacing	7%
Stand conditions/structure PREDOMINANTLY influenced by long-interval fire regimes	**Rarely Occurred**		**Rarely Occurred**		**Rarely Occurred**		**Stand Replace/ Mix-Severity >74 yr return interval**		**Stand Replace/ Mix-Severity 120 yr Mean Fire Interval**		**Stand Replace/ Mix-Severity 50-200 yr return interval**		**Stand Replace/ Mix-Severity ? yr. return interval**	
SMALL TREES	*Bur oak, Paper birch, Ironwood, Ponderosa pine*		*Ponderosa pine, Rocky Mountain juniper, Bur oak*		*Ponderosa pine, Rocky Mountain juniper, Bur oak, Paper birch*		*Ponderosa pine, Quaking aspen, Paper birch, White spruce*		*Quaking aspen, Paper birch, White spruce, Ponderosa pine*		*White spruce, Ponderosa pine, Quaking aspen, Lodgepole pine*		*Not available*	
MEDIUM TREES	*Bur oak, Paper birch, Ponderosa pine, Ironwood*		*Ponderosa pine, Bur oak*		*Ponderosa pine, Bur oak*		*Ponderosa pine, Quaking aspen, Paper birch, White spruce*		*Quaking aspen, Paper birch, White spruce, Ponderosa pine*		*White spruce, Ponderosa pine, Quaking aspen, Lodgepole pine*		*Not available*	
LARGE TREES	*Bur oak, Ponderosa pine*		*Ponderosa pine*		*Ponderosa pine*		*Ponderosa pine, White spruce*		*Ponderosa pine, White spruce*		*White spruce, Ponderosa pine*		*Not available*	
TOTAL ACRES IN EACH ECOSYSTEM	**100,410**		**406,903**		**157,996**		**316,756**		**Insufficient information for mapping**		**143,994**		**Insufficient information for mapping**	

LEGEND

Successional Pathways

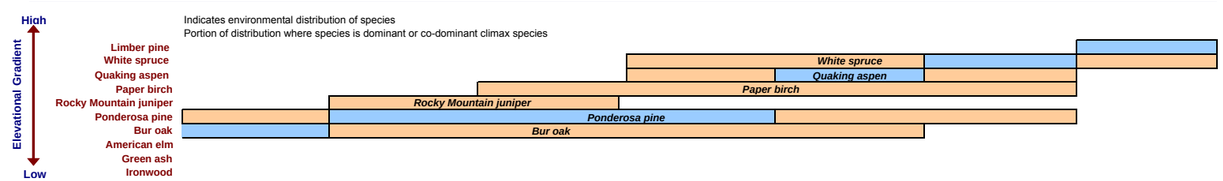
TREE CODES

QUMA = Bur oak
PIPO = Ponderosa pine
POTR = Quaking aspen
PIGL = White spruce

HABITAT TYPES

Warm, Dry Bur Oak	Xeric Ponderosa Pine	Warm, Dry Ponderosa Pine	Warm, Moist Ponderosa Pine	Warm, Moist Quaking Aspen	Cool, Moist White Spruce
QUMA/OSVI QUMA/SYOC	PIPO/JUSC PIPO/CAHE PIPO/SCSC PIPO/PASM	PIPO/SYAL PIPO/PHMA PIPO/PRVI	PIPO/ARUV PIPO/JUCO	POTR/COCO POTR/OSVI	PIGL/LIBO PIGL/VASC

ENVIRONMENTAL DISTRIBUTION OF MAJOR TREE SPECIES



References

Ecosystem Diversity Matrix concept described in:

1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Site classification derived from:

1) Hoffman, G.R. and R.R. Alexander. 1987. Forest vegetation of the Black Hills National Forest of South Dakota and Wyoming. USDA Forest Serv., RM-276.
2) Sheppard, W.D. and M.A. Battaglia. 2002. Ecology, silviculture, and management of Black Hills Ponderosa Pine. USDA For. Service, RMRS-GTR-97.

Fire regimes derived from:

1) Sheppard, W.D. and M.A. Battaglia. 2002. Ecology, silviculture, and management of Black Hills Ponderosa Pine. USDA For. Service, RMRS-GTR-97.
2) Brown, P.M. 2003. Fire, climate, and forest structure in Ponderosa Pine forests of the Black Hills. Ph.D. Dissertation, Colorado State Univ.
3) Fischer, W.C. and B. D. Clayton. 1983. Fire ecology of Montana Forest Habitat Types East of the Continental Divide. USDA For. Serv., GTR-INT-141.

Table 3.12. Approximate number of historical acres for ecological sites representing forested ecosystems of the Black Hills ecoregion.

Warm, dry Bur Oak	Xeric P. Pine	Warm, Dry P. Pine	Warm, Moist P. Pine	Warm, Moist Quaking Aspen	Cool, Moist White Spruce	High Elevation Limber Pine
100,410	406,903	157,996	316,756	Insufficient information	143,994	Insufficient information

Existing conditions: Information on the current condition of forest ecosystems relative to disturbance categories of the coarse filter/EDM, is not available at this time. More generalized results of the South Dakota GAP assessment indicate that approximately 59% of the Black Hills Ecoregion is currently covered by forest ecosystems. The majority of these acres were classified as ponderosa pine (90%) dominated communities. Information on structure and size classes is not currently available.

MISSOURI RIVER ECOREGION

Landscape description: The Missouri River runs through the central part of South Dakota (Figure 3.14). To the east of the river lie the low hills, lakes, and potholes formed by the many glaciers that have occupied the area in the distant past. To the west of the river lie the arid deep canyons and rolling plains of the steppe. The Missouri River cuts a wide valley in a south to southeast direction through the state that is known as the Missouri River Trench. Most of the river's course was created by glacial water that scoured deep channels during warm periods. The geology and soils change quite abruptly from one side of the river valley to the other. The valley averages slightly over a mile in width and the valley floor ranges from 300 to 600 feet below the steep, eroded bluffs. The river's gradient averages a drop of roughly one foot per mile and goes from 3700 feet in elevation in the north to 1100 feet in elevation in the south. Early explorers report that the river was muddy most of the time and the river later became known as the "Big Muddy".

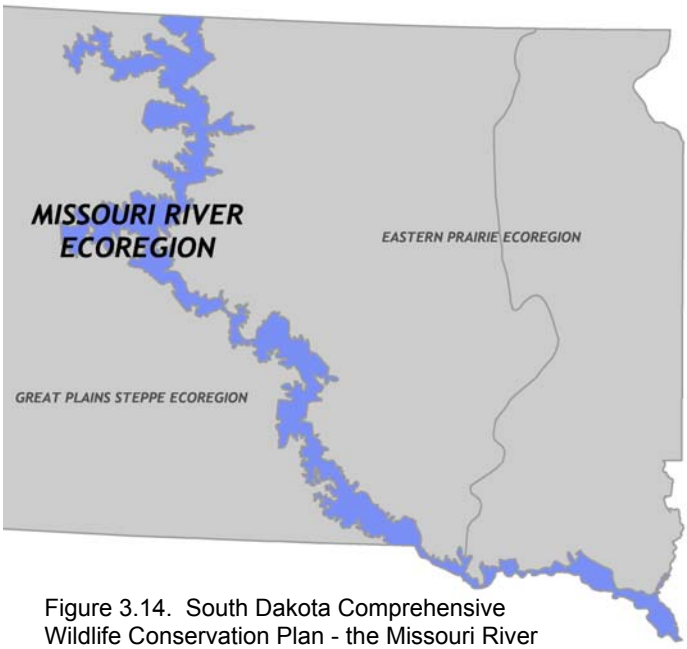


Figure 3.14. South Dakota Comprehensive Wildlife Conservation Plan - the Missouri River Ecoregion.

Historical Vegetation: Historically, the Missouri River was characterized by a shifting, braided channel and an abundance of vegetated and unvegetated sandbars. The shifting channel provided a wide variety of both above- and below-ground water environments and a large quantity of connected and non-connected off-channel water bodies. Riparian/wetland ecosystems dominated the valley bottom surrounding the ever-changing river channel. Gallery forests of cottonwood and green ash were common along the valley bottom. The tributaries and drainages that flowed into the valley often supported riparian woodlands as well. The backwater areas and beaver ponds supported aquatic, emergent, and shrub communities. Aquatic ecosystems were diverse from those occurring in the flowing river channel, to the stagnant backwater areas, and the nutrient rich beaver ponds.

Approximate acreages of historical riparian/wetland ecosystems and aquatic ecosystems are not available due to the alteration of the valley bottom by water impoundment and channelization activities.

Wildlife: Common wildlife species at the time of Lewis and Clark included beaver, bald eagles, paddlefish, pallid sturgeon, and river otter. The river and its many associated backwater sloughs, beaver ponds, islands and sandbars supported countless swans, ducks, geese, shorebirds, terns, etc. as both breeding habitat and for migration. Several of the species present at that time have been extirpated from this Ecoregion including the river otter, and winged mapleleaf.

Land use and management: The South Dakota portion of the Missouri River is now made up of a chain of four reservoirs impounded by large dams. These dams include Oahe, Big Bend, Gavins Point, and Fort Randall dams. The dams were built for flood control and to provide water for irrigation and the generation of electricity. The flood control measures of the dams to protect the floodplain, have allowed the development of much of the surrounding riparian/wetland ecosystems for agricultural purposes and urbanization.

RIPARIAN/WETLAND ECOSYSTEMS

Coarse filter: The ecosystem diversity matrix for riparian/wetland ecosystems of the Missouri River Ecoregion is presented in figure 3.15. The primary disturbance mechanisms that historically operated in riparian/wetland ecosystems of the Missouri River Ecoregion included flood, fire, beaver, and grazing.

Historical amounts: Estimating the historical amounts of aquatic ecosystems relative to the disturbance categories of the coarse filter/EDM, requires an understanding of aquatic community response within each ecological site to historical disturbance regimes. At this time, insufficient information is available on the species composition and structure of aquatic ecosystems in response to historical disturbance regimes, thereby limiting our ability to reconstruct or model historical range of variability. In addition, providing estimates of the historical amounts for ecological sites is also problematic using existing information as many sites have been modified since European settlement. However, a more generalized estimate of ecological sites for riverine systems were mapped using Aquatic GAP GIS data to quantify the number of stream miles for each of the three riverine subclasses, as stream size and gradient are less easily modified. Table 3.13 identifies the number of stream miles for each riverine ecological site that is assumed to approximate the historical amounts. See Appendix B-3 for a map of riparian/wetland ecosystems in the Missouri River Ecoregion.

Table 3.13. Approximate predicted amounts (stream miles) for ecological sites representing riverine riparian/wetland ecosystems of the Missouri River Ecoregion.

RIVERINE SYSTEMS		
Perennial	***Intermittent***	
Low Gradient ≤ 2% slope	**Low Gradient ≤ 2% slope**	**Mid-High Grad. > 2% slope**
1301 miles	**2939 miles**	**1168 miles**

Existing conditions: Information on the current condition of riparian/wetland ecosystems relative to disturbance categories of the coarse filter/EDM, is not available at this time. The results of an analysis of soils data (SSURGO) and National Wetland Inventory (NWI) data are presented in table 3.14 for the Missouri River Ecoregion. The NWI data were also used to provide information on the level of human-modification in riparian/wetland ecosystems and are presented in the table.

Figure 3.15. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for riparian/wetland ecosystems of the Missouri River Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MISSOURI RIVER ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptor	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
Geomorphic →										
Water Regime →				*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
Slope →							Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore							
			Emergent							
			Scrub-Shrub							
			Forested							
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore							
			Emergent							
			Scrub-Shrub							
			Forested							
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore							
			Emergent							
			Scrub-Shrub							
			Forested							
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore							
			Emergent							
			Scrub-Shrub							
			Forested							
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore							
			Emergent							
			Scrub-Shrub							
			Forested							
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore							
			Emergent							
			Scrub-Shrub							
			Forested							
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore							
			Emergent							
			Scrub-Shrub							
			Forested							
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore							
			Emergent							
			Scrub-Shrub							
			Forested							

Information on plant species distributions relative to disturbance categories is not available at this time

KEY

Ecosystems that do not occur

References

Ecosystem Diversity Matrix concept described in:

1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes similar to:

1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Corp of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

Table 3.14. Existing amounts (acres) for ecological sites representing riparian/wetland ecosystems of the Missouri River Ecoregion. Developed from an assessment of soils (SSURGO) and NWI data. First number indicates unmodified acres/second number indicates human-modified acres. na = information not available.

	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS		SLOPE SYSTEMS
	Littoral	*Temporary*	*Semi-perm.*	*Permanent*	*Perennial*	*Intermittent*	
Rocky Shore	0 / 0	0 / 0	0 / 0		0 / 0	0 / 0	na
Unconsol. Shore	9 / 1103	17 / 6	0 / 0		17 / 6	172 / 11	na
Emergent	na	2,813 / 1,098	340 / 614		3,275 / 2,141	na	na
Scrub-Shrub	na	128 / 206	0 / 0		364 / 91	na	na
Forested	na	210 / 33	0 / 0		438 / 14	na	na
UNDEFINED	na	50,306	10,831		98,720	28,442	na
Total	**1,112**	**54,817**	**11,785**		**105,066**	**28,625**	

AQUATIC ECOSYSTEMS

Coarse filter: The ecosystem diversity matrix for aquatic ecosystems of the Missour River Ecoregion is presented in figure 3.16. The primary disturbance mechanisms that historically operated in aquatic ecosystems included flood events and beaver.

Historical amounts: Estimating the historical amounts of aquatic ecosystems relative to the disturbance categories of the coarse filter/EDM, requires an understanding of aquatic community response within each ecological site to historical disturbance regimes. At this time, insufficient information is available on the species composition and structure of aquatic ecosystems in response to historical disturbance regimes, thereby limiting our ability to reconstruct or model historical range of variability. In addition, providing estimates of the historical amounts for ecological sites is problematic using existing information as many sites have been modified since European settlement. However, a more generalized estimate of ecological sites for riverine systems was mapped using Aquatic GAP GIS data to quantify the number of stream miles for each of the four riverine subclasses, as stream size and gradient are less easily modified. Table 3.15 identifies the number of stream miles for each riverine system ecological site that is assumed to approximate the historical amounts. See Appendix B-3 for a map of aquatic ecosystems in the Missouri River Ecoregion.

Table 3.15. Approximate number of historical stream miles for ecological sites representing riverine aquatic ecosystems of the Missouri River Ecoregion.

RIVERINE SYSTEMS			
Perennial (miles)			
Large River	*Small Rivers*	*Creeks*	*Headwater Stream*
669	**116**	**350**	**167**

Existing conditions: Information on the current condition of aquatic ecosystems relative to disturbance categories of the coarse filter/EDM is not available at this time. The results of an analysis of soils data (SSURGO) and National Wetland Inventory (NWI) data are presented in table 3.16 for the Missouri River Ecoregion. NWI data were also used to provide information on the level of human-modification in aquatic ecosystems.

Figure 3.16. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for aquatic ecosystems of the Missouri River Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MISSOURI RIVER ECOREGION

AQUATIC ECOSYSTEMS

Disturbance Influenced Pathways			Geomorphic Setting / *Water Regime* / *Sizeclass* / Habitat Descriptor	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS			
				Limnetic	*Littoral*	*Semi-permanent*	*Permanent*	*Perennial*			
								Large River	*Small Rivers*	*Creeks*	*Headwater Stream*
Time Since Major Disturbance (i.e., flood)	EARLY SUCCESSIONAL	Beaver Influenced System	Streambed								
			Unconsolidated Bottom								
			Aquatic Bed								
		Beaver Absent	Streambed								
			Unconsolidated Bottom								
			Aquatic Bed								
	LATE SUCCESSIONAL	Beaver Influenced System	Streambed								
			Unconsolidated Bottom								
			Aquatic Bed								
		Beaver Absent	Streambed								
			Unconsolidated Bottom								
			Aquatic Bed								

Information on macroinvertebrate distributions relative to disturbance categories is not available at this time

References

Ecosystem Diversity Matrix concept described in: 1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes similar to: 1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Corp of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

Table 3.16. Existing amounts (acres) for ecological sites representing aquatic ecosystems of the Missouri River Ecoregion. Developed from an assessment of soils (SSURGO) and NWI data. First number indicates unmodified acres/second number indicates human-modified acres. na = information not available.

	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS
	Limnetic	*Littoral*	*Semi-permanent*	*Permanent*	*Perennial*
Stream Bottom	0 / 0	0 / 0	0 / 0	0 / 0	157 / 8
Unconsolidated Bottom	0 / 14,514	0 / 570	0 / 37	0 / 41	175 / 408
Aquatic Bed	0 / 0	563 / 573	74 / 1,517	0 / 87	174 / 128
TOTAL ACRES	**14,514**	**1,706**	**1,628**	**128**	**1,050**
Undefined	**210,293**				

EASTERN PRAIRIE ECOREGION

The Eastern Prairie Ecoregion is represented by two subregions: the Tallgrass and the Mixedgrass Subregions. These subregions are combined into the Eastern Prairie Ecoregion for administrative purposes but will be described and discussed individually for the conservation plan. The Tallgrass Subregion represents approximately 8.8 million acres in South Dakota while the Mixedgrass Subregion represents approximately 13.5 million acres.

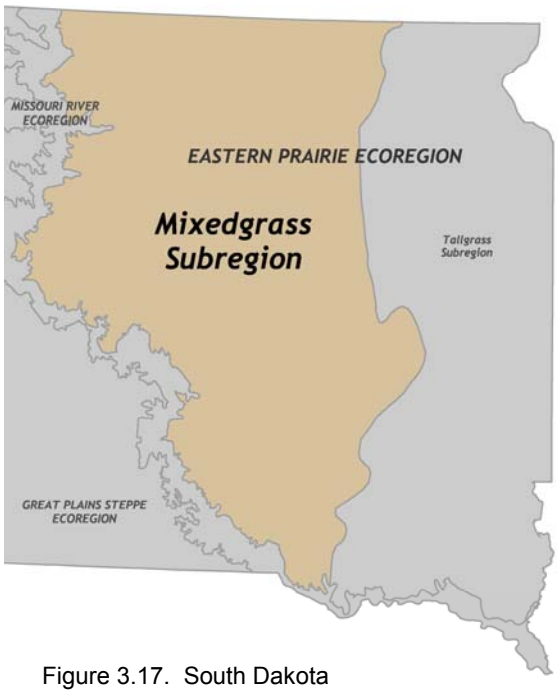


Figure 3.17. South Dakota Comprehensive Wildlife Conservation Plan - the Mixedgrass Subregion.

MIXEDGRASS SUBREGION

Landscape Description: The Mixedgrass Subregion is characterized by nearly level to undulating glacial till plains with potholes and moraines in the east-central portion of the State (figure 3.17). Most of the soils are deep and moderately well-drained, with sandy to clayey textures. The region's major rivers are often flanked by steep slopes or glacial lake plains. Perennial streams are relatively uncommon and widely spaced. The potholes/wetlands can occur in varying densities of a few to many per square mile and are estimated to cover approximately 10% of the total landscape.

The Mixedgrass Subregion includes 4 MLRA's, including 53C – Southern Dark Brown Glaciated Plains, 53B – Central Dark Brown Glaciated Plains, 55B – Central Black Glaciated Plains, and 55C – Southern Black Glaciated Plains. Elevation ranges from 950 feet in the lowlands to 2300 feet in the uplands. The region receives average annual precipitation ranging from 14 to 21 inches, with half of this occurring during the growing season. The mean annual temperature ranges from 34 to 48° F and the growing season is approximately 110 to 155 days.

Historical Vegetation: The vegetation of the pre-settlement Mixedgrass Subregion was dominated by grass/shrub ecosystems. In general, these were grass dominated ecosystems characterized by both the short-statured warm-season grasses of the Great Plains Steppe Ecoregion to the west and the tall-statured cool- and warm-season grasses of the Tallgrass Subregion to the east. Shrubs were a relatively minor component of the upland vegetation, occurring primarily on protected microsites. Forest ecosystems were very rare in the upland areas and primarily occurred in small pockets where fire was unable to access or influence the site. For this reason, upland forest ecosystems are not represented as

a primary pre-settlement ecosystem type in the Mixedgrass Subregion for ecosystem diversity purposes. Riparian/wetland ecosystems were well distributed throughout the Mixedgrass Subregion and were frequently characterized by emergent, shrub and forested conditions, particularly along large floodplains. Aquatic ecosystems are primarily associated with rivers and streams, as well as naturally occurring lakes and ponds.

Approximate acreages:

Grass/shrub ecosystems – 10.9 million
Riparian/wetland ecosystems – 2.2 million (based on current/modified conditions)
Aquatic ecosystems – 285,000 (based on current/modified conditions)
Rock outcrops – 5,000

Wildlife: Common wildlife species at the time of Lewis and Clark included American bison, black-tailed prairie dogs, pronghorn, elk, white-tailed deer, mule deer, wolf, coyote, beaver, bald eagles, meadowlarks, northern pike, channel catfish, and sharp-tailed grouse. The wetlands of the Mixedgrass Subregion supported countless ducks and geese both for breeding and migration. Several of the species present at that time have been extirpated from this subregion including American bison, elk, wolf, and river otter.

Land use and management: Land use in the Mixedgrass Subregion is dominated by farming and ranching. Nearly 70% of the land surface has been reported to be cultivated for crops. An additional 25% of the land surface is characterized by native or tame pasture. These pasture areas are typically associated with steeper slopes or thinner soils on the landscape. Most of the land-base is in private ownership with management practices that support farming or ranching objectives. Some irrigation is practiced on perennial streams, ponds, or reservoirs.

GRASS/SHRUB ECOSYSTEMS

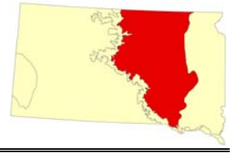
Coarse filter: The Mixedgrass Subregion ecosystem diversity matrix for grass/shrub ecosystems incorporates NRCS ecological site descriptions for MLRA 53B as well as range site descriptions for East Central South Dakota. The primary disturbance mechanisms that historically operated in the grass/shrub ecosystems included fire, grazing, and prairie dog colonies. The resulting grass/shrub ecosystem diversity matrix for the Mixedgrass Subregion is presented in Figure 3.18.

Historical amounts: Existing information on the historical amounts of grass/shrub ecosystems in the Mixedgrass Subregion relative to disturbance categories of the coarse filter/EDM, is not available at this time. As a more generalized estimate of historical amounts, NRCS soils data were used to map ecological sites based on the coarse filter/EDM. Table 3.17 identifies the approximate number of acres of the Mixedgrass Subregion in each of the eight ecological sites. See Appendix B-4 for a map of grass/shrub ecosystems in the Mixedgrass Subregion.

Table 3.17. Approximate number of historical acres for ecological sites representing grass/shrub ecosystems of the Mixedgrass Subregion.

Dense Clay	Clayey	Shallow Clayey	Claypan	Loamy	Sandy	Shallow	Very Shallow
55,978	1,545,265	176,149	645,762	7,462,109	384,305	444,351	252,076

Figure 3.18. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for grass/shrub ecosystems of the Mixedgrass Subregion.



ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

GRASS-SHRUB ECOSYSTEMS

Ecolological Site Class

Disturbance Influenced Pathways	Dense Clay		Clayey		Shallow Clayey		Claypan		Loamy		Sandy		Shallow		Very Shallow	
	Potential Dominant Species	HRV	Potential Dominant Species	HRV	Potential Dominant Species	HRV	Potential Dominant Species	HRV	Potential Dominant Species	HRV	Potential Dominant Species	HRV	Potential Dominant Species	HRV	Potential Dominant Species	HRV
Early Seral	*Red threeawn* *Six weeks fescue* *Prairie junegrass*	na	*Red threeawn* *Six weeks fescue* *Prairie junegrass*	na	*Red threeawn* *Six weeks fescue* *Prairie junegrass*	na	*Sixweeks fescue* *Needle-and-thread* *Curlycup gumweed*	na	*Red three-awn* *Sixweeks fescue* *Needle-and-thread*	na	*Red threeawn* *Sand dropseed* *Curlycup gumweed*	na	*Red threeawn* *Sixweeks fescue*	na	*Red threeawn* *Sixweeks fescue* *Curlycup gumweed*	na
Prairie Dog Town, active		0	*Red threeawn* *Six weeks fescue* *Prairie junegrass*	na		0	*Sixweeks fescue* *Needle-and-thread* *Curlycup gumweed*	na	*Red three-awn* *Sixweeks fescue* *Needle-and-thread*	na		0		0		0
Prairie Dog Town, inactive		0	*Western wheatgrass* *Needle-and-thread*	na		0	*Western wheatgrass* *Needle-and-thread*	na	*Western wheatgrass* *Needle-and-thread*	na		0		0		0
Vegetative composition/structure primarily influenced by short-interval fire regimes (<10 yrs.)																
Light Grazing	*Green needlegrass* *Western wheatgrass*	na	*Green needlegrass* *Porcupine grass* *Thickspike wheatgrass*	Min 4% Max 10%	*Green needlegrass* *Western wheatgrass* *Big bluestem* *Little bluestem*	na	*Green needlegrass* *Western wheatgrass* *Needle-and-thread*	Min 5% Max 11%	*Green needlegrass* *Western wheatgrass* *Needle-and-thread* *Porcupinegrass*	Min 17% Max 34%	*Sand bluestem* *Prairie sandreed* *Big bluestem*	Min 38% Max 71%	*Green needlegrass* *Little bluestem* *Plains muhly* *Big bluestem*	Min 5% Max 14%	*Needle-and-thread* *Little bluestem* *Plains muhly* *Porcupinegrass*	Min 37% Max 58%
Moderate Grazing	*Western wheatgrass* *Green needlegrass* *Sedges*	na	*Western wheatgrass* *Needle-and-thread* *Blue grama*	Min 13% Max 21%	*Western wheatgrass* *Sideoats grama* *Big bluestem*	na	*Western wheatgrass* *Blue grama* *Green needlegrass* *Needle-and-thread*	Min 15% Max 24%	*Western wheatgrass* *Needle-and-thread* *Sideoats grama* *Blue grama*	Min 16% Max 45%	*Needle-and-thread* *Western wheatgrass* *Blue grama*	Min 5% Max 13%	*Western wheatgrass* *Green needlegrass* *Sideoats grama* *Little bluestem*	Min 16% Max 26%	*Needle-and-thread* *Blue grama* *Western wheatgrass* *Sideoats grama*	Min 2% Max 10%
Heavy Grazing	*Sedges* *Western wheatgrass* *Bare ground*	na	*Blue grama* *Sedges* *Western wheatgrass*	Min 69% Max 82%	*Blue grama* *Bluegrasses* *Sedges*	na	*Blue grama* *Sandberg bluegrass* *Inland saltgrass* *Buffalograss*	Min 63% Max 77%	*Blue grama* *Sedges* *Bluegrasses*	Min 24% Max 60%	*Threadleaf sedge* *Blue grama* *Western wheatgrass* *Needle-and-thread*	Min 21% Max 50%	*Blue grama* *Sedges* *Sideoats grama* *Bare ground*	Min 63% Max 78%	*Blue grama* *Threadleaf sedge* *Red threeawn*	Min 55% Max 74%
Vegetative composition/structure primarily influenced by long-interval fire regimes (>10 yrs.)																
Light Grazing	*Green needlegrass* *Western wheatgrass* *Eastern red cedar*	na	*Green needlegrass* *Western wheatgrass* *Porcupine grass* *Eastern red cedar*	Min 0.3% Max 0.7%	*Green needlegrass* *Western wheatgrass* *Big bluestem* *Quercus macrocarpa*	na	*Green needlegrass* *Western wheatgrass* *Needle-and-thread* *Broom snakeweed*	Min 2% Max 5%	*Green needlegrass* *Western wheatgrass* *Needle-and-thread* *Eastern red cedar*	Min 0.6% Max 1%	*Sand bluestem* *Prairie sandreed* *Big bluestem* *Eastern red cedar*	Min 0.7% Max 2%	*Green needlegrass* *Little bluestem* *Plains muhly* *Eastern red cedar*	Min 0.3% Max 0.8%	*Needle-and-thread* *Little bluestem* *Plains muhly* *Eastern red cedar*	Min 1% Max 3%
Moderate Grazing	*Western wheatgrass* *Green needlegrass* *Sedges* *Western snowberry*	na	*Western wheatgrass* *Needle-and-thread* *Blue grama* *Eastern red cedar*	0	*Western wheatgrass* *Sideoats grama* *Big bluestem* *Quercus macrocarpa*	na	*Western wheatgrass* *Blue grama* *Needle-and-thread* *Broom snakeweed*	Min 0% Max 0.6%	*Western wheatgrass* *Needle-and-thread* *Sideoats grama* *Eastern red cedar*	0	*Needle-and-thread* *Western wheatgrass* *Blue grama* *Eastern red cedar*	0	*Western wheatgrass* *Green needlegrass* *Eastern red cedar*	0	*Needle-and-thread* *Blue grama* *Western wheatgrass* *Eastern red cedar*	0
Heavy Grazing	*Sedges* *Western wheatgrass* *Bare ground* *Western snowberry*	na	*Blue grama* *Sedges* *Western wheatgrass* *Eastern red cedar*	0	*Blue grama* *Bluegrasses* *Sedges* *Quercus macrocarpa*	na	*Blue grama* *Sandberg bluegrass* *Buffalograss* *Broom snakeweed*	Min 0% Max 0.5%	*Blue grama* *Sedges* *Bluegrasses* *Eastern red cedar*	0	*Threadleaf sedge* *Blue grama* *Eastern red cedar*	0	*Blue grama* *Sedges* *Bare ground* *Eastern red cedar*	0	*Blue grama* *Threadleaf sedge* *Red threeawn* *Eastern red cedar*	0
TOTAL ACRES IN EACH ECOLOGICAL SITE	**55,978**		**1,545,265**		**176,149**		**645,762**		**7,462,109**		**384,305**		**444,351**		**252,076**	

NRCS ECOLOGICAL/RANGE SITES

Dense Clay	Clayey	Shallow Clayey	Claypan	Loamy	Sandy	Shallow	Very Shallow
053C Dense Clay	053B, R053B Clayey	053C Shallow Clay	053B, R053B Claypan 053B, R053B Thin Claypan	053B Silty	053B, R053B Sands 053B, R053B Sandy	053B Thin Upland 053B Shallow	053B, R053B Very Shallow 053B, R053B Shallow to Gravel

KEY

Ecosystems that do not occur

na - information is not available at this time
HRV - Historical range of variability

References

Ecosystem Diversity Matrix concept described in:
1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes derived from:
1) Natural Resources Conservation Service, Ecological Site Descriptions

To obtain better information on historical amounts, SIMPPLLE was used to simulate and quantify the historical range of variability for each of the grass/shrub ecosystems of the Mixedgrass Subregion except Dense Clay and Shallow Clayey ecosystems (Figure 3.18). Due to time constraints, SIMPPLLE was used to model a representative portion of the Mixed Grass Subregion (approximately 2.6 million acres). Dense Clay and Shallow Clayey did not occur in this subset of the overall Subregion. See figure 3.18 for a summary of the minimum and maximum values for each of the cells of the EDM included in the simulation.

Results of the SIMPPLLE historical range of variability simulation suggest that the majority of the grass/shrub ecosystems in the Mixedgrass Subregion were a function of high fire frequency fire and heavy grazing, however, grass/shrub ecosystems also occurred as a function of light and moderate grazing in smaller amounts in the same fire regime. Although low fire frequency maintained ecosystems occurred in each ecological site, these ecosystems were relatively rare.

Existing conditions: Information on the current condition of grass/shrub ecosystems relative to disturbance categories of the coarse filter/EDM, is not available at this time. More generalized results of the South Dakota GAP assessment indicate that 39% of the Mixedgrass Subregion is currently covered by grass/shrub ecosystems, down from 81% historically. Of these, 25% were classified as idle grasslands and 75% as pastureland. Pasturelands can include a variety of grassland conditions, but are often characterized by exotic grasses. If this 75% was considered to be functionally impacted, grasslands in the Mixedgrass Subregion would be reduced to less than 10% representation of functional ecosystems.

RIPARIAN/WETLAND ECOSYSTEMS

Coarse filter: The ecosystem diversity matrix for riparian/wetland ecosystems of the Mixedgrass Subregion is presented in figure 3.19. The primary disturbance mechanisms that historically operated in riparian/wetland ecosystems included flood, fire, beaver, and grazing.

Historical amounts: Estimating the historical amounts of aquatic ecosystems relative to the disturbance categories of the coarse filter/EDM, requires an understanding of aquatic community response within each ecological site to historical disturbance regimes. At this time, insufficient information is available on the species composition and structure of aquatic ecosystems in response to historical disturbance regimes, thereby limiting our ability to reconstruct or model historical range of variability. In addition, providing estimates of the historical amounts for ecological sites is problematic using existing information as many sites have been modified since European settlement. However, a more generalized estimate of ecological sites for riverine systems was mapped using Aquatic GAP GIS data to quantify the number of stream miles for each of the three riverine subclasses, as stream size and gradient are less easily modified. Table 3.18 identifies the number of stream miles for each riverine system ecological site that is assumed to approximate the historical amounts. See Appendix B-4 for a map of riparian/wetland ecosystems in the Mixedgrass Subregion.

Table 3.18. Approximate historical amounts (stream miles) for ecological sites representing riverine riparian/wetland ecosystems of the Mixedgrass Subregion.

RIVERINE SYSTEMS		
Perennial	***Intermittent***	
Low Gradient ≤ 2% slope	**Low Gradient ≤ 2% slope**	**Mid-High Grad. > 2% slope**
1430 miles	**11496 miles**	**283 miles**

Figure 3.19. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for riparian/wetland ecosystems of the Mixedgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

RIPARIAN-WETLAND ECOSYSTEMS

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptor	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
			Geomorphic →								
			Water Regime →	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
			Slope →					Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								

Information on plant species distributions relative to disturbance categories was not available at this time

KEY

Ecosystems that do not occur

References

Ecosystem Diversity Matrix concept described in:
1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes similar to:
1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Corp of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

Existing conditions: Information on the current condition of riparian/wetland ecosystems relative disturbance categories of the coarse filter/EDM, is not available at this time. The results of an analysis of soils data (SSURGO) and National Wetland Inventory (NWI) data are presented in table 3.19 for the Mixedgrass Subregion. NWI data were also used to provide information on the level of human-modification in riparian/wetland ecosystems.

Table 3.19. Existing amounts (acres) for ecological sites representing riparian/wetland ecosystems of the Mixedgrass Subregion. Developed from an assessment of soils (SSURGO) and NWI data. First number indicates unmodified acres/second number indicates human-modified acres. na = information not available.

	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS		SLOPE SYSTEMS
	Littoral	*Temporary*	*Semi-perm.*	*Permanent*	*Perennial*	*Intermittent*	
Rocky Shore	0 / 0	0 / 0	0 / 0		0 / 0	0 / 0	na
Unconsol. Shore	147 / 7	0 / 29	0 / 0		0 / 1	36586 / 0	na
Emergent	na	668,535 / 82,598	96,133 / 19,924		58,788 / 29,727	na	na
Scrub-Shrub	na	343 / 62	0 / 0		29 / 35	na	na
Forested	na	3,573 / 562	0 / 0		2,718 / 225	na	na
UNDEFINED	na	166,910	233,503		245,643	858,216	na
Total	**154**	**922,583**	**349,560**		**337,166**	**894,802**	

AQUATIC ECOSYSTEMS

Coarse filter: The ecosystem diversity matrix for aquatic ecosystems of the Mixedgrass Subregion is presented in figure 3.20. The primary disturbance mechanisms that historically operated in aquatic ecosystems included flood events and beaver.

Historical amounts: Estimating the historical amounts of aquatic ecosystems relative to the disturbance categories of the coarse filter/EDM, requires an understanding of aquatic community response within each ecological site to historical disturbance regimes. At this time, insufficient information is available on the species composition and structure of aquatic ecosystems in response to historical disturbance regimes, thereby limiting our ability to reconstruct or model historical range of variability. In addition, providing estimates of the historical amounts for ecological sites is problematic using existing information as many sites have been modified since European settlement. However, a more generalized estimate of ecological sites for riverine systems was mapped using Aquatic GAP GIS data to quantify the number of stream miles for each of the four riverine subclasses, as stream size and gradient are less easily modified. Table 3.20 identifies the number of stream miles for each riverine system ecological site that is assumed to approximate the historical amounts. See Appendix B-4 for a map of aquatic ecosystems in the Mixedgrass Subregion.

Table 3.20. Approximate number of historical stream miles delineated and mapped for ecological sites representing riverine aquatic ecosystems of the Mixedgrass Subregion.

RIVERINE SYSTEMS			
Perennial (miles)			
Large River	*Small Rivers*	*Creeks*	*Headwater Stream*
109	**550**	**388**	**382**

Existing conditions: Information on the current condition of aquatic ecosystems relative to disturbance categories of the coarse filter/EDM, is not available at this time. The results of an analysis of soils data (SSURGO) and National Wetland Inventory (NWI) data are presented in table 3.21 for the Mixedgrass Subregion. NWI data were also used to provide information on the level of human-modification in riparian/wetland ecosystems.

Figure 3.20. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for aquatic ecosystems of the Mixedgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

AQUATIC ECOSYSTEMS

			Geomorphic Setting	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS			
			Water Regime	*Limnetic*	*Littoral*	*Semi-permanent*	*Permanent*	*Perennial*			
			Sizeclass					*Large River*	*Small Rivers*	*Creeks*	*Headwater Stream*
Disturbance Influenced Pathways			**Habitat Descriptor**								
Time Since Major Disturbance (i.e., flood)	**EARLY SUCCESSIONAL**	**Beaver Influenced System**	Streambed								
			Unconsolidated Bottom								
			Aquatic Bed								
		Beaver Absent	Streambed								
			Unconsolidated Bottom								
			Aquatic Bed								
	LATE SUCCESSIONAL	**Beaver Influenced System**	Streambed								
			Unconsolidated Bottom								
			Aquatic Bed								
		Beaver Absent	Streambed								
			Unconsolidated Bottom								
			Aquatic Bed								

Information on macroinvertebrate distributions relative to disturbance categories was not available at this time

References

Ecosystem Diversity Matrix concept described in: 1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes similar to : 1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Corp of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

Table 3.21. Existing amounts (acres) for ecological sites representing aquatic ecosystems of the Mixedgrass Subregion. Developed from an assessment of soils (SSURGO) and NWI data. First number indicates unmodified acres/second number indicates human-modified acres. na = information not available.

	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS
	Limnetic	*Littoral*	*Semi-permanent*	*Permanent*	*Perennial*
Stream Bottom	0 / 0	0 / 0	0 / 0	0 / 0	11,456 / 11
Unconsolidated Bottom	0 / 7,579	349 / 659	15 / 18,809	0 / 0	6,809 / 227
Aquatic Bed	0 / 0	28,658 / 7,875	0 / 0	4,519 / 29,204	947 / 3,082
TOTAL ACRES	**7,579**	**37,541**	**18,824**	**33,723**	**22,532**
Undefined	**15,553**				

TALLGRASS SUBREGION

Landscape Description: The Tallgrass Subregion represents the eastern quarter of the state where evidence of past glacial activity is common on the landscape (figure 3.21). The topography is mostly level to rolling glacial till plain. The soils are deep and characterized by loamy to silty textures. The Coteau des Prairies is a moderately dissected, high plateau covering much of the Tallgrass Subregion and rising as much as 1000 feet above the adjacent Minnesota River valley and 700 feet above the James River valleys. The Coteau des Prairie is characterized by an accumulation of glacial sediments that have an average thickness of 450 feet. This highland area influenced the movement of the glacier in the adjacent river valleys. The glacial till deposits also contributed to the creation of wetlands. These till deposits were mixed with blocks of ice that eventually melted, creating depressional wetlands commonly referred to as potholes. These potholes can occur in varying densities of a few to many per square mile and are estimated to cover approximately 10% of the total landscape in eastern South Dakota. Natural lakes occur in the central section of the Subregion and are relatively shallow and perched on the landscape. Rivers and streams are common in the Subregion with many ultimately draining to the Mississippi River. Streams in the very northeast corner of the Ecoregion, along the North Dakota border, drain into the Hudson Bay, instead. Additionally, some of the streams in this region are "closed basins", especially on the Coteau region, and drain into the lakes areas.

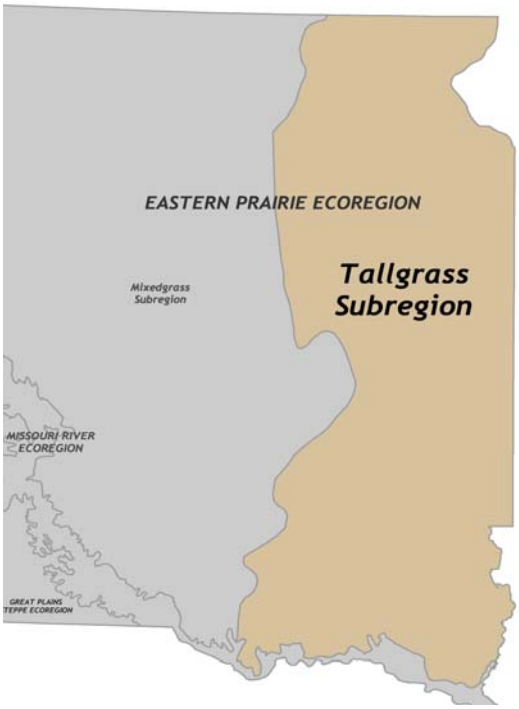


Figure 3.21. South Dakota Comprehensive Wildlife Conservation Plan - the Tallgrass Subregion.

The Tallgrass Subregion includes 2 major MLRA's, 102A – Rolling Till Prairie and 102B – Loess Uplands and Till Plains; as well as portions of 2 minor MLRA's, 56 - Red River Valley, and 102C – Loess Hills. Elevation ranges from 966 feet in the lowlands to 2000 feet in the uplands. The Tallgrass Subregion receives the greatest level of precipitation in South Dakota with an average annual range of 20 to 26 inches, and with half of this occurring during the growing season. The mean annual temperature is about 40 to 48° F and the growing season is approximately 120 to 160 days. The Tallgrass Subregion receives more precipitation and exhibits a more developed soil horizon, when compared to the Mixedgrass Subregion.

Historical Vegetation: The vegetation of the pre-settlement Tallgrass Subregion was dominated by grass/shrub ecosystems. Grass species were dominant and shrubs were a relatively minor component of

the upland vegetation, occurring primarily in protected microsites. Bison are not believed to have been as prevalent in the Tallgrass Subregion as they were in the rest of South Dakota therefore tall-statured bunchgrasses were more common on the landscape. True upland forest ecosystems were very rare in the upland areas and primarily occurred in small pockets where fire and grazers were unable to access or influence the site. For this reason, upland forest ecosystems are not represented as a primary pre-settlement ecosystem type in the Tallgrass Subregion for ecosystem diversity purposes. Riparian/wetland ecosystems were well distributed throughout the Tallgrasss Subregion with high densities of small glacially derived wetlands, making this a vital portion of the famous "Prairie Pothole" Region. Diverse emergent, shrub and forested conditions, particularly along large floodplains, were characteristic of this Subregion's riparian/wetland ecosystems. Aquatic ecosystems were primarily associated with rivers and streams, as well as naturally occurring lakes and ponds.

Approximate acreages:
Grass/shrub ecosystems – 6.3 million
Riparian/wetland ecosystems – 2 million (based on current/modified conditions)
Aquatic ecosystems – 170,000 (based on current/modified conditions)
Rock outcrops - 500

Wildlife: Common wildlife species at the time of Lewis and Clark included American bison, badger, elk white-tailed deer, wolf, coyote, beaver, bald eagles, meadowlarks, northern pike, channel catfish, ground squirrels, and canvasback. The wetlands of the Tallgrass Subregion supported a diversity of waterfowl, shorebirds, terns, songbirds and many other breeding and migratory bird species. Several of the species present at that time have been extirpated from this subregion including American bison, elk, wolf, river otter, slenderhead darter, golden redhorse, and black buffalofish.

Land use and management: Settlement of the Tallgrass Subregion began in the early to mid-1800's. Since that time, most of the Tallgrass Subregion has been developed for agriculture with estimates of 70% or higher conversion of grass/shrub ecosystems into cropland. Most of the land-base is in private ownership and land management objectives typically support agricultural objectives. Recreation is an important land use around the many natural ponds and lakes in the northern part of the Subregion. Irrigation is increasingly practiced in areas where water is available for diversion. Land development and urbanization are continuing to occur around some of the larger cities.

GRASS/SHRUB ECOSYSTEMS

Coarse filter: NRCS ecological sites have not yet been developed for the Tallgrass Subregion, therefore, range sites were extrapolated and interpreted relative to ecological sites developed for nearby MLRA's within South Dakota. The primary disturbance mechanisms that historically operated in the grass/shrub ecosystems of the Tallgrass Subregion included fire and grazing. Prairie dog colonies were not common in the historical Tallgrass Subregion. The resulting grass/shrub ecosystem diversity matrix for the Tallgrass Subregion is presented in Figure 3.22.

Historical amounts: NRCS soils data were used to map ecological sites based on the coarse filter/EDM. Table 3.22 identifies the approximate number of acres of the Tallgrass Subregion in each of the seven ecological sites. See Appendix B-5 for a map of grass/shrub ecosystems in the Tallgrass Subregion.

Table 3.22. Approximate number of historical acres delineated and mapped for ecological sites representing grass/shrub ecosystems of the Tallgrass Subregion,

Clayey	Claypan	Thin Claypan	Loamy	Sandy	Thin Upland	Shallow
325,715	22,496	270[a]	5,018,394	117,832	630,414	255,188

[a] Frequently occurs as an inclusion in other delineated sites, under-representing the actual number of acres in this ecological site.

Figure 3.22. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for grass/shrub ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

GRASS/SHRUB ECOSYSTEMS

	Clayey Potential Dominant Species	Acres	Claypan Potential Dominant Species	Acres	Thin Claypan Potential Dominant Species	Acres	Loamy Potential Dominant Species	Acres	Sandy Potential Dominant Species	Acres	Thin Upland Potential Dominant Species	Acres	Shallow Potential Dominant Species	Acres
Early Seral														
Vegetative composition/structure primarily influenced by short-interval fire regimes (<8 yrs.)														
Light Grazing	*Green needlegrass* *Western wheatgrass* *Big bluestem* *Little bluestem*		*Green needlegrass* *Western wheatgrass* *Big bluestem* *Switchgrass*		*Western wheatgrass*		*Big & Little Bluestem* *Porcupinegrass* *Needle-and-thread* *Prairie dropseed*		*Sand bluestem* *Little bluestem* *Big bluestem* *Prairie sandreed*		*Little bluestem* *Big bluestem* *Porcupinegrass* *Green needlegrass*		*Needle-and-thread* *Plains muhly* *Little bluestem* *Prairie dropseed*	
Moderate Grazing	*Western wheatgrass* *Little & Big bluestem* *Sideoats grama* *Blue grama*		*Western wheatgrass* *Big bluestem* *Switchgrass* *Blue grama*		*Western wheatgrass* *Blue grama* *Inland saltgrass*		*Big & Little bluestem* *Needle-and-thread* *Prairie dropseed* *Sideoats grams*		*Porcupineg rass* *Needleandthread* *Prairie sandreed* *Sideoats grama*		*Needle-and-thread* *Little bluestem* *Prairie dropseed* *Blue grama*		*Needle-and-thread* *Plains muhly* *Sideoats grama* *Blue grama*	
Heavy Grazing	*Blue grama* *Sedges*		*Blue grama* *Sedges*		*Blue grama* *Buffalograss* *Inland saltgrass*		*Blue grama* *Sedges*		*Blue grama* *Sedges*		*Blue grama* *Hairy grama* *Sedges*		*Blue grama* *Threadleaf sedge* *Hairy grama*	
Vegetative composition/structure primarily influenced by long-interval fire regimes (≥8 yrs.)														
Light Grazing	*Green needlegrass* *Western wheatgrass* *Little & Big bluestem* *Eastern red cedar*		*Green needlegrass* *Western wheatgrass* *Eastern red cedar* *Eastern red cedar*		*Western wheatgrass* *Wildrose*		*Big & Little Bluestem* *Green needlegrass* *Needle-and-thread* *Eastern red cedar*		*Sand bluestem* *Little bluestem* *Big bluestem* *Prairie sandreed*		*Little bluestem* *Big bluestem* *Porcupinegrass* *Green needlegrass*		*Needle-and-thread* *Plains muhly* *Little bluestem* *Fringed sagewort*	
Moderate Grazing	*Western wheatgrass* *Little & Big bluestem* *Sideoats grama* *Eastern red cedar*		*Western wheatgrass* *Blue grama* *Eastern red cedar* *Eastern red cedar*		*Western wheatgrass* *Bluegrama* *Inland saltgrass* *Wildrose*		*Big & Little bluestem* *Procupinegrass* *Prairie dropseed* *Eastern red cedar*		*Porcupineg rass* *Needleandthread* *Prairie sandreed* *Sideoats grama*		*Needle-and-thread* *Little bluestem* *Prairie dropseed* *Blue grama*		*Needle-and-thread* *Plains muhly* *Sideoats grama* *Fringed sagewort*	
Heavy Grazing	*Blue grama* *Sedges* *Eastern red cedar*		*Blue grama* *Western wheatgrass* *Sedges* *Eastern red cedar*		*Blue grama* *Buffalograss* *Inland saltgrass* *Wildrose*		*Blue grama* *Sedges* *Eastern red cedar*		*Blue grama* *Sedges*		*Blue grama* *Hairy grama* *Sedges*		*Blue grama* *Threadleaf sedge* *Hairy grama* *Eastern red cedar*	
TOTAL ACRES IN EACH ECOLOGICAL SITE	**325,715**		**22,496**		**270**		**5,018,394**		**117,832**		**630,414**		**255,188**	
NRCS RANGE SITES	102A Clayey 102B Shallow Clay		102A Claypan		102A Thin Claypan		102A Silty		102A Sands 102A Sandy		102A Thin Upland		102A Very Shallow 102A Shallow to Gravel	

References

Ecosystem Diversity Matrix concept described in:

1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes derived from:

1) Natural Resources Conservation Service, Ecological Site Descriptions

Existing conditions: Information on the current condition of grass/shrub ecosystems relative to disturbance categories of the coarse filter/EDM, is not available at this time. More generalized results of the South Dakota GAP assessment indicate that 26% of the Tallgrass Subregion is currently covered by grass/shrub ecosystems. Of these, 19% were classified as idle grasslands and 81% as pastureland.

RIPARIAN/WETLAND ECOSYSTEMS

Coarse filter: The Tallgrass Subregion's ecosystem diversity matrix for riparian/wetland ecosystems is presented in figure 3.23. The primary disturbance mechanisms that historically operated in riparian/wetland ecosystems include flooding, fire, beaver, and grazing.

Historical amounts: Estimating the historical amounts of aquatic ecosystems relative to the disturbance categories of the coarse filter/EDM, requires an understanding of riparian/wetland community response within each ecological site to historical disturbance regimes. At this time, insufficient information is available on the species composition and structure of aquatic ecosystems in response to historical disturbance regimes, thereby limiting our ability to reconstruct or model historical range of variability. In addition, providing estimates of the historical amounts for ecological sites is problematic using existing information as many sites have been modified since European settlement. However, a more generalized estimate of ecological sites for riverine systems were mapped using Aquatic GAP GIS data to quantify the number of stream miles for each of the three riverine subclasses, as stream size and gradient are less easily modified. Table 3.23 identifies the number of stream miles for each riverine ecological site that is assumed to approximate the historical amounts. See Appendix B-5 for a map of riparian/wetland ecosystems in the Tallgrass Subregion.

Table 3.23. Approximate historical amounts (stream miles) for ecological sites representing riverine riparian/wetland ecosystems of the Tallgrass Subregion.

RIVERINE SYSTEMS		
Perennial	*Intermittent*	
Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Grad. > 2% slope
1421 miles	**9582 miles**	**198 miles**

Existing conditions: Information on the current condition of riparian/wetland ecosystems relative to ecological sites and disturbance categories of the coarse/filter EDM is not available at this time. The results of an analysis of soils data (SSURGO) and National Wetland Inventory (NWI) data are presented in table 3.24 for the Tallgrass Subregion.

Table 3.24. Existing amounts (acres) for ecological sites representing riparian/wetland ecosystems of the Tallgrass Subregion. Developed from an assessment of soils (SSURGO) and NWI data. First number indicates unmodified acres/second number indicates human-modified acres. na = information not available.

	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS		SLOPE SYSTEMS
	Littoral	*Temporary*	*Semi-perm.*	*Permanent*	*Perennial*	*Intermittent*	
Rocky Shore	0 / 0	0 / 0	0 / 0		0 / 0	0 / 0	na
Unconsol. Shore	1 / 31	5 / 55	0 / 0		0 / 0	142 / 9	na
Emergent	na	479 / 130	1 / 14 / 4		373 / 110	na	na
Scrub-Shrub	na	29 / 1	0 / 0		69 / 74	na	na
Forested	na	2 / 2	0 / 0		31 / 41	na	na
UNDEFINED	na	62	4,110		40,454	17,921	na
Total	**32**	**765**	**4,129**		**41,152**	**17,442**	

Figure 3.23. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for riparian/wetland ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

RIPARIAN-WETLAND ECOSYSTEMS

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways			Habitat Descriptor	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
				Geomorphic →								
				Water Regime →	Littoral	Temporary	Semi-permanent	Permanent	Perennial	Intermittent		
				Slope →					Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient ≥ 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								
		Heavy Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								
	Beaver Unmodified System	Low to Moderate Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								
		Heavy Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								
		Heavy Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								
	Beaver Unmodified System	Low to Moderate Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								
		Heavy Bison Grazing		Rocky Shore								
				Unconsolidated Shore								
				Emergent								
				Scrub-Shrub								
				Forested								

Information on plant species distributions relative to disturbance categories is not available at this time

KEY

Ecosystems that do not occur

References

Ecosystem Diversity Matrix concept described in:

1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes similar to: 1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Corp of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

AQUATIC ECOSYSTEMS

Coarse filter: The ecosystem diversity matrix for aquatic ecosystems of the Tallgrass Subregion is presented in figure 3.24. The primary disturbance mechanisms that historically operated in aquatic ecosystems include flood events and beaver.

Historical amounts: Estimating the historical amounts of aquatic ecosystems relative to the disturbance categories of the coarse filter/EDM, requires an understanding of aquatic community response within each ecological site to historical disturbance regimes. At this time, insufficient information is available on the species composition and structure of aquatic ecosystems in response to historical disturbance regimes, thereby limiting our ability to reconstruct or model historical range of variability. In addition, providing estimates of the historical amounts for ecological sites is problematic using existing information as many sites have been modified since European settlement. However, a more generalized estimate of ecological sites for riverine systems was mapped using Aquatic GAP GIS data to quantify the number of stream miles for each of the four riverine subclasses, as stream size and gradient are less easily modified. Table 3.25 identifies the number of stream miles for each riverine system ecological site that is assumed to approximate the historical amounts. See Appendix B-5 for a map of aquatic ecosystems in the Tallgrass Subregion.

Table 3.25. Approximate number of historical stream miles delineated and mapped for ecological sites representing riverine aquatic ecosystems of the Tallgrass Subregion.

RIVERINE SYSTEMS			
Perennial (miles)			
Large River	*Small Rivers*	*Creeks*	*Headwater Stream*
21	**484**	**527**	**388**

Existing conditions: Information on the current condition of aquatic ecosystems relative to ecological sites and disturbance categories of the coarse/filter EDM is not available at this time. The results of an analysis of soils data (SSURGO) and National Wetland Inventory (NWI) data are presented in table 3.26 for the Tallgrass Subregion.

Table 3.26. Existing amounts (acres) for ecological sites representing aquatic ecosystems of the Tallgrass Subregion. Developed from an assessment of soils (SSURGO) and NWI data. First number indicates unmodified acres/second number indicates human-modified acres. na = information not available.

	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS
	Limnetic	*Littoral*	*Semi-permanent*	*Permanent*	*Perennial*
Stream Bottom	0 / 0	0 / 0	0 / 0	0 / 0	3,551 / 38
Unconsolidated Bottom	16645 / 11121	376 / 375	5 / 32,095	0 / 260	4,966 / 214
Aquatic Bed	0 / 0	46,300 / 2,022	5,659 / 7,715	93 / 851	1,455 / 1,935
TOTAL ACRES	**27,766**	**49,073**	**45,474**	**1,204**	**12,159**
Undefined	**210,293**				

Figure 3.24. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for aquatic ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

AQUATIC ECOSYSTEMS

Time Since Major Disturbance (i.e., flood)	Disturbance Influenced Pathways	Geomorphic Setting / Water Regime / Sizeclass / Habitat Descriptor	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS			
			Limnetic	Littoral	Semi-permanent	Permanent	Perennial			
							Large River	Small Rivers	Creeks	Headwater Stream
EARLY SUCCESSIONAL	Beaver Influenced System	Streambed								
		Unconsolidated Bottom								
		Aquatic Bed								
	Beaver Absent	Streambed								
		Unconsolidated Bottom								
		Aquatic Bed								
LATE SUCCESSIONAL	Beaver Influenced System	Streambed								
		Unconsolidated Bottom								
		Aquatic Bed								
	Beaver Absent	Streambed								
		Unconsolidated Bottom								
		Aquatic Bed								

Information on macroinvertebrate distributions relative to disturbance categories is not available at this time

KEY

Ecosystems that do not occur

References

Ecosystem Diversity Matrix concept described in:
1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes similar to
1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Corp of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

4.0 SPECIES OF GREATEST CONSERVATION NEED

The South Dakota Comprehensive Wildlife Plan developed the following list of species of greatest conservation need as determined at the state level. The list includes many of the species presently monitored by the South Dakota Natural Heritage Program. There were three primary criteria (selection code) for inclusion in the list: 1) State and or federal listed species for which the State has a mandate for recovery, 2) species for which South Dakota represents a significant portion of the species' overall range, and 3) species that are indicative of or depend upon a declining or unique habitat in South Dakota. The list was developed by ecologists within the South Dakota Natural Heritage Program and includes input from many wildlife experts in the state (Table 4.1). The black bear is a state threatened species, but it is not included as a species of concern because no known populations exist in South Dakota. Any black bear known to occur in the state is protected by South Dakota's state endangered species law.

Table 4.1. List of species of greatest conservation need developed for the South Dakota Comprehensive Wildlife Plan.

Scientific Name	Common Name	Selection Code
BIRDS		
Pelecanus erythrorhynchos	American White Pelican	2
Cygnus buccinator	Trumpeter Swan	2
Pandion haliaetus	Osprey	1
Haliaeetus leucocephalus	Bald Eagle	1
Accipiter gentilis	Northern Goshawk	3
Buteo regalis	Ferruginous Hawk	3
Falco peregrinus	Peregrine Falcon	1
Centrocercus urophasianus	Greater Sage-Grouse	3
Tympanuchus cupido	Greater Prairie-Chicken	2
Grus americana	Whooping Crane	1
Charadrius melodus	Piping Plover	1
Catoptrophorus semipalmatus	Willet	2
Numenius americanus	Long-billed Curlew	2
Limosa fedoa	Marbled Godwit	2
Phalaropus tricolor	Wilson's Phalarope	2
Sterna antillarum athalassos	Interior Least Tern	1
Chlidonias niger	Black Tern	2
Athene cunicularia	Burrowing Owl	3
Melanerpes lewis	Lewis's Woodpecker	3
Picoides dorsalis	American Three-toed Woodpecker	3
Picoides arcticus	Black-backed Woodpecker	3
Cinclus mexicanus	American Dipper	1
Anthus spragueii	Sprague's Pipit	2
Calamospiza melanocorys	Lark Bunting	2
Ammodramus bairdii	Baird's Sparrow	2
Ammodramus leconteii	Le Conte's Sparrow	3
Junco hyemalis aikeni	White-winged Junco	2
Calcarius ornatus	Chestnut-collared Longspur	2
MAMMALS		
Myotis thysanodes pahasapensis	fringe-tailed myotis	2
Myotis septentrionalis	northern myotis	3
Corynorhinus townsendii	Townsend's big-eared bat	3
Spermophilus franklinii	Franklin's ground squirrel	2
Spermophilus richardsonii	Richardson's ground squirrel	2
Glaucomys sabrinus	northern flying squirrel	2
Zapus hudsonius campestris	Bear Lodge meadow jumping mouse	2
Vulpes velox	kit or swift fox	1
Mustela nigripes	black-footed ferret	1
Lontra canadensis	northern river otter	1
FRESHWATER MUSSELS		
Alasmidonta marginata	elktoe	3
Arcidens confragosus	rock pocketbook	3
Lasmigona compressa	creek heelsplitter	3
Lampsilis higginsii	Higgins eye	1
Leptodea leptodon	scaleshell	1

Obovaria olivaria	hickorynut	3
Quadrula quadrula	mapleleaf	3
GASTROPODS		
Vertigo arthuri	Dakota vertigo	3
Vertigo paradoxa	mystery vertigo	3
Catinella gelida	frigid ambersnail	3
Oreohelix strigosa cooperi	Cooper's rocky mountainsnail	2
INSECTS		
Cicindela lepida	ghost tiger beetle	3
Amblycheila cylindriformis	Great Plains tiger beetle	3
Nicrophorus americanus	American burying beetle	1
Oarisma powesheik	Powesheik skipperling	2
Hesperia ottoe	Ottoe skipper	2
Hesperia dacotae	Dakota skipper	2
Atrytone arogos iowa	Iowa skipper	3
Speyeria idalia	regal fritillary	3
Speyeria atlantis pahasapa	Black Hills fritillary	2
FISHES		
Fundulus diaphanus	banded killifish	1
Notropis heterolepis	blacknose shiner	1
Umbra limi	central mudminnow	1
Phoxinus neogaeus	finescale dace	1
Catostomus catostomus	longnose sucker	1
Phoxinus eos	northern redbelly dace	1
Scaphirhynchus albus	pallid sturgeon	1
Polyodon spathula	paddlefish	2
Margariscus margarita	pearl dace	1
Macrhybopsis meeki	sicklefin chub	1
Macrhybopsis gelida	sturgeon chub	1
Notropis topeka	Topeka shiner	1
Percopsis omiscomaycus	trout-perch	1
Couesius plumbeus	lake chub	3
Catostomus platyrhynchus	mountain sucker	3
Phoxinus erythrogaster	southern redbelly dace	3
Nocomis biguttatus	hornyhead chub	3
Notropis rubellus	rosyface shiner	3
Percina caprodes	logperch	3
Percina maculata	blackside darter	3
REPTILES AND AMPHIBIANS		
Emys blandingii	Blanding's Turtle	1
Graptemys pseudogeographica	False Map Turtle	1
Tropidoclonion lineatum	Lined Snake	1
Heterodon platirhinos	Eastern Hognose Snake	1
Storeria occipitomaculata pahasapae	Black Hills Redbelly Snake	2
Hyla chrysoscelis	Cope's Gray Treefrog	3
Apalone mutica	Smooth Softshell	3
Terrapene ornata	Western Box Turtle	3
Holbrookia maculata	Lesser Earless Lizard	3
Acris crepitans	Northern Cricket Frog	3
Eumeces multivirgatus	Many-lined Skink	3
Phrynosoma hernandesi	Short-horned Lizard	3

The following tables present a summary of the present knowledge and status for each species of greatest conservation need. Each table 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 Appendix D.

Distribution

Historical – The expected 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.

Citation – Citation(s) used in determining the distribution of a species.

Key Habitat – Linkage to Ecosystem Diversity

Key Habitat – Physical description of the known primary habitat features that a species requires to persist in the landscape

Ecosystem Diversity – Specifies the appropriate ecosystem diversity matrix(s) to view a species expected occurrence within historical ecosystems, as predicted from our current understanding of key habitat features. The ecosystem diversity matrix represents the coarse filter for identifying historical ecosystem diversity at the landscape scale. Ecosystem diversity is also mapped using a Geographic Information System (GIS). Expected historical/current species distributions relative to ecosystem diversity can be also be mapped using the ecosystem diversity matrix linked to the GIS data. It is important to note that a species link to ecosystem diversity is based on the historical distribution of a species as influenced by historical disturbance processes. For example, Trumpeter Swans presently have a small breeding population in the Great Plains Steppe ecoregion, however, under historical conditions and historical disturbance regimes (e.g., beaver ponds) the Trumpeter Swan was likely more broadly distributed across other South Dakota ecoregions.

Causes of Concern – known or expected causes of concern based on our best knowledge of the species; these concerns are recognized range-wide and may or may not affect the species in South Dakota

Existing Recovery Plan/Conservation Strategy – a pre-existing recovery plan or conservation strategy developed for the species

Birds

COMMON NAME: AMERICAN WHITE PELICAN (AWPE)

Scientific Name: *Pelecanus erythrorhynchos*

DESCRIPTION

Large, white migratory and breeding pelican within South Dakota

PROTECTION STATUS

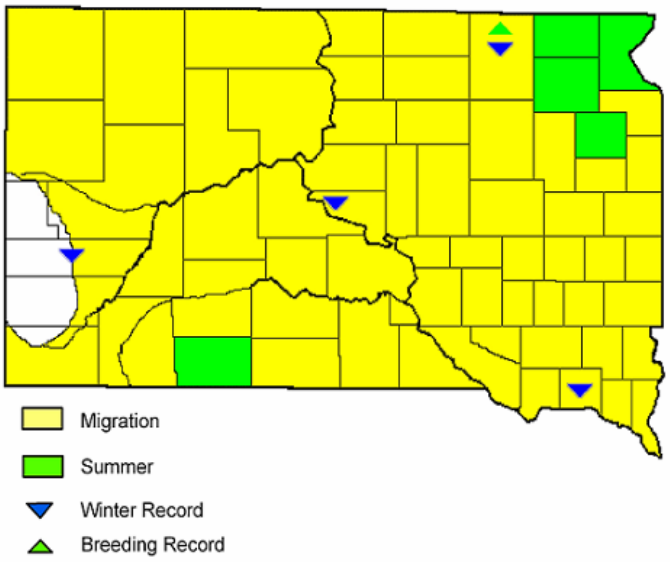
Federal: None
State: None
Global Rank: G3
State Rank: S3B, SZN

DISTRIBUTION

Historical: Missouri River Ecoregion, Eastern Prairie Ecoregion

Current: All Ecoregions except for the Black Hills Ecoregion, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota, USA.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – 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.

Ecosystem Diversity – Missouri River Ecoregion; Tallgrass Subregion; Mixed-grass Subregion
Primary EDM – riparian/wetland ecosystems, see Figures 4.1.2.1, 4.2.2.1 and 4.3.2.1
Qualifier – also requires healthy small fish populations/aquatic ecosystems for foraging and brood rearing

CAUSES OF CONCERN

- Habitat loss/degradation
  - Dams/impoundments on rivers and lakes have reduced the amount of shallow water and corresponding island habitat
- Managed flows:
  - Decreasing water levels can eliminate water barrier to predation
  - Increasing water levels can flood nest sites
- Nest site disturbance from recreational use of lakes/reservoirs
- Pesticides

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

None

COMMON NAME: TRUMPETER SWAN (TRSW)

Scientific Name: *Cygnus buccinator*

DESCRIPTION

Large, white migratory and breeding swan

PROTECTION STATUS

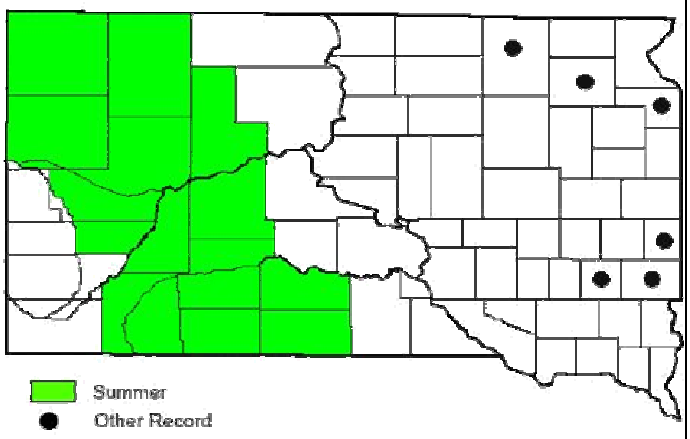
Federal: None
State: None
Global Rank: G4
State Rank: S3

DISTRIBUTION

Historical: All Ecoregions

Current: Great Plains Steppe Ecoregion, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota, USA.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – shallow water ponds, rivers, and lakes with aquatic and emergent vegetation; nests constructed on an island, beaver lodge, or a mat of floating vegetation and consist of cattails, bulrushes, and horsetails.

Ecosystem Diversity – all Ecoregions
Primary EDM – riparian/wetland ecosystems, see Figures 4.1.2.1, 4.2.2.1, 4.3.2.1, 4.4.2.1 and 4.5.2.1

CAUSES OF CONCERN

- Habitat loss/degradation
  - Dams/impoundments on rivers and lakes have reduced the amount of shallow water habitat and heterogeneity of habitat
  - Reduction in beaver numbers have reduced beaver ponds on landscape
  - Loss of winter habitat and overcrowding on remaining winter range has made species more susceptible to disease outbreaks, severe winter weather, or pollution events.
- Managed flows:
  - Decreasing water levels during drought can impact quality of habitat
  - Increasing water levels can flood nest sites
- Nest site disturbance from recreational use and residential development of lakes/reservoirs/ponds/rivers
- Pesticides/pollution
- Illegal shooting
- Sensitive to lead poisoning

RECOVERY PLAN/CONSERVATION STRATEGY

Subcommittee on the Interior Population of Trumpeter Swans. 1997. Mississippi and Central flyway management plan for the Interior population of Trumpeter Swan. Mississippi and Central Flyway Councils. [c/o USFWS, Migratory Bird Coordinator] Twin Cities, MN. Unpublished report.

COMMON NAME: OSPREY (OSPR)

Scientific Name: *Pandion haliaetus*

DESCRIPTION

A nearly eagle-sized bird of prey with dark back and white undersides; head white with dark line through eye

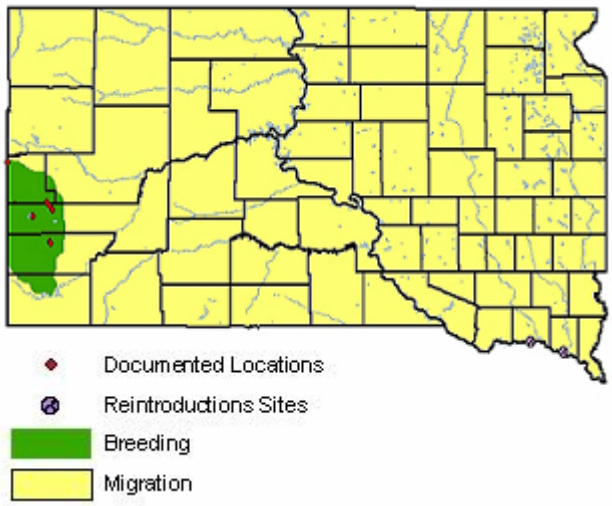
PROTECTION STATUS

Federal: None
State: Threatened
Global Rank: G5
State Rank: S1B, SZN

DISTRIBUTION

Historical: Missouri River Ecoregion

Current: Black Hills Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat - Always found near water – rivers, lakes, ponds; large open-top trees used for nesting and roosting

Ecosystem Diversity – Missouri River Ecoregion
Primary EDM – riparian/wetland ecosystems, see Figure 4.3.2.1
Qualifier – also dependent on nest site juxtaposition to healthy fish populations/aquatic ecosystems

CAUSES OF CONCERN

- Habitat loss/degradation
  - loss of nesting and roosting trees near water bodies; cottonwoods not regenerating due to modification of flood regimes
  - decreasing fish populations due to water quality impacts, and/or food chain disruption by exotic species
- Chronic disturbance by humans or pets, particularly near nest-sites or roosts, can result in abandonment
- Biocide contamination of food supply
- Illegal shooting

RECOVERY PLAN/CONSERVATION STRATEGY

None

COMMON NAME: BALD EAGLE (BAEA)

Scientific Name: *Haliaeetus leucocephalus*

DESCRIPTION

Very large bird of prey with dark back and undersides; head and tail white in adults

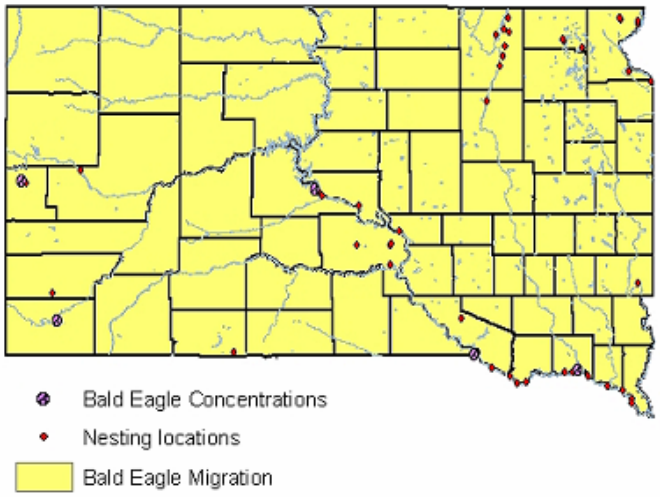
PROTECTION STATUS

Federal: Threatened
State: Threatened
Global Rank: G4
State Rank: S1B, S2N

DISTRIBUTION

Historical: All Ecoregions

Current: All Ecoregions, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat - nearly always 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

Ecosystem Diversity – all Ecoregions
Primary EDM – riparian/wetland ecosystems, see Figures 4.1.2.1, 4.2.2.1, 4.3.2.1, 4.4.2.1 and 4.5.2.1
Qualifiers – also requires nest site juxtaposition to healthy fish populations/aquatic ecosystems

CAUSES OF CONCERN

- Habitat loss/degradation
  - loss of nesting and roosting trees near water bodies; cottonwoods not regenerating due to modification of flood regimes
  - decreasing fish and waterfowl populations due to water quality impacts, and/or food chain disruption by exotic species
- Chronic disturbance by humans or pets, particularly near nest-sites and communal roosts, can result in abandonment
- Biocide contamination of food supply
- Illegal shooting

RECOVERY PLAN/CONSERVATION STRATEGY

Grier, J.W., et al. 1983. Northern states bald eagle recovery plan. U.S. Dept. Interior, Fish and Wildlife Serv., Twin Cities, MN. 76 pp. Recommends identifying essential habitats based on home range size, resource requirements, breeding site specifications and protection from disturbance.

South Dakota Game, Fish and Parks. 2005. Draft South Dakota Bald Eagle (*Haliaeetus leucocephalus*) Management Plan. Available online: http://www.sdgfp.info/Wildlife/WildlifePlans/DraftBEPlan.pdf

COMMON NAME: NORTHERN GOSHAWK (NOGO)

Scientific Name: *Accipiter gentilis*

DESCRIPTION

Migratory and breeding hawk

PROTECTION STATUS

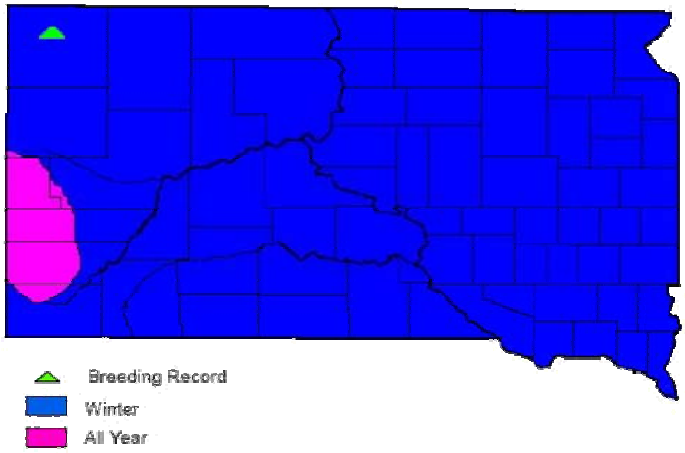
Federal: None
State: None
Global Rank: G5
State Rank: S3B, S2N

DISTRIBUTION

Historical: Breeding primarily in Black Hills Ecoregion but is a migrant throughout the state. Winter resident.

Current: All Ecoregions, breeds only in Black Hills Ecoregion

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – 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

Ecosystem Diversity – Black Hills Ecoregion
Primary EDM – forested ecosystems, see Figure 4.5.4.1

CAUSES OF CONCERN

- Habitat loss/degradation:
  - Timber harvest reduces size and density of trees for nesting
  - Loss of forest landscape heterogeneity due to suppression of fire
- Disturbance near nest sites

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

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.

Bartel, P.E. 1977. Management of the American goshawk in the Black Hills National Forest. M.S. Thesis. University of South Dakota, Springfield, South Dakota, USA.

COMMON NAME: FERRUGINOUS HAWK (FEHA)

Scientific Name: *Buteo regalis*

DESCRIPTION

Large bird of prey endemic to prairie habitat; migratory and breeding bird within South Dakota

PROTECTION STATUS

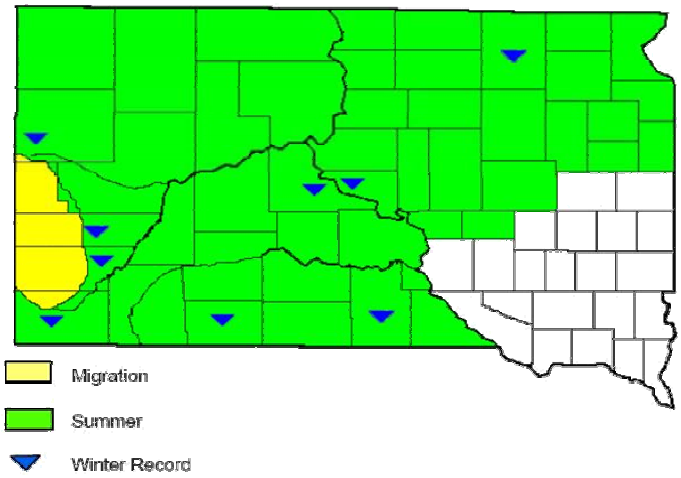
Federal: None
State: None
Global Rank: G4
State Rank: S4B, SZN

DISTRIBUTION

Historical: All Ecoregions except Missouri River Ecoregion

Current: Great Plains Steppe Ecoregion, northern half of Eastern Prairie Ecoregion, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – 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

Ecosystem diversity – Tallgrass and Mixed-grass Subregions; Great Plains Steppe; Black Hills Ecoregions
Primary EDM – grass/shrub ecosystems, see Figures 4.1.1.1, 4.2.1.1, 4.4.1.1 and 4.5.1.1

CAUSES OF CONCERN

- Habitat loss/degradation
  - Conversion of native grass ecosystems to agriculture or monotypic pasture conditions for grazing
  - Reduction in prey base due to less diverse ecosystems - resulting from changes to historical disturbance regimes
  - Loss of nest sites due to tree and shrub removal or heavy grazing that impacts trees and shrubs
- Human disturbance near nest sites
- Illegal shooting
- Poisoning of prey base

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

None

COMMON NAME: PEREGRINE FALCON (PEFA)

Scientific Name: *Falco peregrinus*

DESCRIPTION

Medium size bird of prey with pale brown back and creamy white and heavily spotted underside

PROTECTION STATUS

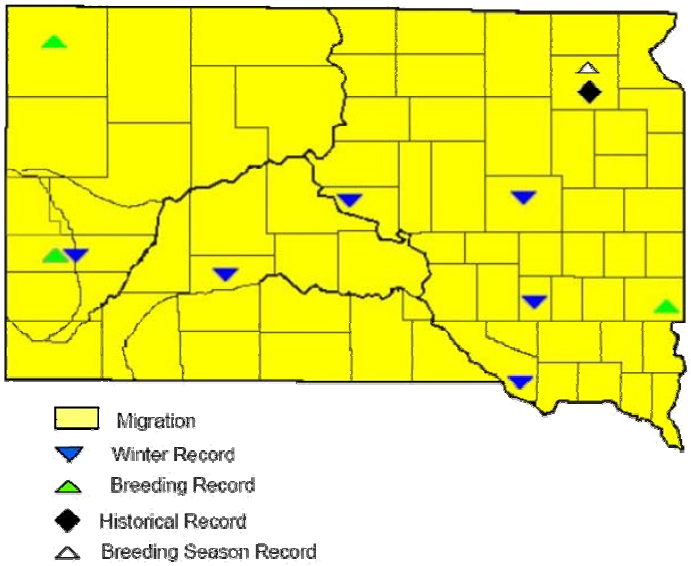
Federal: None
State: Endangered
Global Rank: G4
State Rank: SXB, SZN

DISTRIBUTION

Historical: All Ecoregions

Current: All Ecoregions, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – open grasslands with suitable nesting cliffs and rock outcroppings near a concentrated prey base such as waterfowl or colonial ground squirrels

Ecosystem diversity – all Ecoregions
Primary EDM – none, linkage is to a "special feature" of the landscape – Rock Outcroppings

CAUSES OF CONCERN

- Habitat loss/degradation
  - Conversion of nesting sites
  - Impacts to prey base
- Pesticides/pollution
- Small population size
- Human disturbance near nest sites

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

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.

COMMON NAME: GREATER SAGE-GROUSE (SAGR)

Scientific Name: *Centrocercus urophasianus*

DESCRIPTION

Largest of the North American grouse species; gray with a blackish belly

PROTECTION STATUS

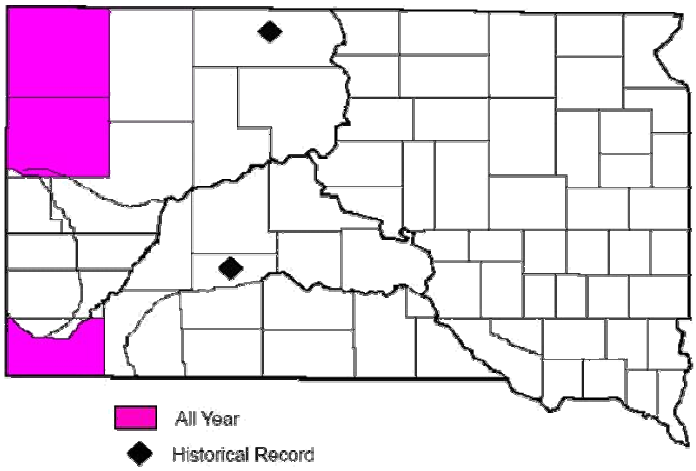
Federal: None
State: None
Global Rank: G4
State Rank: S2

DISTRIBUTION

Historical: Great Plains Steppe Ecoregion

Current: northern and southern Great Plains Steppe Ecoregion, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – mixture of sagebrush/grass ecosystems and different grass ecosystem structural classes, in close proximity.

Ecosystem diversity – Great Plains Steppe Ecoregion
Primary EDM – grass/shrub ecosystems, see Figure 4.4.1.1

CAUSES OF CONCERN

- Habitat loss/degradation
  - conversion of habitat for agricultural purposes, mining and energy development, reservoirs, and other purposes
  - degradation and fragmentation of sagebrush habitat due to sagebrush control, exotic plant species, and monotypic livestock grazing policies
- 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

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

Connelly, J.W., S.T. Knick, M.A. Schroeder, and S.J. Stiver. 2004. Conservation assessment of greater sage-grouse and sagebrush habitats. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, Wyoming.

Common Name: GREATER PRAIRIE-CHICKEN (GPCH)

Scientific Name: *Tympanuchus cupido*

DESCRIPTION

Medium sized grouse with a short dark rounded tail and feathered toes.

PROTECTION STATUS

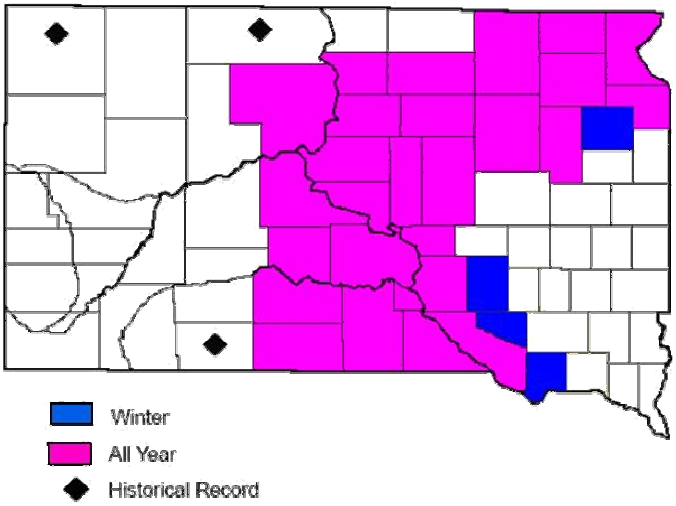
Federal: None
State: None
Global Rank: G4
State Rank: S4

DISTRIBUTION

Historical: Tallgrass and Mixedgrass Subregion

Current: Great Plains Steppe and Eastern Prairie Ecoregions, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

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

Ecosystem diversity – Tallgrass and Mixedgrass Subregions
Primary EDM – grass/shrub ecosystems, see Figure 4.1.1.1 and 4.2.1.1

CAUSES OF CONCERN

- Habitat loss/degradation
  - Conversion of native grasslands for agricultural or other purposes
  - Fragmentation of the remaining native grasslands
  - Woody plant encroachment
- Competition with ring-necked pheasants, an introduced species
- Insecticide use may decrease the availability of insects to young birds
- Introduced diseases such as West Nile Virus

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

None

COMMON NAME: WHOOPING CRANE (WHCR)

Scientific Name: *Grus americana*

DESCRIPTION

Very tall white bird with a long neck, long legs, and red facial skin

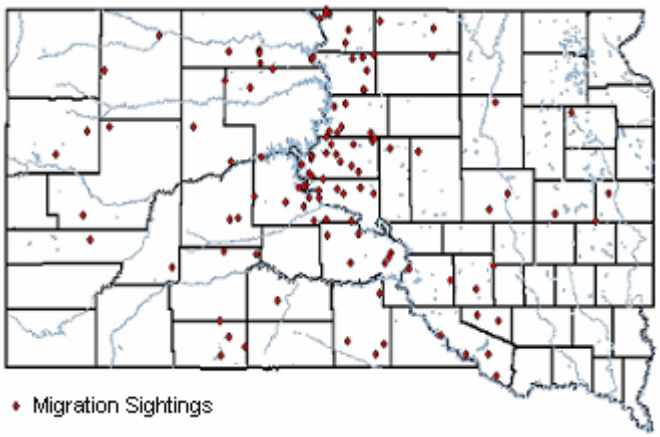
PROTECTION STATUS

Federal: Endangered
State: Endangered
Global Rank: G1
State Rank: SZN

DISTRIBUTION

Historical: All Ecoregions, except Black Hills; migratory only

Current: All Ecoregions, except Black Hills; migratory only, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

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

Ecosystem diversity – Tallgrass Subregion; Mixed-grass Subregion; Missouri River Ecoregion; Great Plains Steppe Ecoregion
Primary EDM – riparian/wetland ecosystems, see Figures 4.1.2.1, 4.2.2.1, 4.3.2.1 and 4.4.2.1
Qualifier – frequently use adjacent upland intact grass ecosystems as well

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Draining of wetlands for agricultural and other purposes
- Collision with power lines
- Illegal shooting

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

Canadian Wildlife Service and U.S. Fish and Wildlife Service. 2005. Draft International recovery plan for the whooping crane. Ottawa: Recovery of Nationally Endangered Wildlife (RENEW), and U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 196 pp.

COMMON NAME: PIPING PLOVER (PIPL)

Scientific Name: *Charadrius melodus*

DESCRIPTION

Small, stocky, sandy-colored plover with yellow-orange legs

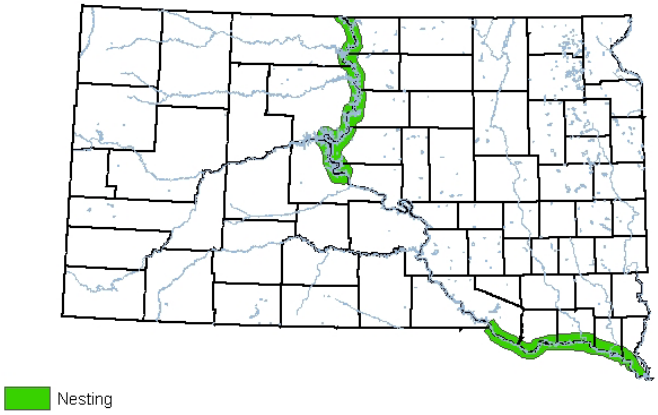
PROTECTION STATUS

Federal: Threatened
State: Threatened
Global Rank: G3
State Rank: S2B, SZN

DISTRIBUTION

Historical: Missouri River Ecoregion

Current: Missouri River Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – 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

Ecosystem diversity –Missouri River Ecoregion
Primary EDM – riparian/wetland ecosystems, see Figure 4.3.2.1

CAUSES OF CONCERN

- Habitat loss/degradation
  - conversion/degradation of suitable wetlands for agricultural or other purposes
  - changes to flood regimes on rivers and lakes through water impoundment and flow control projects reduce the amount of sparsely vegetated sandy shorelines and sandbars (i.e., allows encroachment of surrounding vegetation)
  - water management on rivers and reservoirs may cause flooding of nests
- Nest depredation
- Human disturbance of nest sites
- Possibly pesticides

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

U.S. Fish and Wildlife Service. 1988. Great Lakes and Northern Great Plains Piping Plover Recovery Plan. U.S. Fish and Wildlife Service, Twin Cities, MN.

South Dakota Game, Fish and Parks. 2005. Draft South Dakota Interior Least Tern (*Sterna antillarum athalassos*) and Piping Plover (*Charadrius melodus*) Management Plan. Available online: http://www.sdgfp.info/Wildlife/WildlifePlans/PPIndex.htm

COMMON NAME: WILLET (WILL)

Scientific Name: *Catoptrophorus semipalmatus*

DESCRIPTION

Large, long-legged shorebird, gray above, white below and lightly barred on flanks

PROTECTION STATUS

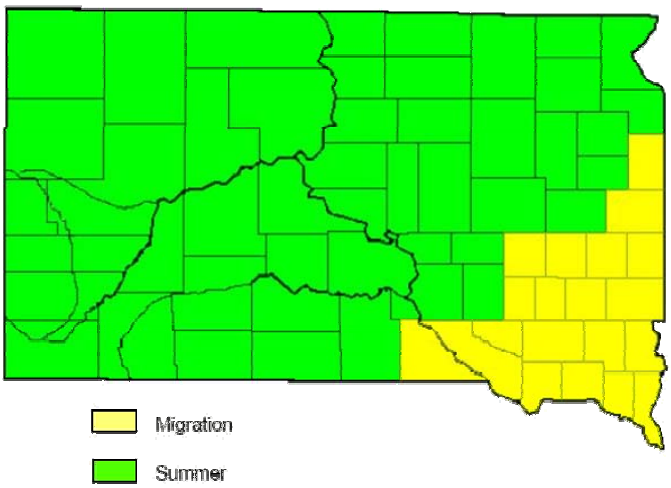
Federal: None
State: None
Global Rank: G5
State Rank: S5

DISTRIBUTION

Historical: All Ecoregions except Black Hills

Current: All Ecoregions, except Black Hills; see Figure on right (range map over approximates distributions in the Black Hills due to mapping methods)

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – shallow-water areas with short, sparse shoreline vegetation; nests on ground in short-grass or bare areas

Ecosystem diversity – Great Plains Steppe Ecoregion; Tallgrass Subregion; Mixed-grass Subregion; Missouri River Ecoregion
Primary EDM – riparian/wetland ecosystems, see Figures 4.1.2.1, 4.2.2.1, 4.3.2.1 and 4.4.2.1
Secondary EDM - grassland/shrub; while prefers to nest adjacent to or in dry areas of wetlands, requires the mix of wetlands and intact grazed grass ecosystems for optimal habitat conditions

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Draining/conversion of wetlands for agriculture and other purposes
- Human/pet disturbance of nest sites
- Nest depredation

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

None

COMMON NAME: LONG-BILLED CURLEW (LBCU)

Scientific Name: *Numenius americanus*

DESCRIPTION

Largest North-American shorebird with a distinctive long, curved bill; migratory and breeding bird within South Dakota

PROTECTION STATUS

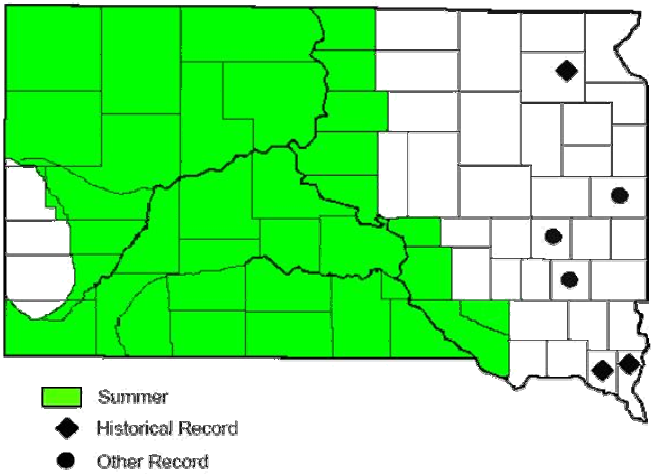
Federal: None
State: None
Global Rank: G5
State Rank: S3B, SZN

DISTRIBUTION

Historical: Great Plains Steppe Ecoregion, Eastern Prairie Ecoregion

Current: Great Plains Steppe Ecoregion, Mixed-grass Subregion, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – short grasses (<12 in); may use prairie dog colonies for foraging

Ecosystem Diversity – Great Plains Steppe Ecoregion; Tallgrass Subegion; Mixed-grass Subregion
Primary EDM – grass/shrub ecosystems; riparian/wetland ecosystems, see Figures 4.1.1.1, 4.2.1.1, 4.4.1.1, 4.1.2.1, 4.2.2.1, and 4.4.2.1

CAUSES OF CONCERN

- Habitat loss/degradation/alteration-
  - Extirpated from Eastern Prairie Ecoregion by cultivation/conversion of grassland
  - Changes to historical disturbance regimes have resulted in more homogeneous landscape; less diversity of conditions for nesting, feeding, and migrating
- Nest site disturbance –
  - early season grazing
  - agricultural practices such as mowing
  - human activities near nests
  - possible spread of mammalian predators into areas they did not occur historically
- Pesticides/herbicide impacts

RECOVERY PLAN/CONSERVATION STRATEGY

None

COMMON NAME: MARBLED GODWIT (MAGO)

Scientific Name: *Limosa fedoa*

DESCRIPTION

Large shorebird with dark brown plumage and black markings, light brown belly, and long bill

PROTECTION STATUS

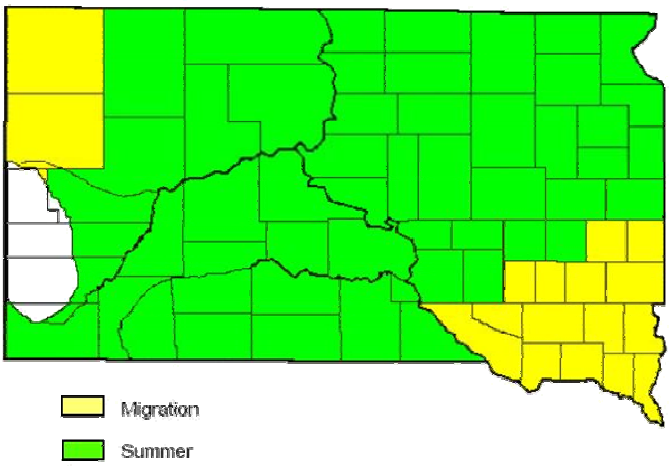
Federal: None
State: None
Global Rank: G5
State Rank: S5

DISTRIBUTION

Historical: Great Plains Steppe Ecoregion, Tallgrass Subregion, Mixed-grass Subregion

Current: all Ecoregions except the Black Hills Ecoregion, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – short, sparse to moderately vegetated intermixed riparian/wetland ecosystems; prefers relatively large contiguous blocks (>250 ac); attracted to burned areas 2 years post-burn

Ecosystem diversity – Great Plains Steppe Ecoregion; Tallgrass Subregion; Mixed-grass Subregion
Primary EDM – riparian/wetland, see Figures 4.1.2.1, 4.2.2.1, and 4.4.2.1
Qualifier – while prefers to nest adjacent to or in dry areas of wetlands, requires the mix of wetlands and intact grazed grass ecosystems for optimal habitat conditions

CAUSES OF CONCERN

- Habitat loss/degradation
  - Conversion/drainage/degradation of wetlands for agricultural purposes or other uses
  - Reduced heterogeneity of habitat due to suppression/interruption of historical disturbance regimes
  - Fragmentation of remaining habitat
  - Waterfowl management that promotes tall grasses near wetlands

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

None

COMMON NAME: WILSON'S PHALAROPE (WIPH)

Scientific Name: *Phalaropus tricolor*

DESCRIPTION

Similar to sandpipers but swims readily; white rump and dark wings

PROTECTION STATUS

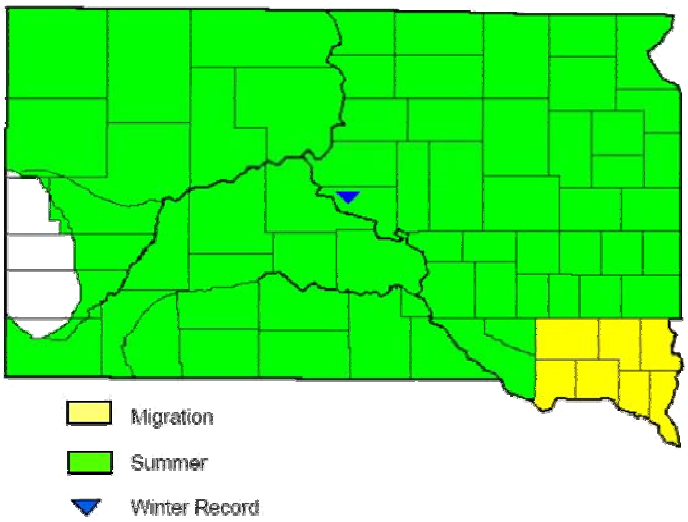
Federal: None
State: None
Global Rank: G5
State Rank: S4

DISTRIBUTION

Historical: All Ecoregions

Current: All Ecoregions except the Black Hills Ecoregion, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – shallow marshes and wet meadows adjacent to intact upland grass ecosystems; prefers dense nesting cover

Ecosystem diversity – all Ecoregions

Primary EDM – riparian/wetland ecosystems, see Figure 4.1.2.1, 4.2.2.1, 4.3.2.1, 4.4.2.1 and 4.5.2.1

Qualifier – less likely to nest in habitat grazed during the breeding season; more heterogeneous wetland conditions at the landscape level will help ensure adequate nesting habitat at the ecosystem level (i.e., a dry spring will present different opportunities for preferred nesting than a wet spring)

Limitation – contradictory information on habitat requirements

CAUSES OF CONCERN

- Habitat loss/degradation
  - Conversion/drainage/degradation of wetlands for agriculture or other uses
  - Loss of heterogeneity of wetland habitat at the landscape level due to suppression/interruption of historical disturbance regimes
- Nest depredation

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

None

COMMON NAME: INTERIOR LEAST TERN (LETE)

Scientific Name: *Sterna antillarum athalassos*

DESCRIPTION

Smallest North American tern

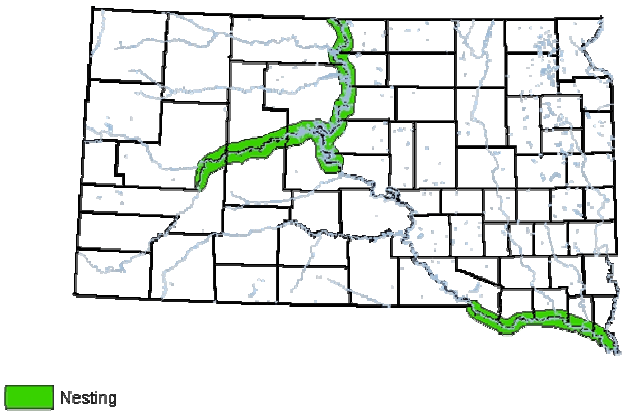
PROTECTION STATUS

Federal: Endangered
State: Endangered
Global Rank: G4T2Q
State Rank: S2B, SZN

DISTRIBUTION

Historical: Missouri River Ecoregion, Great Plains Steppe Ecoregion

Current: Missouri River Ecoregion and Great Plains Steppe Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

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

Ecosystem diversity – Missouri River Ecoregion; Great Plains Steppe Ecoregion
Primary EDM – riparian/wetland ecosystems, see Figures 4.3.2.1 and 4.4.2.1

CAUSES OF CONCERN

- Habitat loss/degradation-
  - River channelization, water diversion, and the construction of reservoirs and impoundments have changed the natural flood regime process that creates and renews much of the least tern's habitat
  - Management of river flow regimes can impact nesting through flooding of existing nests or the availability of quality nest sites
- Human disturbance of nest sites
- Water pollution caused by pesticides and industrial discharge can reduce small fish populations as well as bio-accumulate in terns
- Predation

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

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.

South Dakota Game, Fish and Parks. 2005. Draft South Dakota Interior Least Tern (*Sterna antillarum athalassos*) and Piping Plover (*Charadrius melodus*) Management Plan. Available online: http://www.sdgfp.info/Wildlife/WildlifePlans/PPIndex.htm

COMMON NAME: BLACK TERN (BLTE)

Scientific Name: *Chlidonias niger*

DESCRIPTION

A small tern with a dark, sooty gray body

PROTECTION STATUS

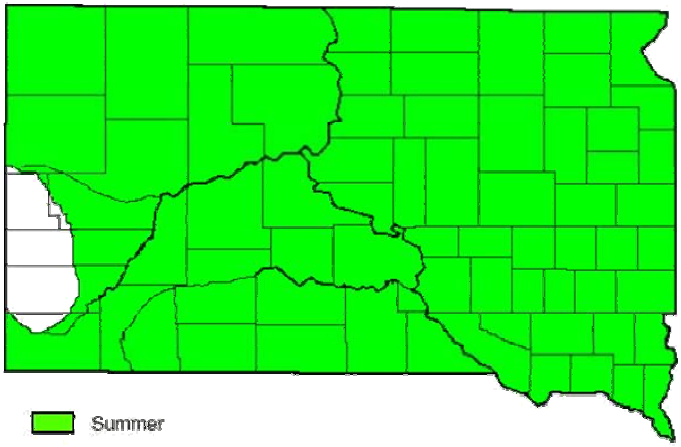
Federal: None
State: None
Global Rank: G4
State Rank: S3B, SZN

DISTRIBUTION

Historical: All Ecoregions except Black Hills Ecoregion

Current: All Ecoregions except Black Hills Ecoregion, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

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

Ecosystem Diversity – Great Plains Steppe Ecoregion; Tallgrass Subregion; Mixed-grass Subregion; Missouri River Ecoregion
Primary EDM – riparian/wetland ecosystems, see Figure 4.1.2.1, 4.2.2.1, 4.3.2.1 and 4.4.2.1
Qualifier – likely benefits from heterogeneous wetland conditions at the landscape level to ensure adequate nesting habitat at the ecosystem level (i.e., a dry spring will present different opportunities for preferred nesting than a wet spring)

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Conversion/drainage of wetlands for agriculture or other uses
  - Changes to historical disturbance regimes that impact the heterogeneity of habitat across the landscape
- Vulnerable to weather conditions that destroy nests through wind and waves, or changing water levels
- Water level manipulations that flood nests or make them vulnerable to predation
- Nest depredation and trampling
- Agricultural pesticides/herbicides

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

None

COMMON NAME: BURROWING OWL (BUOW)

Scientific Name: *Athene cunicularia*

DESCRIPTION

Small, ground dwelling owl with long legs, white chin stripe, round head, and stubby tail

PROTECTION STATUS

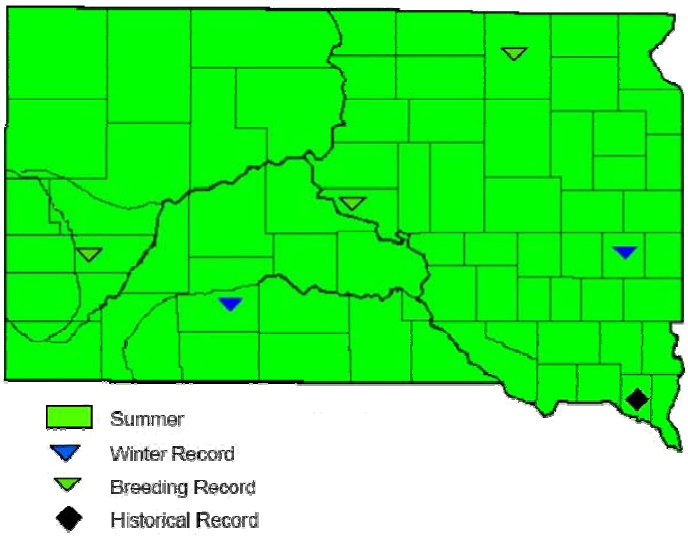
Federal: None
State: None
Global Rank: G4
State Rank: S3S4B, SZN

DISTRIBUTION

Historical: All Ecoregions except Missouri River Ecoregion

Current: All Ecoregions except Missouri River, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

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

Ecosystem diversity – Tallgrass Subregion; Mixed-grass Subregion; Great Plains Steppe Ecoregion; Black Hills Ecoregion
Primary EDM – grass/shrub ecosystems, see Figures 4.1.1.1, 4.2.1.1, 4.4.1.1 and 4.5.1.1

CAUSES OF CONCERN

- Habitat loss/degradation-
  - conversion for agricultural or other purposes
  - loss of burrowing mammals due to control programs
- Elevated structures such as fence posts and utility poles may provide a hunting advantage to avian predators of burrowing owls
- Nest depredation
- Vehicle collisions
- Illegal or unintentional shooting

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

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.

COMMON NAME: LEWIS'S WOODPECKER (LEWO)

Scientific Name: *Melanerpes lewis*

DESCRIPTION

Large woodpecker with a black back and rose red belly; a deep red band runs across the forehead and throat

PROTECTION STATUS

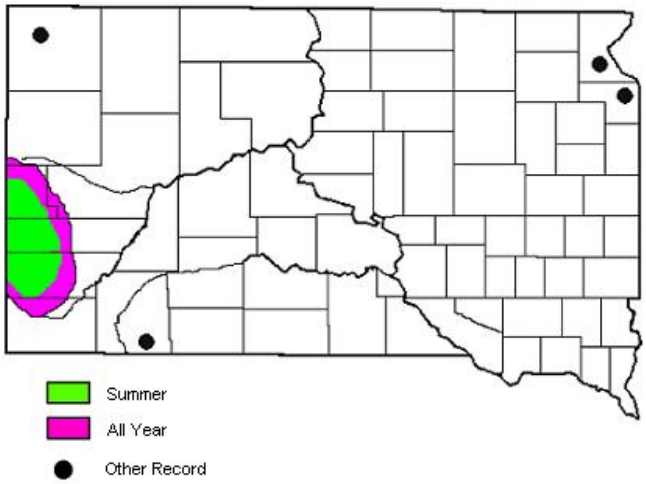
Federal: None
State: None
Global Rank: G4
State Rank: S3B, S3N

DISTRIBUTION

Historical: Black Hills Ecoregion

Current: see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – fire maintained old-growth ponderosa pine; large snags are used for nest cavities; often found in burned stands

Ecosystem Diversity - Black Hills Ecoregion
Primary EDM – forest ecosystems, see Figure 4.5.4.1

CAUSES OF CONCERN

- Habitat loss/degradation –
  - timber harvest that removed large ponderosa pine, both live and dead trees
  - suppression of historical fire regime has resulted in higher densities of trees and less open canopies as well as fewer snags
- European Starlings may out-compete for nest cavities

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

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

COMMON NAME: AMERICAN THREE-TOED WOODPECKER (ATTW)

Scientific Name: *Picoides dorsalis*

DESCRIPTION

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

PROTECTION STATUS

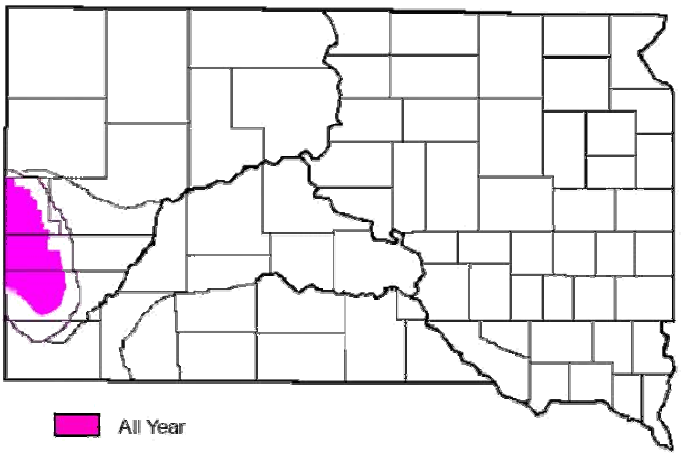
Federal: None
State: None
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Black Hills Ecoregion

Current: Black Hills Ecoregion, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – spruce forests, particularly where dead timber remains after fires; nests in cavities of large dead trees

Ecosystem diversity – Black Hills Ecoregion
Primary EDM – forest ecosystems, see Figure 4.5.4.1

CAUSES OF CONCERN

- Habitat loss/degradation –
  - timber harvest that removed snags
  - forest fragmentation
  - logging of recently burned stands
  - suppression of historical fire regime that has reduced the number and distribution of snags on the landscape

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

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

COMMON NAME: BLACK-BACKED WOODPECKER (BBWO)

Scientific Name: *Picoides arcticus*

DESCRIPTION

Woodpecker with solid black back and barred sides; males have yellow cap

PROTECTION STATUS

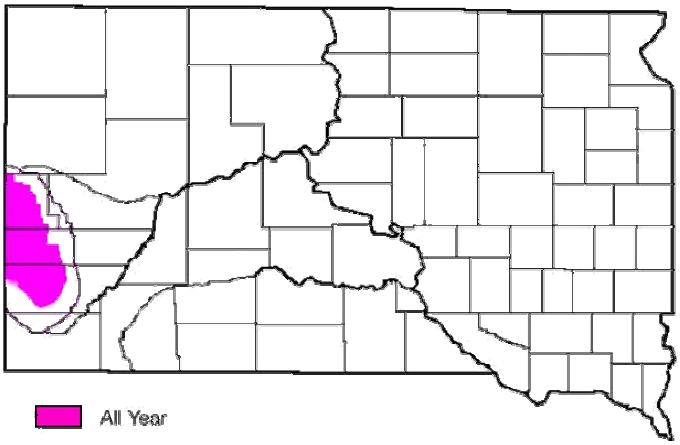
Federal: None
State: None
Global Rank: G5
State Rank: S3

DISTRIBUTION

Historical: Black Hills Ecoregion

Current: Black Hills Ecoregion, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

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

Ecosystem diversity – Black Hills Ecoregion
Primary EDM – forest ecosystems, see Figure 4.5.4.1

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Timber harvest that removed medium to large snags
  - Suppression of the historical fire regime that reduced the number and distribution of burns on the landscape

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

None

COMMON NAME: AMERICAN DIPPER (AMDI)

Scientific Name: *Cinclus mexicanus*

DESCRIPTION

Small, gray bird with characteristic bobbing motion when it moves; breeding bird within South Dakota

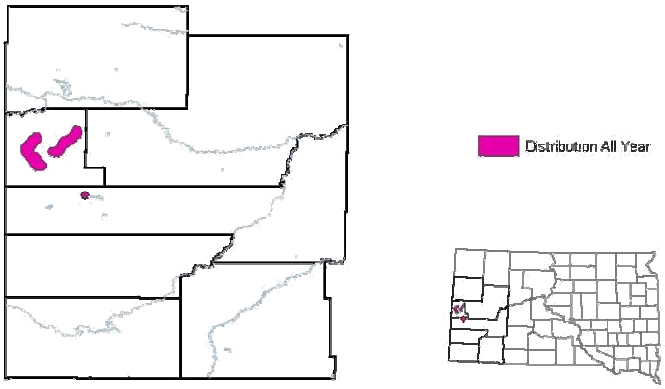
PROTECTION STATUS

Federal: None
State: Threatened
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Black Hills Ecoregion

Current: Black Hills Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – clean, cold, fast flowing mountain streams with abundant aquatic insects

Ecosystem Diversity – Black Hills Ecoregion
Primary EDM – riparian/wetland ecosystems, see Figure 4.5.2.1

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Water quality impacts from heavy livestock use of streams, road building, logging steep slopes adjacent to streams, and pollution from mining, septic tanks, and other sources
  - Dams/impoundments that flood habitat, destruction of habitat downstream and upstream of dam by decreasing water flow rates and increasing rate of sedimentation,
  - Erratic release of water from large dams can cause disruption of habitat downstream and in winter months can allow stream to freeze over, resulting in no open water for foraging.
  - Reduced stream flows from diversion for irrigation, community water, groundwater wells, or other human-uses.
  - Reduced runoff/groundwater reaching stream resulting from increased uptake by surrounding vegetation - the density of ponderosa pine and understory vegetation in the Black Hills has increased on many sites relative to historical conditions due primarily to fire suppression efforts over the last century.
- Nest-site disturbance due to trail development and other recreational activities adjacent to streams

RECOVERY PLANS/CONSERVATION STRATEGIES

Doug Backlund. 2005. The American Dipper, *Cinclus mexicanus*, in the Black Hills of South Dakota: Past and Present. SD Dept. of Game Fish and Parks. Online: http://www.sdgfp.info/Wildlife/Diversity/dipper/index.htm.

COMMON NAME: SPRAGUE'S PIPIT (SPPI)

Scientific Name: *Anthus spragueii*

DESCRIPTION

Pale, slender, sparrow-sized bird with white outer tail feathers, a thin bill, pale legs, and streaked back

PROTECTION STATUS

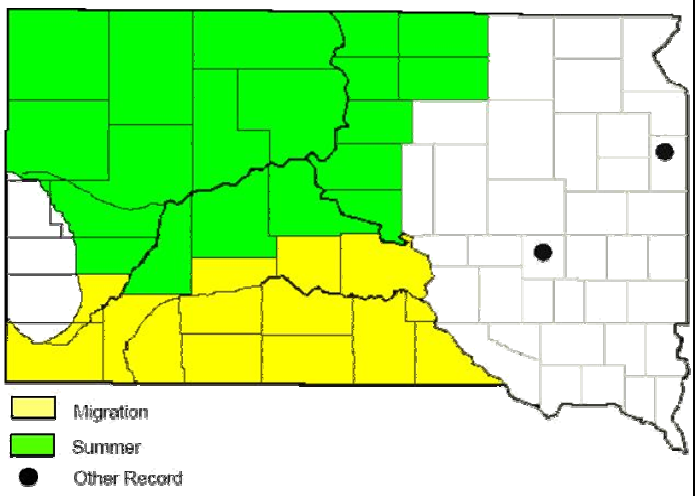
Federal: None
State: None
Global Rank: G4
State Rank: S2B, SZN

DISTRIBUTION

Historical: Breeds in northern ½ of Great Plains Steppe Ecoregion; migrant in lower ½ Great Plains Steppe Ecoregion

Current: Great Plains Steppe Ecoregion, Missouri River Ecoregion, and Mixed-grass Subregion, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – lightly to moderately grazed grass ecosystems with low to moderate levels of litter; also prefers grass ecosystems several years post-burn

Ecosystem diversity – Great Plains Steppe Ecoregion
Primary EDM's – grass/shrub ecosystems, see Figure 4.4.1.1
Qualifier – intense grazing during the nesting season appears to negatively impact nesting
Limitations – contradictory literature on key habitat; unclear as to whether this species prefers sparse or dense vegetation and short or medium-height grass conditions

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Conversion for agricultural or other purposes
  - Suppression of historical fire regime has reduced preferred habitat on the landscape
  - Invasion of exotic plant species reduces the quality of native grasslands
  - Mowing may reduce occurrence
- Reduced productivity due to brown-headed cowbird parasitism in fragmented native prairie
- Human disturbance during the nesting season

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, and B. R. Euliss. 1998 (revised 2003). Effects of management practices on grassland birds: Sprague's pipit. Northern Prairie Wildlife Research Center, Jamestown, ND. 15 pages.

COMMON NAME: LARK BUNTING (LABU)

Scientific Name: *Calamospiza melanocorys*

DESCRIPTION

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

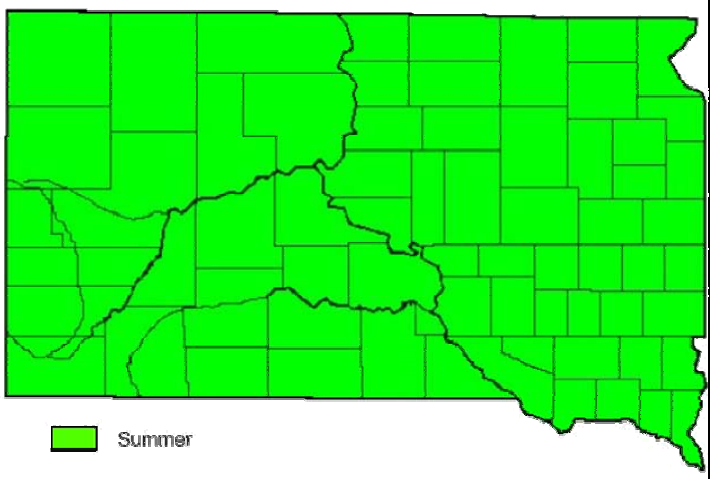
Federal: None
State: None
Global Rank: G5
State Rank: S5

DISTRIBUTION

Historical: All Ecoregions except Missouri River Ecoregion, and Black Hills Ecoregion

Current: All Ecoregions, but rare in Black Hills; see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

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 ft

Ecosystem diversity – Tallgrass Subregion; Mixed-grass Subregion; Great Plains Steppe Ecoregion
Primary EDM – grass/shrub ecosystems, see Figure 4.1.1.1, 4.2.1.1 and 4.4.1.1

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Conversion for agricultural or other purposes
  - Mowing during the nesting season
- Pesticide treatments for grasshoppers can cause mortality
- Parasitism by Brown-headed Cowbirds

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

Dechant, J.A., M.L. Sondreal, D.H. Johnson, L.D. Igl, C.M. Goldade, A.L. Zimmerman, and B.R. Euliss. 1999. Effects of management practices on grassland birds: lark bunting. Northern Prairie Wildlife Research Center, Jamestown, ND. 18pp.

COMMON NAME: BAIRD'S SPARROW (BASP)

Scientific Name: *Ammodramus bairdii*

DESCRIPTION

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

PROTECTION STATUS

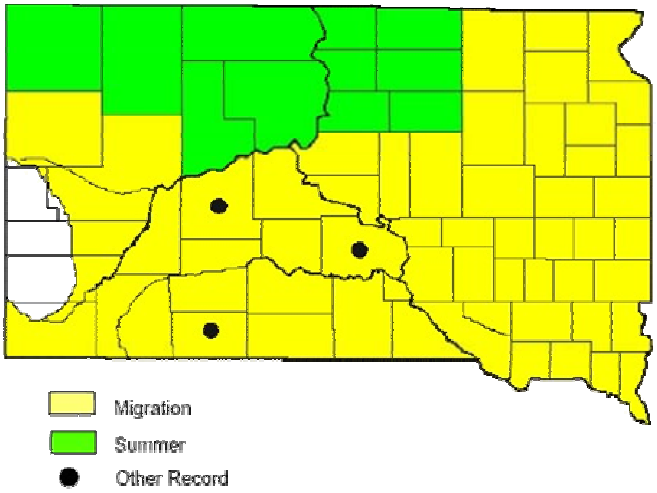
Federal: None
State: None
Global Rank: G4
State Rank: S2B, SZN

DISTRIBUTION

Historical: Northern ¼ of Great Plains Steppe Ecoregion

Current: All Ecoregions except Black Hills Ecoregion, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – lightly grazed native grass ecosystems and wetland meadows with low shrub cover and little woody vegetation

Ecosystem diversity – Great Plains Steppe Ecoregion
Primary EDM – grass/shrub ecosystems and riparian/wetland ecosystems, see Figure 4.4.1.1 and 4.4.2.1
Qualifier – habitat needs may be dynamic as they appear to prefer wet meadows in dry years

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Conversion for agricultural or other purposes
  - Degradation of habitat due to moderate to heavy grazing levels
  - Draining of wet meadows
  - Woody plant encroachment
- Nest depredation
- Nest parasitism by Brown-headed Cowbirds

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

Baird's Sparrow Status Assessment and Conservation Plan. Northern Prairie Wildlife Research Center, Jamestown, ND. Available online: http://www.r6.fws.gov/bairdssparrow/planfinl.htm

COMMON NAME: LE CONTE'S SPARROW (LCSP)

Scientific Name: *Ammodramus leconteii*

DESCRIPTION

Small bird with a mottled brown back and a white belly and crown stripe, an orange-yellow eye stripe and collar

PROTECTION STATUS

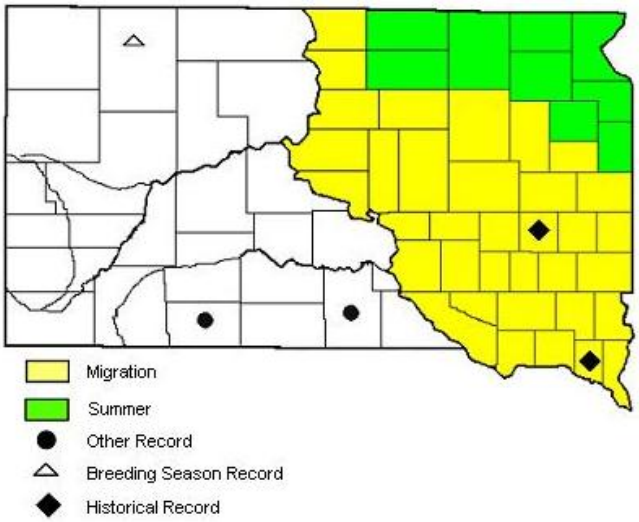
Federal: None
State: None
Global Rank: G4
State Rank: S1S2B, SZN

DISTRIBUTION

Historical: Breeding - northeastern 1/4 of the Eastern Prairie Ecoregion; migrant- remaining ¼ Eastern Prairie Ecoregion

Current: See Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – wet meadows and marshy areas; springs/fens; nests in drier parts; also appears to prefer burned sites 2 years post-burn

Ecosystem Diversity – Tallgrass Subregion; Mixed-grass Subregion
Primary EDM – riparian/wetland ecosystems, see Figure 4.1.2.1 and 4.2.2.1
Qualifiers – sites should receive little to no grazing during the breeding season; while this species appears to prefer wet meadows for nesting, adjacent upland grass ecosystems are used as well for foraging, and sometimes nesting, and should be considered in the habitat complex

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Conversion/draining of wetlands for agricultural purposes
  - Mowing or grazing during the breeding season
  - Loss of habitat heterogeneity due to suppression/interruption of historical disturbance regimes, such as fire
- Nest parasitism by Brown-headed Cowbirds

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, A. L. Zimmerman, and B. R. Euliss. 1998 (revised 2003). Effects of management practices on grassland birds: Le Conte's sparrow. Northern Prairie Wildlife Research Center, Jamestown, ND. 15 pages.

COMMON NAME: WHITE-WINGED JUNCO (WWJU)

Scientific Name: *Junco hyemalis aikeni*

DESCRIPTION

A subspecies of the dark-eyed junco with two white wingbars; breeds in Black Hills and often year-round resident

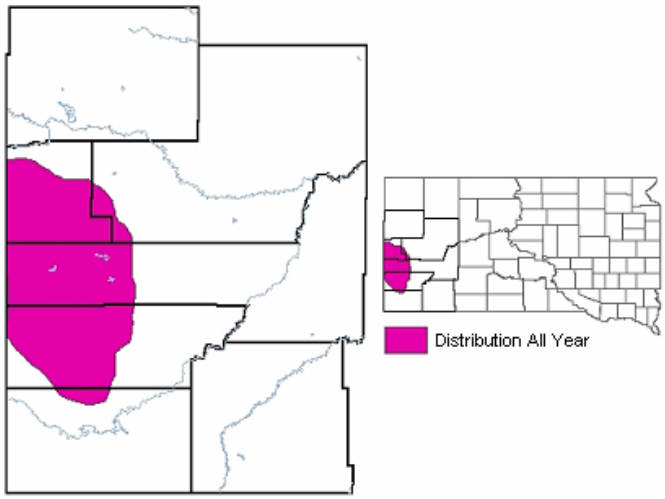
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5T4
State Rank: S5

DISTRIBUTION

Historical: Black Hills Ecoregion

Current: Black Hills Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – utilizes coniferous and deciduous forest openings and edges; little information available

Ecosystem Diversity – Black Hills Ecoregion
Primary EDM – forest ecosystems, see Figure 4.5.4.1
Qualifiers – likely benefits from landscape heterogeneity and openings resulting from historical fire disturbance regimes
Limitations – very little information available on habitat requirements; extrapolated from dark-eyed junco habitat description

CAUSES OF CONCERN

- Limited range and a general lack of information regarding this subspecies of junco

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

Jones, S.L. and M.T. Green. 1998. Barid's Sparrow status assessment and conservation plan. Administrative report. U.S. Dept of Interior, Fish and Wildlife Service, Denver, Co.

COMMON NAME: CHESTNUT-COLLARED LONGSPUR (CCLO)

Scientific Name: *Calcarius ornatus*

DESCRIPTION

Sparrow-sized bird with black underparts and white on face and wings

PROTECTION STATUS

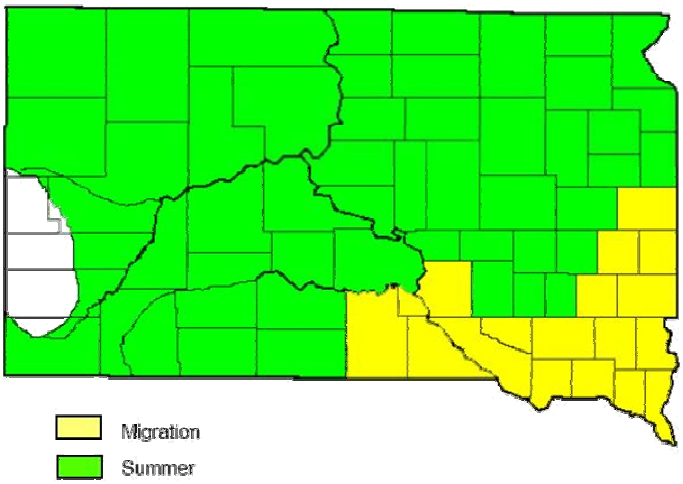
Federal: None
State: None
Global Rank: G5
State Rank: S4

DISTRIBUTION

Historical: Great Plains Steppe Ecoregion, Mixed-grass Subregion

Current: All Ecoregions except for the Black Hills Ecoregion, see Figure on right

Source: Tallman, D. A., D. L. Swanson, and J. S. Palmer. 2002. Birds of South Dakota. Midstates/Quality Quick Print, Aberdeen, South Dakota.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – prefers heterogeneous grazed cover of short and mid-statured grasses, particularly bunchgrasses; avoids shrubby areas; avoids areas with dense litter accumulation

Ecosystem diversity – Great Plains Ecoregion; Mixed-grass Subregion
Primary EDM – grass/shrub ecosystems, see Figures 4.2.1.1 and 4.4.1.1

CAUSES OF CONCERN

- Habitat loss/degradation
  - More homogeneous grassland conditions due to grazing policies and suppression of historical disturbance
  - Conversion for agricultural purposes and urban development
- Nest depredation
- Pesticides/herbicides

EXISTING RECOVERY PLAN/CONSERVATION STRATEGY

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, and B. R. Euliss. 1998 (revised 2003). Effects of management practices on grassland birds: Chestnut-collared Longspur. Northern Prairie Wildlife Research Center, Jamestown, ND. 17 pages.

Figure 4.1.1.1. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of bird species of greatest conservation need within grass/shrub ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

GRASS/HRUB ECOSYSTEMS

Disturbance Influenced Pathways	Clayey	Claypan	Thin Claypan	Loamy	Sandy	Thin Upland	Shallow
Early Seral							
Vegetative composition-structure primarily influenced by short-interval fire regimes (<8 yrs.)							
Light Grazing	GPCH-LABU	GPCH-LABU	GPCH-LABU	GPCH-LABU	GPCH-LABU	GPCH-LABU	GPCH-LABU
Moderate Grazing	FEHA-GPCH-LBCU-LABU	FEHA-GPCH-LBCU-LABU	FEHA-GPCH-LBCU-LABU	FEHA-GPCH-LBCU-LABU	FEHA-GPCH-LBCU-LABU	FEHA-GPCH-LBCU-LABU	FEHA-GPCH-LBCU-LABU
Heavy Grazing	FEHA-GPCH-LBCU-BUOW	FEHA-GPCH-LBCU-BUOW	FEHA-GPCH-LBCU-BUOW	FEHA-GPCH-LBCU-BUOW	FEHA-GPCH-LBCU-BUOW	FEHA-GPCH-LBCU-BUOW	FEHA-GPCH-LBCU-BUOW
Vegetative composition-structure primarily influenced by long-interval fire regimes (≥8 yrs.)							
Light Grazing	LABU	LABU	LABU	LABU	LABU	LABU	LABU
Moderate Grazing	LABU	LABU	LABU	LABU	LABU	LABU	LABU
Heavy Grazing							

Species Codes	
BUOW = Burrowing Owl	LABU = Lark Bunting
FEHA = Ferruginous Hawk	LBCU = Long-billed Curlew
GPCH = Greater Prairie-Chicken	

Figure 4.1.2.1. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of bird species of greatest conservation need within in riparian/wetland ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

RIPARIAN-WETLAND ECOSYSTEMS

KEY

Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
			Geomorphic								
			Water Regime	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
			Slope					Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WHCR-AWPE				WHCR			
			Emergent	TRSW-WHCR-WIPH-BLTE-LCSP		WIPH-BLTE-LCSP	TRSW-WIPH-BLTE-LCSP	TRSW-WHCR-WIPH-BLTE-LCSP			
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WILL-AWPE		WILL	WILL	WILL			
			Emergent	WILL-LBCU-MAGO		WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO			
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WHCR-AWPE				WHCR			
			Emergent	TRSW-WHCR-WIPH-BLTE-LCSP	WIPH-BLTE-LCSP	WIPH-BLTE-LCSP	TRSW-WIPH-BLTE-LCSP	TRSW-WHCR-WIPH-BLTE-LCSP	WIPH		LCSP
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WILL-AWPE	WILL	WILL	WILL	WILL			
			Emergent	WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO	MAGO-WILL		
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WHCR-AWPE				WHCR			
			Emergent	TRSW-WHCR-WIPH-BLTE-LCSP		WIPH-BLTE-LCSP	TRSW-WIPH-BLTE-LCSP	TRSW-WHCR-WIPH-BLTE-LCSP			
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WILL-AWPE		WILL	WILL	WILL			
			Emergent	WILL-LBCU-MAGO		WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO			
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WHCR-AWPE				WHCR			
			Emergent	TRSW-WHCR-WIPH-BLTE-LCSP	WIPH-BLTE-LCSP	WIPH-BLTE-LCSP	TRSW-WIPH-BLTE-LCSP	TRSW-WHCR-WIPH-BLTE-LCSP	WIPH		LCSP
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WILL-AWPE	WILL	WILL	WILL	WILL			
			Emergent	WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO	MAGO-WILL		
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			

Species Codes

AWPE = American White Pelican
BAEA = Bald Eagle
BLTE = Black Tern
LBCU = Long-billed Curlew
LCSP - LeConte's Sparrow
MAGO = Marbled Godwit
TRSW = Trumpeter Swan
WHCR = Whooping Crane
WILL = Willet
WIPH = Wilson's Phalarope

Figure 4.2.1.1. South Dakota Comprehensive Wildlife Conservation Strategy - expected distributions of bird species of greatest conservation need within grass/shrub ecosystems of the Mixedgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

GRASS/SHRUB ECOSYSTEMS

Disturbance Influenced Pathways	Ecolological Site Class							
	Dense Clay	Clayey	Shallow Clayey	Claypan	Loamy	Sandy	Shallow	Very Shallow
Early Seral								
Prairie Dog Town, active		FEHA-LBCU-BUOW		FEHA-LBCU-BUOW	FEHA-LBCU-BUOW			
Prairie Dog Town, inactive		BUOW		BUOW	BUOW			
Vegetative composition-structure primarily influenced by short-interval fire regimes (<10 yrs.)								
Light Grazing	LABU-CCLO-GPCH	LABU-CCLO-GPCH	LABU-CCLO-GPCH	LABU-CCLO-GPCH	LABU-CCLO-GPCH	LABU-CCLO-GPCH	LABU-CCLO-GPCH	LABU-CCLO-GPCH
Moderate Grazing	FEHA-BUOW-CCLO GPCH	FEHA-BUOW-CCLO GPCH	FEHA-BUOW-CCLO GPCH	FEHA-BUOW-CCLO GPCH	FEHA-BUOW-CCLO GPCH	FEHA-BUOW-CCLO GPCH	FEHA-BUOW-CCLO GPCH	FEHA-BUOW-CCLO GPCH
Heavy Grazing	FEHA-BUOW-GPCH	FEHA-BUOW-GPCH	FEHA-BUOW-GPCH	FEHA-BUOW-GPCH	FEHA-BUOW-GPCH	FEHA-BUOW-GPCH	FEHA-BUOW-GPCH	FEHA-BUOW-GPCH
Vegetative composition-structure primarily influenced by long-interval fire regimes (>10 yrs.)								
Light Grazing	LABU	LABU	LABU	LABU	LABU	LABU	LABU	LABU
Moderate Grazing	LABU	LABU	LABU	LABU	LABU	LABU	LABU	LABU
Heavy Grazing								

Ecosystems that do not occur

Species Codes	
BUOW = Burrowing Owl	GPCH = Greater Prairie-Chicken
CCLO = Chestnut-collared Longspur	LABU = Lark Bunting
FEHA = Ferruginous Hawk	LBCU = Long-billed Curlew

Figure 4.2.2.1. South Dakota Comprehensive Wildlife Conservation Strategy - expected distributions of bird species of greatest conservation need within riparian/wetland ecosystems of the Mixedgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
			Geomorphic →								
			Water Regime →	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
			Slope →					Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WHCR-AWPE				WHCR			
			Emergent	TRSW-WHCR-WIPH-BLTE-LCSP		WIPH-BLTE-LCSP	TRSW-WIPH-BLTE-LCSP	TRSW-WHCR-WIPH-BLTE-LCSP			
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WILL-AWPE		WILL	WILL	WILL			
			Emergent	WILL-LBCU-MAGO		WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO			
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WHCR-AWPE				WHCR			
			Emergent	TRSW-WHCR-WIPH-BLTE-LCSP	WIPH-BLTE-LCSP	WIPH-BLTE-LCSP	TRSW-WIPH-BLTE-LCSP	TRSW-WHCR-WIPH-BLTE-LCSP	WIPH-BLTE-LCSP		LCSP
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WILL-AWPE	WILL	WILL	WILL	WILL	WILL		
			Emergent	WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO		
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WHCR-AWPE				WHCR			
			Emergent	TRSW-WHCR-WIPH-BLTE-LCSP		WIPH-BLTE-LCSP	TRSW-WIPH-BLTE-LCSP	TRSW-WHCR-WIPH-BLTE-LCSP			
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WILL-AWPE		WILL	WILL	WILL			
			Emergent	WILL-LBCU-MAGO		WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO			
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WHCR-AWPE				WHCR			
			Emergent	TRSW-WHCR-WIPH-BLTE-LCSP	WIPH-BLTE-LCSP	WIPH-BLTE-LCSP	TRSW-WIPH-BLTE-LCSP	TRSW-WHCR-WIPH-BLTE-LCSP	WIPH-BLTE-LCSP		LCSP
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore	WILL-AWPE	WILL	WILL	WILL	WILL	WILL		
			Emergent	WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO	WILL-LBCU-MAGO		
			Scrub-Shrub								
			Forested	BAEA			BAEA	BAEA			

Species Codes

AWPE = American White Pelican
BAEA = Bald Eagle
BLTE = Black Tern
LBCU = Long-billed Curlew
LCSP = Le Conte's Sparrow
MAGO = Marbled Godwit
TRSW = Trumpeter Swan
WHCR = Whooping Crane
WILL = Willet
WIPH = Wilson's Phalarope

Figure 4.3.2.1. South Dakota Comprehensive Wildlife Conservation Strategy- expected distributions of bird species of greatest conservation need within riparian/wetland ecosystems of the Missouri River Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MISSOURI RIVER ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
			Geomorphic →							
			Water Regime →	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
			Slope →				Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore			WHCR	WHCR-AWPE			
			Emergent		WIPH-BLTE	WHCR-TRSW-WIPH-BLTE	WHCR-TRSW-WIPH-BLTE			
			Scrub-Shrub							
			Forested			OSPR-BAEA	OSPR-BAEA			
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore		WILL	WILL	WILL-AWPE			
			Emergent		WILL	WILL	WILL			
			Scrub-Shrub							
			Forested			OSPR-BAEA	OSPR-BAEA			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore			WHCR	WHCR-PIPL-LETE-AWPE			
			Emergent	WIPH-BLTE	WIPH-BLTE	WHCR-TRSW-WIPH-BLTE	WHCR-TRSW-WIPH-BLTE			
			Scrub-Shrub							
			Forested			OSPR-BAEA	OSPR-BAEA			
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore	WILL	WILL	WILL	PIPL-WILL-LETE-AWPE			
			Emergent	WILL	WILL	WILL	WILL			
			Scrub-Shrub							
			Forested			OSPR-BAEA	OSPR-BAEA			
LATE SUCCESSIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore			WHCR	WHCR-AWPE			
			Emergent		WIPH-BLTE	WHCR-TRSW-WIPH-BLTE	WHCR-TRSW-WIPH-BLTE			
			Scrub-Shrub							
			Forested			OSPR-BAEA	OSPR-BAEA			
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore		WILL	WILL	WILL-AWPE			
			Emergent		WILL	WILL	WILL			
			Scrub-Shrub							
			Forested			OSPR-BAEA	OSPR-BAEA			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore			WHCR	WHCR-PIPL-LETE-AWPE			
			Emergent	WIPH-BLTE	WIPH-BLTE	WHCR-TRSW-WIPH-BLTE	WHCR-TRSW-WIPH-BLTE			
			Scrub-Shrub							
			Forested			OSPR-BAEA	OSPR-BAEA			
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore	WILL	WILL	WILL	PIPL-WILL-LETE-AWPE			
			Emergent	WILL	WILL	WILL	WILL			
			Scrub-Shrub							
			Forested			OSPR-BAEA	OSPR-BAEA			

Species Codes
AWPE = American White Pelican
BAEA = Bald Eagle
BLTE = Black Tern
LETE = Interior Least Tern
OSPR = Osprey
PIPL = Piping Plover
TRSW = Trumpeter Swan
WHCR = Whooping Crane
WILL = Willet
WIPH = Wilson's Phalarope

Figure 4.4.1.1. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of bird species of greatest conservation need within grass/shrub ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

GRASS/SHRUB ECOSYSTEMS

Disturbance Influenced Pathways	Ecolological Site Class								
	Porous Clay	Dense Clay	Clayey	Claypan	Loamy	Shallow	Badlands	Sandy	Saline Upland
Early Seral									
Prairie Dog Town, active			FEHA-LBCU-BUOW	FEHA-LBCU-BUOW	FEHA-LBCU-BUOW				FEHA-LBCU-BUOW
Prairie Dog Town, inactive			BUOW	BUOW	BUOW				BUOW
Vegetative composition-structure primarily influenced by short-interval fire regimes (<15 yrs.)									
Light Grazing	SPPI-BASP-CCLO-LABU	SPPI-BASP-CCLO-LABU	SPPI-BASP-CCLO-LABU	SPPI-BASP-CCLO-LABU	SPPI-BASP-CCLO-LABU	SPPI-BASP-CCLO-LABU	SPPI-BASP-CCLO-LABU	SPPI-BASP-CCLO-LABU	SPPI-BASP-CCLO-LABU
Moderate Grazing	FEHA-LBCU-BUOW-SPPI-CCLO	FEHA-LBCU-BUOW-SPPI-CCLO	FEHA-LBCU-BUOW-SPPI-CCLO	FEHA-LBCU-BUOW-SPPI-CCLO	FEHA-LBCU-BUOW-SPPI-CCLO	FEHA-LBCU-BUOW-SPPI-CCLO	FEHA-LBCU-BUOW-SPPI-CCLO	FEHA-LBCU-BUOW-SPPI-CCLO	FEHA-LBCU-BUOW-SPPI
Heavy Grazing	FEHA-LBCU-BUOW	FEHA-LBCU-BUOW	FEHA-LBCU-BUOW	FEHA-LBCU-BUOW	FEHA-LBCU-BUOW	FEHA-LBCU-BUOW	FEHA-LBCU-BUOW	FEHA-LBCU-BUOW	FEHA-LBCU-BUOW
Vegetative composition-structure primarily influenced by long-interval fire regimes (>15 yrs.)									
Light Grazing	LABU	SAGR-LABU	SAGR-LABU	SAGR-LABU	SAGR-LABU	SAGR-LABU	SAGR-LABU	LABU	LABU
Moderate Grazing	LABU	SAGR-LABU	SAGR-LABU	SAGR-LABU	SAGR-LABU	SAGR-LABU	SAGR-LABU	LABU	LABU
Heavy Grazing		SAGR	SAGR	SAGR	SAGR	SAGR	SAGR		

Ecosystems that do not occur

Species Codes		
BASP = Baird's Sparrow	FEHA = Ferruginous Hawk	SAGR = Greater Sage-Grouse
BUOW = Burrowing Owl	LABU = Lark Bunting	SPPI = Sprague's Pipit
CCLO = Chestnut-collared Longspur	LBCU = Long-billed Curlew	

Figure 4.4.2.1. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of bird species of greatest conservation need within riparian/wetland ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Disturbance Influenced Pathways			Habitat Descriptors	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS				SLOPE SYSTEMS
			Geomorphic →									
			Water Regime →	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*		*Intermittent*		
			Slope →					Low Gradient with floodplain	Mid-High Gradient without floodplain	Low Gradient with floodplain	Mid-High Gradient without floodplain	
Time Since Major Disturbance (i.e., flood, fire, etc.)	EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore								
				Unconsolidated Shore	WHCR			WHCR				
				Emergent	WHCR/TRSW/WIPH/BLTE	WIPH/BLTE/BASP	TRSW/WIPH/BLTE	WHCR/TRSW/WIPH/BLTE				
				Scrub-Shrub								
				Forested	BAEA		BAEA	BAEA				
			Heavy Bison Grazing	Rocky Shore								
				Unconsolidated Shore	WILL		WILL	WILL				
				Emergent	WILL/LBCU/MAGO	WILL/LBCU/MAGO	WILL/LBCU/MAGO	WILL/LBCU/MAGO				
				Scrub-Shrub								
				Forested	BAEA		BAEA	BAEA				
		Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore								
				Unconsolidated Shore	WHCR/LETE			WHCR/LETE				
				Emergent	WHCR/TRSW/WIPH/BLTE	WIPH/BLTE/BASP	WIPH/BLTE/BASP	TRSW/WIPH/BLTE	WHCR/TRSW/WIPH/BLTE		WIPH/BLTE/BASP	
				Scrub-Shrub								
				Forested	BAEA		BAEA	BAEA				
			Heavy Bison Grazing	Rocky Shore								
				Unconsolidated Shore	WILL/LETE	WILL	WILL	WILL	WILL/LETE			
				Emergent	WILL/LBCU/MAGO	WILL/LBCU/MAGO	WILL/LBCU/MAGO	WILL/LBCU/MAGO	WILL/LBCU/MAGO		WILL/LBCU/MAGO	
				Scrub-Shrub								
				Forested	BAEA		BAEA	BAEA				
	LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore								
				Unconsolidated Shore	WHCR			WHCR				
				Emergent	WHCR/TRSW/WIPH/BLTE	WIPH/BLTE/BASP	TRSW/WIPH/BLTE	WHCR/TRSW/WIPH/BLTE				
				Scrub-Shrub								
				Forested	BAEA		BAEA	BAEA				
			Heavy Bison Grazing	Rocky Shore								
				Unconsolidated Shore	WILL		WILL	WILL				
				Emergent	WILL/LBCU/MAGO	WILL/LBCU/MAGO	WILL/LBCU/MAGO	WILL/LBCU/MAGO				
				Scrub-Shrub								
				Forested	BAEA		BAEA	BAEA				
		Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore								
				Unconsolidated Shore	WHCR/LETE			WHCR/LETE				
				Emergent	WHCR/TRSW/WIPH/BLTE	WIPH/BLTE/BASP	WIPH/BLTE/BASP	TRSW/WIPH/BLTE	WHCR/TRSW/WIPH/BLTE		WIPH/BLTE/BASP	
				Scrub-Shrub								
				Forested	BAEA		BAEA	BAEA				
			Heavy Bison Grazing	Rocky Shore								
				Unconsolidated Shore	WILL/LETE	WILL	WILL	WILL	WILL/LETE			
				Emergent	WILL/LBCU/MAGO	WILL/LBCU/MAGO	WILL/LBCU/MAGO	WILL/LBCU/MAGO	WILL/LBCU/MAGO		WILL/LBCU/MAGO	
				Scrub-Shrub								
				Forested	BAEA		BAEA	BAEA				

Species Codes

- BAEA - Bald Eagle
- BASP - Baird's Sparrow
- BLTE - Black Tern
- LBCU - Long-billed Curlew
- LETE = Interior Least Tern
- MAGO = Marbled Godwit
- TRSW = Trumpeter Swan
- WHCR = Whooping Crane
- WILL = Willet
- WIPH = Wilson's Phalarope

Figure 4.5.1.1. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of bird species of greatest conservation need within grass/shrub ecosystems of the Black Hills Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

GRASS/SHRUB ECOSYSTEMS

Disturbance Influenced Pathways	Ecolological Site Class							
	Clayey	Claypan	Loamy	Shallow	Thin Upland	Sandy	High Country Loamy	Mountain Prairie
Early Seral								
Prairie Dog Town, active	FEHA-BUOW	FEHA-BUOW	FEHA-BUOW				FEHA-BUOW	FEHA-BUOW
Prairie Dog Town, inactive	BUOW	BUOW	BUOW				BUOW	BUOW
Vegetative composition-structure primarily influenced by short-interval fire regimes (<25 yrs.)								
Light Grazing								
Moderate Grazing	FEHA	FEHA	FEHA	FEHA	FEHA	FEHA	FEHA	FEHA
Heavy Grazing	FEHA-BUOW	FEHA-BUOW	FEHA-BUOW	FEHA-BUOW	FEHA-BUOW	FEHA-BUOW	FEHA-BUOW	FEHA-BUOW
Vegetative composition-structure primarily influenced by long-interval fire regimes (>25 yrs.)								
Light Grazing								
Moderate Grazing								
Heavy Grazing								

Ecosystems that do not occur

Species Codes
BUOW = Burrowing Owl
FEHA = Ferruginous Hawk

Figure 4.5.2.1. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of bird species of greatest conservation need within riparian/wetland ecosystems of the Black Hills Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - BLACK HILLS ECOSYSTEM

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways			Habitat Descriptors	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS				SLOPE SYSTEMS
				Geomorphic →								
				Water Regime →	Temporary	Semi-permanent	Permanent	Perennial		Intermittent		
				Gradient →				Low Gradient < 2% slope	Mid-High Gradient > 2% slope	Low Gradient < 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Grazing	Rocky Shore									
			Unconsolidated Shore									
			Emergent			WIPH	TRSW-WIPH	TRSW-WIPH				
			Scrub-Shrub									
			Forested				BAEA	BAEA				
		Heavy Grazing	Rocky Shore									
			Unconsolidated Shore									
			Emergent									
			Scrub-Shrub									
			Forested				BAEA	BAEA				
	Beaver Unmodified System	Low to Moderate Grazing	Rocky Shore						AMDI		AMDI	
			Unconsolidated Shore									
			Emergent		WIPH	WIPH	TRSW-WIPH	TRSW-WIPH		WIPH		
			Scrub-Shrub									
			Forested				BAEA	BAEA				
		Heavy Grazing	Rocky Shore									
			Unconsolidated Shore									
			Emergent									
			Scrub-Shrub									
			Forested				BAEA	BAEA				
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Grazing	Rocky Shore									
			Unconsolidated Shore									
			Emergent			WIPH	TRSW-WIPH	TRSW-WIPH				
			Scrub-Shrub									
			Forested				BAEA	BAEA				
		Heavy Grazing	Rocky Shore									
			Unconsolidated Shore									
			Emergent									
			Scrub-Shrub									
			Forested				BAEA	BAEA				
	Beaver Unmodified System	Low to Moderate Grazing	Rocky Shore						AMDI		AMDI	
			Unconsolidated Shore									
			Emergent		WIPH	WIPH	TRSW-WIPH	TRSW-WIPH		WIPH		
			Scrub-Shrub									
			Forested				BAEA	BAEA				
		Heavy Grazing	Rocky Shore									
			Unconsolidated Shore									
			Emergent									
			Scrub-Shrub									
			Forested				BAEA	BAEA				

Species Codes
AMDI = American dipper
BAEA = Bald Eagle
TRSW = Trumpeter Swan
WIPH = Wilson's Phalarope

Figure 4.5.4.1. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of bird species of greatest conservation need within forested ecosystems of the Black Hills Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

FORESTED ECOSYSTEMS

Disturbance Influenced Pathways	Warm, Dry Bur Oak	Xeric Ponderosa Pine	Warm, Dry Ponderosa Pine	Warm, Moist Ponderosa Pine	Warm, Moist Quaking Aspen	Cool, Moist White Spruce	High Elevation Limber Pine
SEEDLING-SHRUB			NOGO	NOGO-WWJU		NOGO-WWJU	
SAPLING			NOGO	NOGO-WWJU		NOGO-WWJU	
Stand conditions-structure PREDOMINANTLY influenced by short-interval fire regimes							
SMALL TREES			NOGO	NOGO		NOGO-ATTW	
MEDIUM TREES			NOGO	NOGO		NOGO-ATTW	
LARGE TREES		LEWO	NOGO-LEWO	NOGO-LEWO		NOGO-ATTW	
Stand conditions-structure PREDOMINANTLY influenced by long-interval fire regimes							
SMALL TREES				NOGO-BBWO-WWJU	NOGO	NOGO-ATTW-BBWO-WWJU	
MEDIUM TREES				NOGO-BBWO-WWJU	NOGO	NOGO-ATTW-BBWO-WWJU	
LARGE TREES				NOGO-BBWO-WWJU	NOGO	NOGO-ATTW-BBWO-WWJU	

Species Codes
ATTW = American Three-toed Woodpecker
BBWO = Black-backed Woodpecker
LEWO = Lewis's Woodpecker
NOGO = Northern Goshawk
WWJU = White-winged Junco

Mammals

COMMON NAME: FRINGE-TAILED MYOTIS (FTMY)

Scientific Name: *Myotis thysanodes pahasapensis*

DESCRIPTION

Medium sized, insectivorous bat with dark colored fur and long-ears.

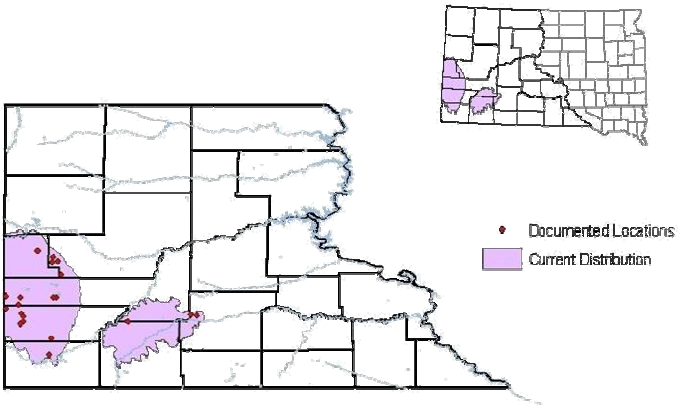
PROTECTION STATUS

Federal: None
State: None
Global Rank: G4G5T2
State Rank: S2

DISTRIBUTION

Historical: Black Hills Ecoregion and southwestern Great Plains Steppe Ecoregion

Current: Black Hills Ecoregion and southwestern Great Plains Steppe Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

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

Ecosystem diversity – Black Hills Ecoregion; Great Plains Steppe Ecoregion
Primary EDM – grass/shrub ecosystems (GPS) and forest ecosystems, see Figures 4.4.1.2, 4.4.4.2, and 4.5.4.2
Qualifier – forest conditions should also be in relatively close proximity to riparian/wetland and aquatic ecosystems such as wet meadows and open water

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Timber harvest that reduces number of large trees and snags
  - Closure of abandoned mines and caves
- Human disturbance and vandalism of roost sites
- Pesticides to control mosquitoes and other prey items

EXISTING RECOVERY PLANS/CONSERVATION STRATEGY

South Dakota Bat Working Group. 2004. South Dakota bat management plan. Wildlife Division Report 2004-08. 89pp. Available online at: http://www.sdgfp.info/Wildlife/ Diversity/batmanagmentplan71304.pdf

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://www.sdgfp.info/Wildlife/Diversity/battechreport.pdf

COMMON NAME: NORTHERN MYOTIS (NOMY)

Scientific Name: *Myotis septentrionalis*

DESCRIPTION

Small, insectivorous bat with light to dark brown fur with buffy shoulder patch and long-ears; year-round resident

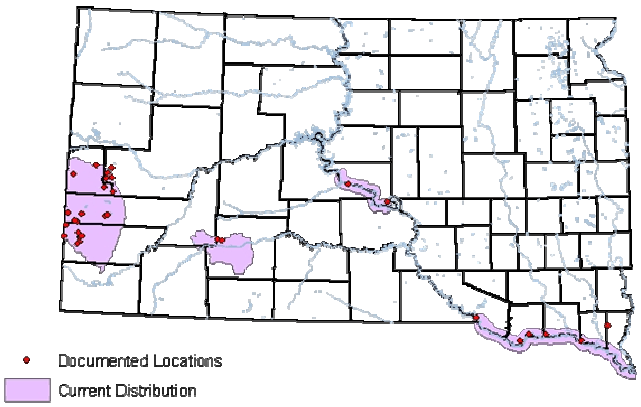
PROTECTION STATUS

Federal: None
State: None
Global Rank: G4
State Rank: S3

DISTRIBUTION

Historical: Found in suitable habitat throughout South Dakota but highest populations are in the Black Hills Ecoregion

Current: Black Hills and Great Plains Steppe Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – typically found near water and dense forest conditions, both coniferous and riparian; roost sites consNof exfoliating bark and tree cavities, open buildings, and caves or mines; winter hibernacula are frequently caves and mines

Ecosystem diversity – all Ecoregions
Primary EDM's – forested ecosystems; riparian/wetland ecosystems, see Figures 4.1.2.2, 4.2.2.2, 4.3.2.2, 4.4.2.2, 4.5.2.2, 4.4.4.2, and 4.5.4.2

CAUSES OF CONCERN

- Habitat loss/degradation
  - Timber harvest that removes large trees and snags
  - Suppression of historical fire regimes that promoted large trees and snags on the landscape
  - Closure of mines and caves
- Human disturbance of roosting sites and hibernacula
- Pesticides to control mosquitoes and other prey items

EXISTING RECOVERY PLANS/CONSERVATION STRATEGY

South Dakota Bat Working Group. 2004. South Dakota bat management plan. Wildlife Division Report 2004-08. 89pp. Available online at: http://www.sdgfp.info/Wildlife/ Diversity/batmanagmentplan71304.pdf

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://www.sdgfp.info/Wildlife/Diversity/battechreport.pdf

COMMON NAME: TOWNSEND'S BIG-EARED BAT (TBBA)

Scientific Name: *Corynorhinus townsendii*

DESCRIPTION

Large, insectivorous bat with buff colored fur on back and pale buff on the belly; year-round resident

PROTECTION STATUS

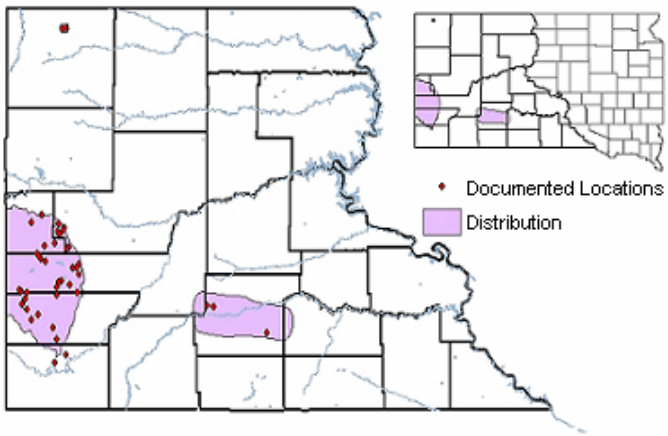
Federal: None
State: None
Global Rank: G4
State Rank: S2S3

DISTRIBUTION

Historical: Black Hills and Great Plains Steppe Ecoregions

Current: Black Hills and Great Plains Steppe Ecoregions, see Figure on right

Sources: Jones, J. K., Jr., D. M. Armstrong, R. S. Hoffmann, and C. Jones. 1983. Mammals of the northern Great Plains. University of Nebraska, Lincoln, Nebraska.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

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

Ecosystem diversity – Black Hills; Great Plains Steppe Ecoregions
Primary EDM – forested ecosystems, see Figures 4.4.4.2 and 4.5.4.2
Qualifier – riparian/wetland and grass/shrub ecosystems adjacent to forested ecosystems may be important foraging habitat as well
Limitations –information is not available on preferred foraging habitat by ecological site

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Closure of caves and mines
- Disturbance and vandalism to roost sites and hibernacula

EXISTING RECOVERY PLANS/CONSERVATION STRATEGY

South Dakota Bat Working Group. 2004. South Dakota bat management plan. Wildlife Division Report 2004-08. 89pp. Available online at: http://www.sdgfp.info/Wildlife/ Diversity/batmanagmentplan71304.pdf

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://www.sdgfp.info/Wildlife/Diversity/battechreport.pdf

COMMON NAME: FRANKLIN'S GROUND SQUIRREL (FGSQ)

Scientific Name: *Spermophilus franklinii*

DESCRIPTION

Large, burrowing ground squirrel with brownish gray back and yellowish rump

PROTECTION STATUS

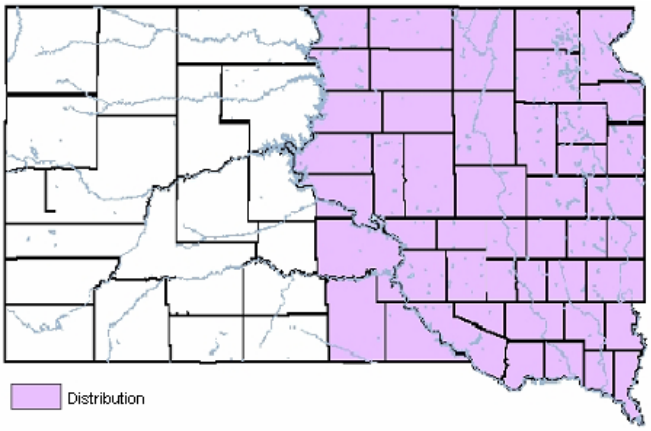
Federal: None
State: None
Global Rank: G5
State Rank: S5

DISTRIBUTION

Historical: Eastern Prairie Ecoregion

Current: Tallgrass and Mixed-grass Subregions, see Figure on right

Sources: Hall, E. R. 1981. Mammals of North America. John Wiley and Sons, New York, NY.
Higgins, K. F., E. Dowd Stukel, J. M. Goulet, and D. C. Backlund. 2000. Wild mammals of South Dakota. South Dakota Department of Game, Fish and Parks, Pierre, South Dakota.
Jones, J. K., Jr., D. M. Armstrong, R. S. Hoffmann, and C. Jones. 1983. Mammals of the northern Great Plains. University of Nebraska, Lincoln, Nebraska.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – prefers tall-statured grass ecosystems with relatively dense cover

Ecosystem Diversity – Tallgrass and Mixed-grass Subregions
Primary EDM – grass/shrub ecosystems, see Figures 4.1.1.2 and 4.2.1.2
Qualifier – sometimes prefers grasslands adjacent to riparian/wetland ecosystems
Limitations – contradictory information on preferred habitat

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Conversion due to agriculture, urban development, and other purposes
  - Unable to disperse in fragmented landscapes due to aversion to short-grass or sparsely vegetated conditions
- Possible increased predation rates

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: RICHARDSON'S GROUND SQUIRREL (RGSQ)

Scientific Name: *Spermophilus richardsonii*

DESCRIPTION

Burrowing ground squirrel

PROTECTION STATUS

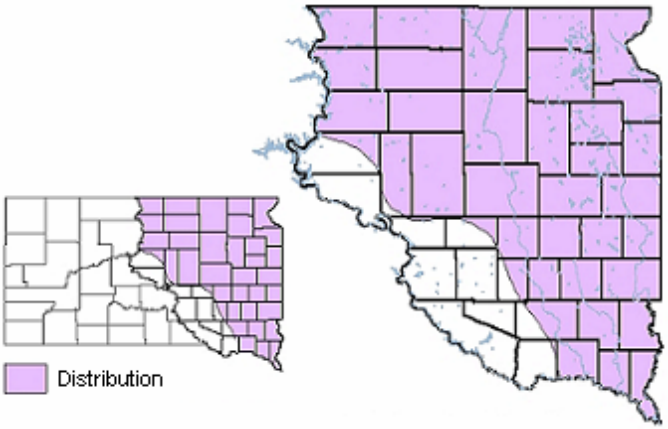
Federal: None
State: None
Global Rank: G5
State Rank: S5

DISTRIBUTION

Historical: Northern 2/3 of Tallgrass Subregion and northern 1/3 of Mixed-grass Subregion

Current: Tallgrass and Mixed-grass Subregions see Figure on right

Sources: Hall, E. R. 1981. Mammals of North America. John Wiley and Sons, New York, NY.
Higgins, K. F., E. Dowd Stukel, J. M. Goulet, and D. C. Backlund. 2000. Wild mammals of South Dakota. South Dakota Department of Game, Fish and Parks, Pierre, South Dakota.
Jones, J. K., Jr., D. M. Armstrong, R. S. Hoffmann, and C. Jones. 1983. Mammals of the northern Great Plains. University of Nebraska, Lincoln, Nebraska.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – relatively flat to gently rolling, short-statured grassland ecosystems

Ecosystem Diversity – Tallgrass and Mixed-grass Subregions
Primary EDM – grass/shrub ecosystems, see Figures 4.1.1.2 and 4.2.1.2
Limitations – contradictory information on preferred soils with some indicating preference for sandy soils and others indicating preference for soils that will not collapse

CAUSES OF CONCERN

- Habitat loss/degradation
  - Conversion to agricultural lands or for urbanization
- Mortality due to poisoning, shooting, or trapping

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: NORTHERN FLYING SQUIRREL (NFSQ)

Scientific Name: *Glaucomys sabrinus*

DESCRIPTION

Small, nocturnal squirrel that glides from tree-top to tree-top

PROTECTION STATUS

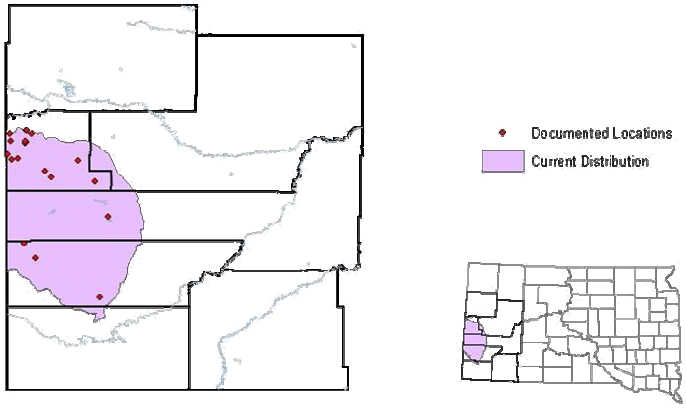
Federal: None
State: None
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Black Hills Ecoregion

Current: Black Hills Ecoregion, see Figure on right

Source: Jones, J. K., Jr., D. M. Armstrong, R. S. Hoffmann, and C. Jones. 1983. Mammals of the northern Great Plains. University of Nebraska, Lincoln, Nebraska.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – 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

Ecosystem Diversity – Black Hills Ecoregion
Primary EDM – forested ecosystems, see Figure 4.5.4.2

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Timber harvest reduces occurrence of large snags for nesting
  - Less contiguous expanses of medium to large tree overstory canopy conditions
  - Increased tree density of overstory canopy

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.

COMMON NAME: BEAR LODGE MEADOW JUMPING MOUSE (BLJM)

Scientific Name: *Zapus hudsonius campestris*

DESCRIPTION

Sub-species of the meadow jumping mouse

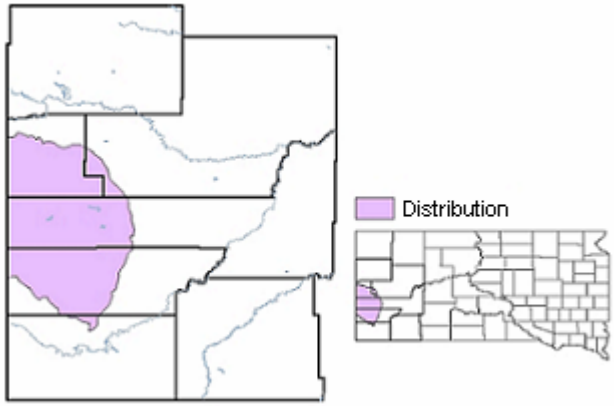
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5T3
State Rank: Not ranked

DISTRIBUTION

Historical: Black Hills Ecoregion

Current: Black Hills Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat - moist lowland areas; prefers relatively thick vegetation of open grassy and brushy areas of marshes, meadows, swamps, and stream sides; elevations up to 6500 feet

Ecosystem Diversity – Black Hills Ecoregion
Primary EDM – riparian/wetland ecosystems, see Figure 4.5.2.2

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Conversion for urbanization and road construction
  - Reduction in amount and quality of riparian vegetation due to reduced in-stream flows resulting from an increase in adjacent upland trees (reduced runoff reaching riparian zone) and water diversion for agriculture, domestic and industrial use
  - Livestock impacts such as over-grazing or brush control to improve grazing
  - Water impoundments and stream channelization
  - Historical mining impacts to stream banks and water quality
  - Timber harvest impacts to streamside vegetation
  - Reduction in active beaver dam complexes and associated riparian vegetation
  - Exotic plants species replacing native species
- Disturbance from recreational activities

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: KIT OR SWIFT FOX (SWFO)

Scientific Name: *Vulpes velox*

DESCRIPTION

Small fox with a black-tipped tail

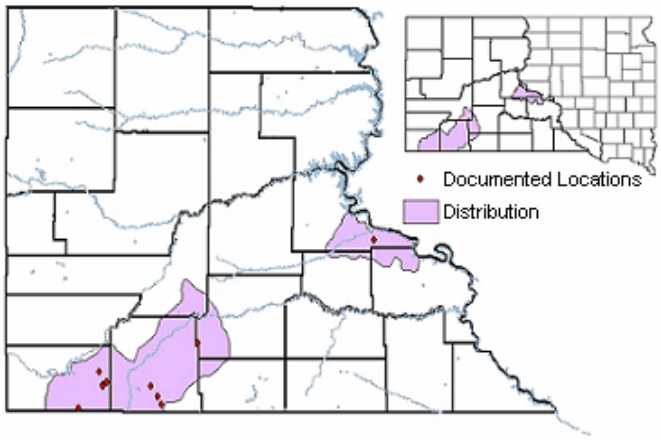
PROTECTION STATUS

Federal: None
State: Threatened
Global Rank: G3
State Rank: S1

DISTRIBUTION

Historical: All Ecoregions except Missouri River

Current: Southern and east-central Great Plains Steppe, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – shortgrass or mixed-grass prairies with open gently rolling topography; usually associated with prairie dogs or ground squirrel colonies

Ecosystem Diversity – Tallgrass Subregion; Mixed-grass Subregion; Great Plains Steppe Ecoregion; Black Hills Ecoregion
Primary EDM – grass/shrub ecosystems, see Figure 4.1.1.2, 4.2.1.2, 4.4.1.2 and 4.5.1.2

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Agricultural conversion and mineral extraction
  - Reduction in number, size and distribution of prairie dog colonies
- Predation and interspecific competition with coyotes and red fox
- Canine distemper
- Susceptible to shooting, trapping, and poisoning
- Vehicle collisions

EXISTING RECOVERY PLANS/CONSERVATION STRATEGY

Kahn, R., L. Fox, P. Homer, B. Giddings, and C. Roy, editors. 1997. Conservation assessment and conservation strategy for swift fox in the United States.

Brechtel, S., *et al*., 1996. National Recovery Plan for the Swift Fox. Report No. 15. Ottawa: Recovery of Nationally Endangered Wildlife Committee, 29 pp.

COMMON NAME: BLACK-FOOTED FERRET (BFFE)

Scientific Name: *Mustela nigripes*

DESCRIPTION

Mink-sized, buff-colored weasel with a short furry tail and oval ears

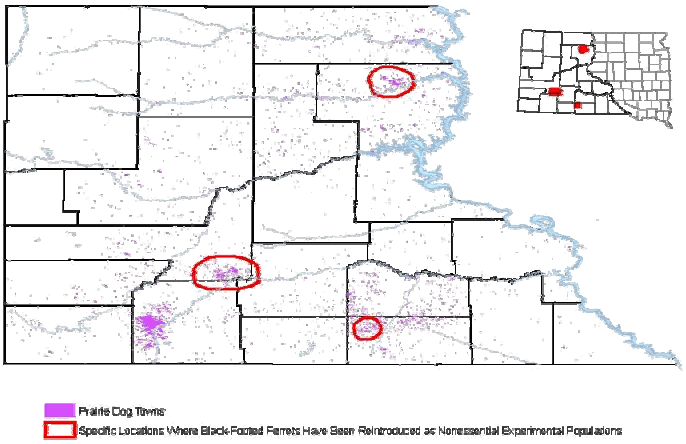
PROTECTION STATUS

Federal: Endangered
State: Endangered
Global Rank: G1
State Rank: S1

DISTRIBUTION

Historical: Great Plains Steppe Ecoregion, Mixed-grass Subregion

Current: Great Plains Steppe Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – requires black-tailed prairie dog colonies in South Dakota; estimates of 100-150 acres of prairie dog colony are required to support one ferret

Ecosystem Diversity – Great Plain Steppe Ecoregion; Mixed-grass Subregion
Primary EDM – grass/shrub ecosystems, see Figures 4.2.1.2 and 4.4.1.2

CAUSES OF CONCERN

- Habitat loss/degradation
  - Reduced number and size of prairie dog colonies resulting from control programs and/or sylvatic plague
- Canine distemper
- Predation by coyotes and badgers
- Barriers to dispersal

EXISTING RECOVERY PLANS/CONSERVATION STRATEGY

U.S. Fish and Wildlife Service. 1988. Black-footed Ferret Recovery Plan. U.S. Fish and Wildlife Service, Denver, Colorado. 154 pp.

COMMON NAME: NORTHERN RIVER OTTER (NROT)

Scientific Name: *Lontra canadensis*

DESCRIPTION

Large, brown furbearing mustelid

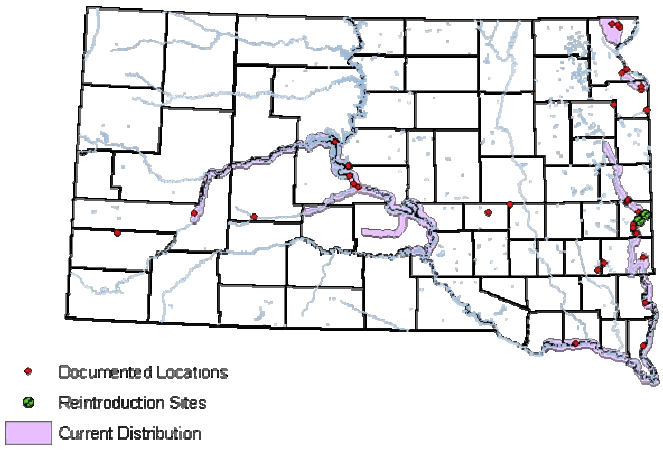
PROTECTION STATUS

Federal: None
State: Threatened
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: All Ecoregions

Current: All Ecoregions, except Black Hills; see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – slow-moving rivers and streams with deep pools, abundant riparian vegetation, and plentiful fish; often associated with beaver activity

Ecosystem Diversity – all Ecoregions
Primary EDM – riparian/wetland ecosystems, see Figures 4.1.2.2, 4.2.2.2, 4.3.2.2, 4.4.2.2 and 4.5.2.2

CAUSES OF CONCERN

- Habitat loss/degradation
  - Degraded riparian vegetation
  - Water pollution
  - Reduced prey populations
  - Reduced number of beaver modified streams/creeks
- Beaver traps
- Road kills
- Diseases such as distemper, rabies, etc.

EXISTING CONSERVATION STRATEGIES/RECOVERY PLAN

None

Figure 4.1.1.2. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of mammal species of greatest conservation need within grass/shrub ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

GRASS/SHRUB ECOSYSTEMS

Disturbance Influenced Pathways	Clayey	Claypan	Thin Claypan	Loamy	Sandy	Thin Upland	Shallow
Early Seral							
Vegetative composition-structure primarily influenced by short-interval fire regimes (<8 yrs.)							
Light Grazing	FGSQ	FGSQ		FGSQ			
Moderate Grazing	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO
Heavy Grazing	RGSQ-SWFO	RGSQ-SWFO	SWFO	RGSQ-SWFO	RGSQ-SWFO	SWFO	SWFO
Vegetative composition-structure primarily influenced by long-interval fire regimes (≥ 8 yrs.)							
Light Grazing							
Moderate Grazing							
Heavy Grazing							

Species Codes
FGSQ = Franklin's ground squirrel
RGSQ = Richardson's ground squirrel
SWFO = kit or swift fox

Figure 4.1.2.2. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of mammal species of greatest conservation need within riparian/wetland ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

RIPARIAN/WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Species Codes: NOMY = northern myotis; NROT = northern river otter

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors (Geomorphic / Water Regime / Slope)	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
				Littoral	Temporary	Semi-permanent	Permanent	Perennial: Low Gradient ≤ 2% slope	Intermittent: Low Gradient ≤ 2% slope	Intermittent: Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore					NROT			
			Unconsolidated Shore					NROT			
			Emergent					NROT			
			Scrub-Shrub					NROT			
			Forested					NROT			
		Heavy Bison Grazing	Rocky Shore					NROT			
			Unconsolidated Shore					NROT			
			Emergent					NROT			
			Scrub-Shrub					NROT			
			Forested					NROT			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore					NROT			
			Unconsolidated Shore					NROT			
			Emergent					NROT			
			Scrub-Shrub					NROT			
			Forested					NROT			
		Heavy Bison Grazing	Rocky Shore					NROT			
			Unconsolidated Shore					NROT			
			Emergent					NROT			
			Scrub-Shrub					NROT			
			Forested					NROT			
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore					NROT			
			Unconsolidated Shore					NROT			
			Emergent					NROT			
			Scrub-Shrub					NROT			
			Forested					NROT			
		Heavy Bison Grazing	Rocky Shore					NROT			
			Unconsolidated Shore					NROT			
			Emergent					NROT			
			Scrub-Shrub					NROT			
			Forested					NROT			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore					NROT			
			Unconsolidated Shore					NROT			
			Emergent					NROT			
			Scrub-Shrub					NROT			
			Forested	NOMY	NOMY	NOMY	NOMY	NOMY/NROT	NOMY	NOMY	NOMY
		Heavy Bison Grazing	Rocky Shore					NROT			
			Unconsolidated Shore					NROT			
			Emergent					NROT			
			Scrub-Shrub					NROT			
			Forested	NOMY	NOMY	NOMY	NOMY	NOMY/NROT	NOMY	NOMY	NOMY

Figure 4.2.1.2. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of mammal species of greatest conservation need within grass/shrub ecosystems of the Mixedgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

GRASS/SHRUB ECOSYSTEMS

Disturbance Influenced Pathways	Ecolological Site Class							
	Dense Clay	Clayey	Shallow Clayey	Claypan	Loamy	Sandy	Shallow	Very Shallow
Early Seral								
Prairie Dog Town, active		SWFO/BFFE		SWFO/BFFE	SWFO/BFFE			
Prairie Dog Town, inactive		SWFO		SWFO	SWFO			
Vegetative composition/structure primarily influenced by short-interval fire regimes (<10 yrs.)								
Light Grazing	FGSQ	FGSQ	FGSQ	FGSQ	FGSQ	FGSQ	FGSQ	FGSQ
Moderate Grazing	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO
Heavy Grazing	SWFO	RGSQ-SWFO	SWFO	RGSQ-SWFO	RGSQ-SWFO	RGSQ-SWFO	SWFO	SWFO
Vegetative composition/structure primarily influenced by long-interval fire regimes (>10 yrs.)								
Light Grazing								
Moderate Grazing								
Heavy Grazing								

Ecosystems that do not occur

Species Codes
BFFE = black-footed ferret
FGSQ = Franklin's ground squirrel
RGSQ = Richardson's ground squirrel
SWFO = kit or swift fox

Figure 4.2.2.2. South Dakota Comprehensive Wildlife Conservation Strategy - expected distributions of mammal species of greatest conservation need within riparian/wetland ecosystems of the Mixedgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

RIPARIAN-WETLAND ECOSYSTEMS

KEY

Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways			Habitat Descriptors	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
				Geomorphic →								
				Water Regime →	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
				Slope →					Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing		Rocky Shore					NROT			
				Unconsolidated Shore					NROT			
				Emergent					NROT			
				Scrub-Shrub					NROT			
				Forested					NROT			
		Heavy Bison Grazing		Rocky Shore					NROT			
				Unconsolidated Shore					NROT			
				Emergent					NROT			
				Scrub-Shrub					NROT			
				Forested					NROT			
	Beaver Unmodified System	Low to Moderate Bison Grazing		Rocky Shore					NROT			
				Unconsolidated Shore					NROT			
				Emergent					NROT			
				Scrub-Shrub					NROT			
				Forested					NROT			
		Heavy Bison Grazing		Rocky Shore					NROT			
				Unconsolidated Shore					NROT			
				Emergent					NROT			
				Scrub-Shrub					NROT			
				Forested					NROT			
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing		Rocky Shore					NROT			
				Unconsolidated Shore					NROT			
				Emergent					NROT			
				Scrub-Shrub					NROT			
				Forested					NROT			
		Heavy Bison Grazing		Rocky Shore					NROT			
				Unconsolidated Shore					NROT			
				Emergent					NROT			
				Scrub-Shrub					NROT			
				Forested					NROT			
	Beaver Unmodified System	Low to Moderate Bison Grazing		Rocky Shore					NROT			
				Unconsolidated Shore					NROT			
				Emergent					NROT			
				Scrub-Shrub					NROT			
				Forested	NOMY	NOMY	NOMY	NOMY	NOMY/NROT	NOMY	NOMY	NOMY
		Heavy Bison Grazing		Rocky Shore					NROT			
				Unconsolidated Shore					NROT			
				Emergent					NROT			
				Scrub-Shrub					NROT			
				Forested	NOMY	NOMY	NOMY	NOMY	NOMY/NROT	NOMY	NOMY	NOMY

Species Codes
NOMY = northern myotis
NROT = northern river otter

Figure 4.3.2.2. South Dakota Comprehensive Wildlife Conservation Plan- expected distributions of mammal species of greatest conservation need within riparian/wetland ecosystems of the Missouri River Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MISSOURI RIVER ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Species Codes: NOMY = northern myotis; NROT = northern river otter

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways	Habitat Descriptors	DEPRESSIONAL SYSTEMS: Temporary	DEPRESSIONAL SYSTEMS: Semi-permanent	DEPRESSIONAL SYSTEMS: Permanent	RIVERINE SYSTEMS: Perennial, Low Gradient ≤ 2% slope	RIVERINE SYSTEMS: Intermittent, Low Gradient ≤ 2% slope	RIVERINE SYSTEMS: Intermittent, Mid-High Gradient > 2% slope	SLOPE SYSTEMS
EARLY SUCCESSIONAL	Beaver Modified System	Low to Moderate Bison Grazing							
		Rocky Shore				NROT			
		Unconsolidated Shore				NROT			
		Emergent				NROT			
		Scrub-Shrub				NROT			
		Forested				NROT			
		Heavy Bison Grazing							
		Rocky Shore				NROT			
		Unconsolidated Shore				NROT			
		Emergent				NROT			
		Scrub-Shrub				NROT			
		Forested				NROT			
	Beaver Unmodified System	Low to Moderate Bison Grazing							
		Rocky Shore				NROT			
		Unconsolidated Shore				NROT			
		Emergent				NROT			
		Scrub-Shrub				NROT			
		Forested				NROT			
		Heavy Bison Grazing							
		Rocky Shore				NROT			
		Unconsolidated Shore				NROT			
		Emergent				NROT			
		Scrub-Shrub				NROT			
		Forested				NROT			
LATE SUCCESSIONAL	Beaver Modified System	Low to Moderate Bison Grazing							
		Rocky Shore				NROT			
		Unconsolidated Shore				NROT			
		Emergent				NROT			
		Scrub-Shrub				NROT			
		Forested				NROT			
		Heavy Bison Grazing							
		Rocky Shore				NROT			
		Unconsolidated Shore				NROT			
		Emergent				NROT			
		Scrub-Shrub				NROT			
		Forested				NROT			
	Beaver Unmodified System	Low to Moderate Bison Grazing							
		Rocky Shore				NROT			
		Unconsolidated Shore				NROT			
		Emergent				NROT			
		Scrub-Shrub				NROT			
		Forested	NOMY	NOMY	NOMY	NOMY-NROT			NOMY
		Heavy Bison Grazing							
		Rocky Shore				NROT			
		Unconsolidated Shore				NROT			
		Emergent				NROT			
		Scrub-Shrub				NROT			
		Forested	NOMY	NOMY	NOMY	NOMY-NROT			NOMY

Figure 4.4.1.2. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of mammal species of greatest conservation need within grass/shrub ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

GRASS/SHRUB ECOSYSTEMS

Disturbance Influenced Pathways	Ecolological Site Class								
	Porous Clay	Dense Clay	Clayey	Claypan	Loamy	Shallow	Badlands	Sandy	Saline Upland
Early Seral							FTMY		
Prairie Dog Town, active			SWFO/BFFE	SWFO/BFFE	SWFO/BFFE				SWFO/BFFE
Prairie Dog Town, inactive			SWFO	SWFO	SWFO				SWFO
Vegetative composition/structure primarily influenced by short-interval fire regimes (<15 yrs.)									
Light Grazing							FTMY		
Moderate Grazing	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO-FTMY	SWFO	SWFO
Heavy Grazing	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO-FTMY	SWFO	SWFO
Vegetative composition/structure primarily influenced by long-interval fire regimes (>15 yrs.)									
Light Grazing							FTMY		
Moderate Grazing							FTMY		
Heavy Grazing							FTMY		

KEY

Ecosystems that do not occur

Species Codes
BFFE = black-footed ferret
FTMY = fringe-tailed myotis
SWFO = kit or swift fox

Figure 4.4.2.2. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of mammal species of greatest conservation need within riparian/wetland ecosyste of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

KEY

Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways			Habitat Descriptors	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS				SLOPE SYSTEMS
				Geomorphic →									
				Water Regime →	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*		*Intermittent*		
				Slope →					Low Gradient with floodplain	Mid-High Gradient without floodplain	Low Gradient with floodplain	Mid-High Gradient without floodplain	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing		Rocky Shore					NROT	NROT			
				Unconsolidated Shore					NROT	NROT			
				Emergent					NROT	NROT			
				Scrub-Shrub					NROT	NROT			
				Forested					NROT	NROT			
		Heavy Bison Grazing		Rocky Shore					NROT	NROT			
				Unconsolidated Shore					NROT	NROT			
				Emergent					NROT	NROT			
				Scrub-Shrub					NROT	NROT			
				Forested					NROT	NROT			
	Beaver Unmodified System	Low to Moderate Bison Grazing		Rocky Shore					NROT	NROT			
				Unconsolidated Shore					NROT	NROT			
				Emergent					NROT	NROT			
				Scrub-Shrub					NROT	NROT			
				Forested					NROT	NROT			
		Heavy Bison Grazing		Rocky Shore					NROT	NROT			
				Unconsolidated Shore					NROT	NROT			
				Emergent					NROT	NROT			
				Scrub-Shrub					NROT	NROT			
				Forested					NROT	NROT			
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing		Rocky Shore					NROT	NROT			
				Unconsolidated Shore					NROT	NROT			
				Emergent					NROT	NROT			
				Scrub-Shrub					NROT	NROT			
				Forested					NROT	NROT			
		Heavy Bison Grazing		Rocky Shore					NROT	NROT			
				Unconsolidated Shore					NROT	NROT			
				Emergent					NROT	NROT			
				Scrub-Shrub					NROT	NROT			
				Forested					NROT	NROT			
	Beaver Unmodified System	Low to Moderate Bison Grazing		Rocky Shore					NROT	NROT			
				Unconsolidated Shore					NROT	NROT			
				Emergent					NROT	NROT			
				Scrub-Shrub					NROT	NROT			
				Forested	NOMY	NOMY	NOMY	NOMY	NOMY/NROT	NOMY/NROT	NOMY	NOMY	NOMY
		Heavy Bison Grazing		Rocky Shore					NROT	NROT			
				Unconsolidated Shore					NROT	NROT			
				Emergent					NROT	NROT			
				Scrub-Shrub					NROT	NROT			
				Forested	NOMY	NOMY	NOMY	NOMY	NOMY/NROT	NOMY/NROT	NOMY	NOMY	NOMY

Species Codes
NOMY = northern myotis
NROT = northern river otter

Figure 4.4.4.2. South Dakota Comprehensive Wildlife Conservation Plan - expected distribution of mammal species of greatest conservation need within the forested ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX
SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

FORESTED ECOSYSTEMS

Disturbance Influenced Pathways	Warm, Dry Bur Oak	Xeric Ponderosa Pine	Warm, Dry Ponderosa Pine
SEEDLING/ SHRUB			FTMY
SAPLING			FTMY
Stand conditions/structure PREDOMINANTLY influenced by short-interval fire regimes			
SMALL TREES			
MEDIUM TREES			
LARGE TREES	TBBA	TBBA	FTMY/TBBA
Stand conditions/structure PREDOMINANTLY influenced by long-interval fire regimes			
SMALL TREES			
MEDIUM TREES		NOMY	NOMY
LARGE TREES		NOMY	NOMY

Species Codes
FTMY = fringe-tailed myotis
NOMY - Northern myotis
TBBA = Townsend's big-eared bat

Figure 4.5.1.2. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of mammal species of greatest conservation need within grass/shrub ecosystems of the Black Hills Ecoregion. SWFO = kit or swift fox

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

GRASS/SHRUB ECOSYSTEMS

Disturbance Influenced Pathways	Ecological Site Class: Clayey	Claypan	Loamy	Shallow	Thin Upland	Sandy	High Country Loamy	Mountain Prairie
Early Seral								
Prairie Dog Town, active	SWFO	SWFO	SWFO				SWFO	SWFO
Prairie Dog Town, inactive	SWFO	SWFO	SWFO				SWFO	SWFO
Vegetative composition/structure primarily influenced by short-interval fire regimes (<25 yrs.)								
Light Grazing								
Moderate Grazing	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO
Heavy Grazing	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO	SWFO
Vegetative composition/structure primarily influenced by long-interval fire regimes (>25 yrs.)								
Light Grazing								
Moderate Grazing								
Heavy Grazing								

Ecosystems that do not occur

Figure 4.5.2.2. South Dakota Comprehensive Wildlife Conservation Plan - exptected distributions of mammal species of greatest conservation need within riparian/wetland ecosystems of the Black Hills Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - BLACK HILLS ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

KEY

Ecosystems that do not occur

Species Codes
BLJM = Bear Lodge meadow jumping mouse
NOMY = northern myotis
NROT = northern river otter

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS				SLOPE SYSTEMS
			Geomorphic →								
			Water Regime →	Temporary	Semi-permanent	Permanent	Perennial		Intermittent		
			Gradient →				Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Grazing	Rocky Shore				NROT	NROT			
			Unconsolidated Shore				NROT	NROT			
			Emergent		BLJM	BLJM	NROT-BLJM	NROT-BLJM			
			Scrub-Shrub		BLJM	BLJM	NROT-BLJM	NROT-BLJM			
			Forested		BLJM	BLJM	NROT-BLJM	NROT-BLJM			
		Heavy Grazing	Rocky Shore				NROT	NROT			
			Unconsolidated Shore				NROT	NROT			
			Emergent				NROT	NROT			
			Scrub-Shrub				NROT	NROT			
			Forested				NROT	NROT			
	Beaver Unmodified System	Low to Moderate Grazing	Rocky Shore				NROT	NROT			
			Unconsolidated Shore				NROT	NROT			
			Emergent	BLJM	BLJM	BLJM	NROT-BLJM	NROT-BLJM	BLJM	BLJM	BLJM
			Scrub-Shrub	BLJM	BLJM	BLJM	NROT-BLJM	NROT-BLJM	BLJM	BLJM	BLJM
			Forested	BLJM	BLJM	BLJM	NROT-BLJM	NROT-BLJM	BLJM	BLJM	BLJM
		Heavy Grazing	Rocky Shore				NROT	NROT			
			Unconsolidated Shore				NROT	NROT			
			Emergent				NROT	NROT			
			Scrub-Shrub				NROT	NROT			
			Forested				NROT	NROT			
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Grazing	Rocky Shore				NROT	NROT			
			Unconsolidated Shore				NROT	NROT			
			Emergent		BLJM	BLJM	NROT-BLJM	NROT-BLJM			
			Scrub-Shrub		BLJM	BLJM	NROT-BLJM	NROT-BLJM			
			Forested		BLJM-NOMY	BLJM-NOMY	NOMY-NROT-BLJM	NOMY-NROT-BLJM			
		Heavy Grazing	Rocky Shore				NROT	NROT			
			Unconsolidated Shore				NROT	NROT			
			Emergent				NROT	NROT			
			Scrub-Shrub				NROT	NROT			
			Forested		NOMY	NOMY	NOMY-NROT	NOMY-NROT			
	Beaver Unmodified System	Low to Moderate Grazing	Rocky Shore				NROT	NROT			
			Unconsolidated Shore				NROT	NROT			
			Emergent	BLJM	BLJM	BLJM	NROT-BLJM	NROT-BLJM	BLJM	BLJM	BLJM
			Scrub-Shrub	BLJM	BLJM	BLJM	NROT-BLJM	NROT-BLJM	BLJM	BLJM	BLJM
			Forested	NOMY-BLJM	NOMY-BLJM	NOMY-BLJM	NOMY-NROT-BLJM	NOMY-NROT-BLJM	NOMY-BLJM	NOMY-BLJM	NOMY-BLJM
		Heavy Grazing	Rocky Shore				NROT	NROT			
			Unconsolidated Shore				NROT	NROT			
			Emergent				NROT	NROT			
			Scrub-Shrub				NROT	NROT			
			Forested	NOMY	NOMY	NOMY	NOMY-NROT	NOMY-NROT	NOMY	NOMY	NOMY

Figure 4.5.4.2. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of mammal species of greatest conservation need within forested ecosystems of the Black Hills Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

FORESTED ECOSYSTEMS

Disturbance Influenced Pathways	Warm, Dry Bur Oak	Xeric Ponderosa Pine	Warm, Dry Ponderosa Pine	Warm, Moist Ponderosa Pine	Warm, Moist Quaking Aspen	Cool, Moist White Spruce	High Elevation Limber Pine
SEEDLING-SHRUB			FTMY	FTMY	FTMY	FTMY	
SAPLING			FTMY	FTMY	FTMY	FTMY	
Stand conditions-structure PREDOMINANTLY influenced by short-interval fire regimes							
SMALL TREES							
MEDIUM TREES							
LARGE TREES	TBBA-NFSQ	TBBA-NFSQ	FTMY-TBBA-NFSQ	FTMY-TBBA-NFSQ		FTMY	
Stand conditions-structure PREDOMINANTLY influenced by long-interval fire regimes							
SMALL TREES							
MEDIUM TREES				NOMY	NOMY	NOMY	
LARGE TREES				FTMY-NOMY	NOMY	FTMY-NOMY	

Species Codes
FTMY = fringe-tailed myotis
NFSQ = northern flying squirrel
NOMY = northern myotis
TBBA = Townsend's big-eared bat

Freshwater Mussels

COMMON NAME: ELKTOE (ELKT)

Scientific Name: *Alasmidonta marginata*

DESCRIPTION

Freshwater mussel with a bright yellowish green shell with numerous dark green rays

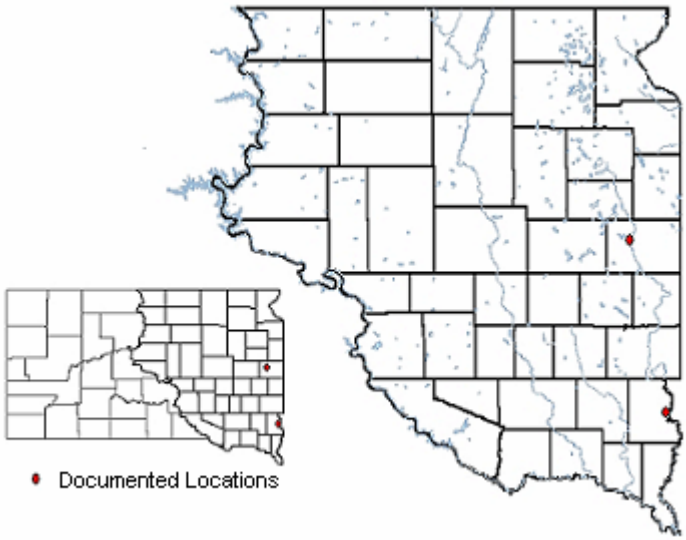
PROTECTION STATUS

Federal: None
State: None
Global Rank: G4
State Rank: S1

DISTRIBUTION

Historical: Big Sioux River of the Tallgrass Subregion

Current: Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – prefers small streams with a swift current and sand or gravel bottoms at depths of several inches to two feet

Ecosystem diversity – Tallgrass Subregion
Primary EDM – aquatic ecosystems, see Figure 4.1.3.3

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Point (agricultural, urban and/or industrial discharge) and non-point (surface runoff of pesticides, fertilizers, and silt) pollution
  - Dredging for channel maintenance or modification
  - Impoundments or altered hydrology
- Competition from exotic species
- Predation by raccoons, mink, turtles, muskrats, and some birds

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: ROCK POCKETBOOK (ROPO)

Scientific Name: *Arcidens confragosus*

DESCRIPTION

Mussel with large, relatively thin shell and heavily sculptured

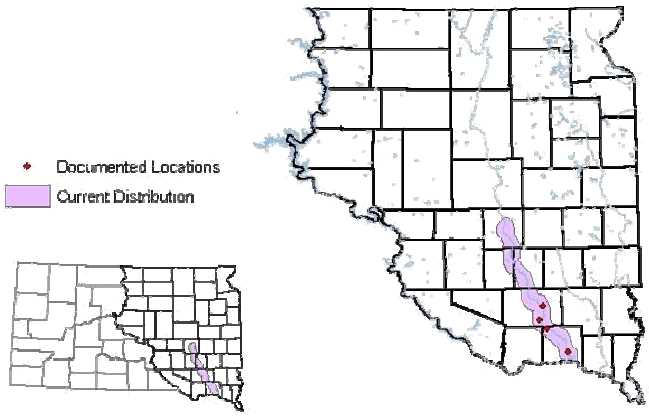
PROTECTION STATUS

Federal: None
State: None
Global Rank: G4
State Rank: S1

DISTRIBUTION

Historical: Common in the James River of the Eastern Prairie Ecoregion

Current: Tallgrass Subregion, Mixed-grass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – prefers mud and sand bottom pools in medium to large rivers in standing or slow flowing water; large lowland streams with little or no flow; host species include rock bass and channel catfish

Ecosystem diversity – Tallgrass Subregion; Mixed-grass Subregion
Primary EDM – aquatic ecosystems, see Figures 4.1.3.3 and 4.2.3.3

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Point (agricultural, urban and/or industrial discharge) and non-point (surface runoff of pesticides, fertilizers, and silt) pollution
  - Dredging for channel maintenance or modification; also contributes to direct mortality
  - Impoundments or altered hydrology
- Competition from exotic species
- Predation by raccoons, mink, turtles, muskrats, and some birds

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: CREEK HEELSPLITTER (CRHE)

Scientific Name: *Lasmigona compressa*

DESCRIPTION

Small to medium-sized mussel with relatively thin, elongate shell and well-developed lateral teeth

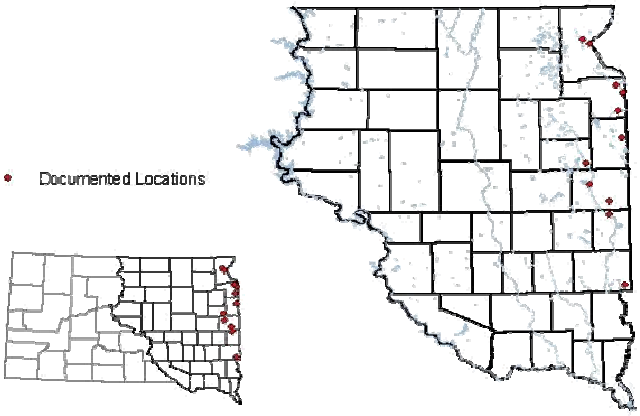
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S1

DISTRIBUTION

Historical: Tallgrass Subregion

Current: Eastern portion of the Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – creeks and the headwaters of small to medium sized rivers in fine gravel or sand; rarely found in large rivers; potential host species include spotfin shiners, slimy sculpins, crappie, and perch.

Ecosystem diversity – Tallgrass Subregion
Primary EDM – aquatic ecosystems, see Figure 4.1.3.3

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Point (agricultural, urban and/or industrial discharge) and non-point (surface runoff of pesticides, fertilizers, and silt) pollution
  - Dredging for channel maintenance or modification
  - Impoundments or altered hydrology
- Competition from exotic species
- Predation by raccoons, mink, turtles, muskrats, and some birds

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: HIGGINS EYE (HIEY)

Scientific Name: *Lampsilis higginsii*

DESCRIPTION

Mussel with slightly elongate, thick, smooth, and inflated shell; yellowish brown with green rays

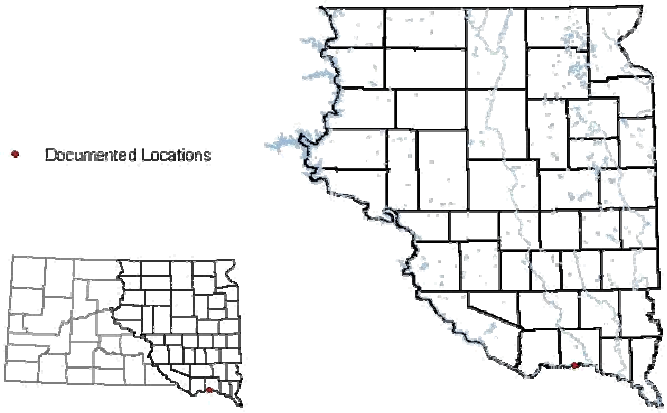
PROTECTION STATUS

Federal: Endangered
State: None
Global Rank: G1
State Rank: S1

DISTRIBUTION

Historical: Unknown

Current: Missouri River Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – prefers large rivers where it is usually found in deep water and moderate currents; buries itself in sand and gravel river bottoms; host species may include bass and walleye

Ecosystem diversity – Missouri River Ecoregion
Primary EDM – aquatic ecosystems, see Figure 4.3.3.3

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Point (agricultural, urban and/or industrial discharge) and non-point (surface runoff of pesticides, fertilizers, and silt) pollution
  - Dredging for channel maintenance or modification
  - Impoundments or altered hydrology
- Competition from exotic species

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

U.S. Fish and Wildlife Service. 2004. Higgins Eye Pearlymussel (*Lampsilis higginsii*) Recovery Plan: First Revision. Ft. Snelling, Minnesota. 126 pp.

COMMON NAME: SCALESHELL (SCAL)

Scientific Name: *Leptodea leptodon*

DESCRIPTION

Mussel with an elongated-elliptical, compressed, thin, translucent shell

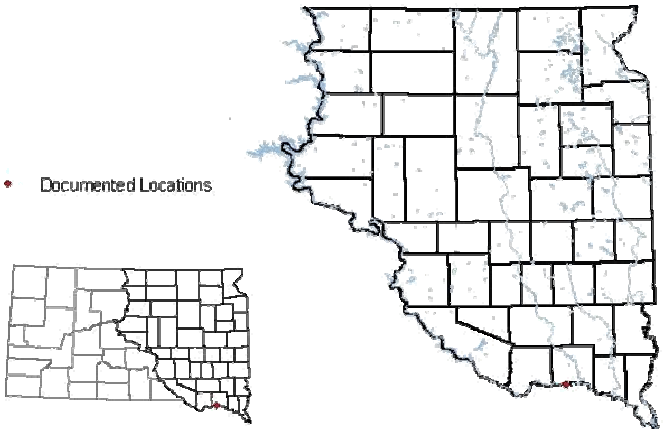
PROTECTION STATUS

Federal: Endangered
State: None
Global Rank: G1
State Rank: S1

DISTRIBUTION

Historical: Unknown

Current: Missouri River Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – occurs in riffles with moderate to high gradients in creeks to large rivers; substrates of mud, sand, or mixed gravel, cobble, and boulders; host species freshwater drum

Ecosystem diversity – Missouri River Ecoregion
Primary EDM – aquatic ecosystems, see Figure 4.3.3.3

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Point (agricultural, urban and/or industrial discharge) and non-point (surface runoff of pesticides, fertilizers, and silt) pollution
  - Dredging for channel maintenance or modification
  - Impoundments or altered hydrology
- Competition from exotic species

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

U.S. Fish and Wildlife Service. 2004. Scaleshell Mussel Draft Recovery Plan (*Leptodea leptodon*). U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 90 pp.

COMMON NAME: HICKORYNUT (HICK)

Scientific Name: *Obovaria olivaria*

DESCRIPTION

Mussel with thick, rounded, or oblong shell with a smooth surface; greenish or yellowish brown

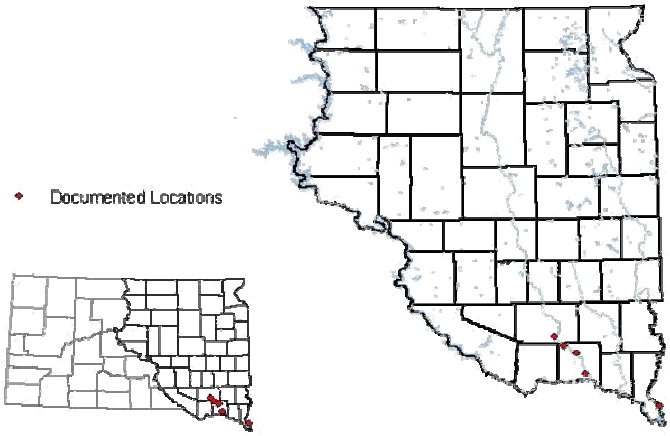
PROTECTION STATUS

Federal: None
State: None
Global Rank: G4
State Rank: S1

DISTRIBUTION

Historical: Missouri River, Mixedgrass and Tallgrass Subregions

Current: Missouri River Ecoregion, Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – large rivers in sand or mixed sand and gravel in good current; host species include freshwater drum and shovelnose sturgeon

Ecosystem diversity – Tallgrass Subregion and Mixedgrass Subregion; Missouri River Ecoregion
Primary EDM – aquatic ecosystems, see Figure 4.1.3.3, 4.2.3.3, and 4.3.3.3

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Point (agricultural, urban and/or industrial discharge) and non-point (surface runoff of pesticides, fertilizers, and silt) source pollution
  - Dredging for channel maintenance or modification
  - Impoundments or altered hydrology
  - Barriers to host fish movements such as dams
- Competition from exotic species

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: MAPLELEAF (MAPL)

Scientific Name: *Quadrula quadrula*

DESCRIPTION

Mussel with square-ish, somewhat inflated shell; yellowish-green to light brown

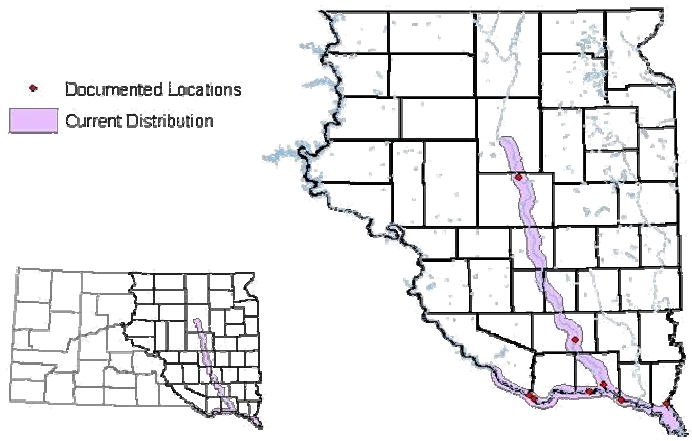
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Missouri River Ecoregion, Mixedgrass and Tallgrass Subregions

Current: Missouri River Ecoregion, Mixedgrass Subregion, Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – medium to large rivers with mud, sand, or gravel bottom; fish host – flathead catfish

Ecosystem diversity – Missouri River Ecoregion, Tall Grass Subregion and Mixedgrass Subregion
Primary EDM – aquatic ecosystems, see Figure 4.1.3.3, 4.2.3.3 and 4.3.3.3

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Point (agricultural, urban and/or industrial discharge) and non-point (surface runoff of pesticides, fertilizers, and silt) pollution
  - Dredging for channel maintenance or modification
  - Impoundments or altered hydrology
  - Barriers to host fish movements such as dams
- Competition from exotic species

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

Figure 4.1.3.3. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of mussel species of greatest conservation need within aquatic ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

AQUATIC ECOSYSTEMS

Time Since Major Disturbance (i.e., flood)	Disturbance Influenced Pathways		Geomorphic Setting / Water Regime / Sizeclass / Habitat Descriptor	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS			
								Perennial			
				Limnetic	Littoral	Semi-permanent	Permanent	Large River	Small Rivers	Creeks	Headwater Stream
EARLY SUCCESSIONAL		Beaver Influenced System	Rock Bottom								
			Unconsolidated Bottom					ROPO-MAPL	MAPL		CRHE
			Aquatic Bed								
		Beaver Absent	Rock Bottom								
			Unconsolidated Bottom					ROPO-ELKT-MAPL-HICK	MAPL		CRHE
			Aquatic Bed								
LATE SUCCESSIONAL		Beaver Influenced System	Rock Bottom								
			Unconsolidated Bottom					ROPO-MAPL	MAPL		CRHE
			Aquatic Bed								
		Beaver Absent	Rock Bottom								
			Unconsolidated Bottom					ROPO-ELKT-MAPL-HICK	MAPL		CRHE
			Aquatic Bed								

Species Codes
ELKT = elktoe
CRHE = creek heelsplitter
HICK = hickorynut
MAPL = mapleleaf
ROPO = rock pocketbook

Figure 4.2.3.3. South Dakota Comprehensive Wildlife Conservation Strategy - expected distributions of mussel species of greatest conservation need within aquatic ecosystems of the Mixedgrass subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

AQUATIC ECOSYSTEMS

Time Since Major Disturbance (i.e., flood)	Disturbance Influenced Pathways	Geomorphic Setting / Water Regime / Sizeclass / Habitat Descriptor	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS			
			Limnetic	Littoral	Semi-permanent	Permanent	Perennial			
							Large River	Small River	Creek	Headwater Stream
EARLY SUCCESSIONAL	Beaver Influenced System	Rock Bottom								
		Unconsolidated Bottom					ROPO-MAPL	MAPL		
		Aquatic Bed								
	Beaver Absent	Rock Bottom								
		Unconsolidated Bottom					ROPO-MAPL-HICK	MAPL		
		Aquatic Bed								
LATE SUCCESSIONAL	Beaver Influenced System	Rock Bottom								
		Unconsolidated Bottom					ROPO-MAPL	MAPL		
		Aquatic Bed								
	Beaver Absent	Rock Bottom								
		Unconsolidated Bottom					ROPO-MAPL-HICK	MAPL		
		Aquatic Bed								

Species Codes
HICK = hickorynut
MAPL = mapleleaf
ROPO = rock pocketbook

Figure 4.3.3.3. South Dakota Comprehensive Wildlife Conservation Strategy - expected distributions of mussel species of greatest conservation need within aquatic ecosystems of the Missouri River Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MISSOURI RIVER ECOREGION

AQUATIC ECOSYSTEMS

Time Since Major Disturbance (i.e., flood)	Disturbance Influenced Pathways	Habitat Descriptor	DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS			
Geomorphic Setting					Perennial			
Water Regime			Semi-permanent	Permanent	Large River	Small River	Creek	Headwater Stream
Sizeclass								
EARLY SUCCESSIONAL	Beaver Influenced System	Streambed						
		Unconsolidated Bottom			HIEY-MAPL	MAPL		
		Aquatic Bed						
	Beaver Absent	Streambed			SCAL	SCAL	SCAL	
		Unconsolidated Bottom			HIEY-MAPL-HICK-SCAL	MAPL-SCAL	SCAL	
		Aquatic Bed						
LATE SUCCESSIONAL	Beaver Influenced System	Streambed						
		Unconsolidated Bottom			HIEY-MAPL	MAPL		
		Aquatic Bed						
	Beaver Absent	Streambed			SCAL	SCAL	SCAL	
		Unconsolidated Bottom			HIEY-MAPL-HICK-SCAL	MAPL-SCAL	SCAL	
		Aquatic Bed						

Species Codes
HICK = hickorynut
HIEY = Higgins eye
MAPL = mapleleaf
SCAL = scaleshell

Gastropods

COMMON NAME: DAKOTA VERTIGO (DAVE)

Scientific Name: *Vertigo arthuri*

DESCRIPTION

Land snail with dark orange/brown shell

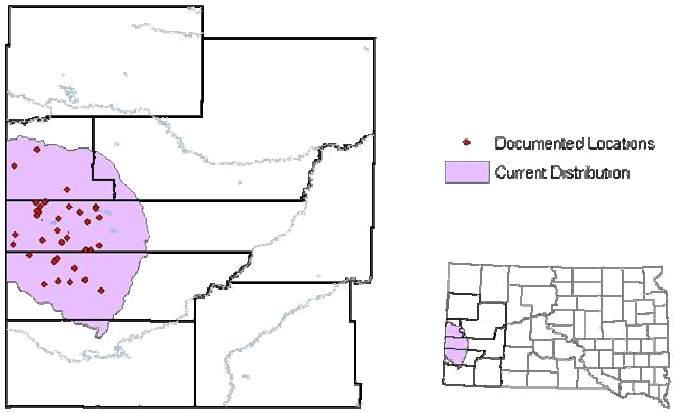
PROTECTION STATUS

Federal: None
State: None
Global Rank: G3Q
State Rank: S2

DISTRIBUTION

Historical: Black Hills Ecoregion

Current: Black Hills Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – undisturbed, moist forests of white spruce or ponderosa pine; understory often characterized by deep litter

Ecosystem diversity – Black Hills Ecoregion
Primary EDM – forested ecosystems, see Figure 4.5.4.4

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Timber harvest that opens the canopy and increases possibility of desiccation
  - Surface disturbance such as trail construction or maintenance, recreational area construction, road salting, road construction, etc.
  - Fire impacts
  - Heavy livestock grazing
- Herbicides/pesticides

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

COMMON NAME: MYSTERY VERTIGO (MYVE)

Scientific Name: *Vertigo paradoxa*

DESCRIPTION

Land snail

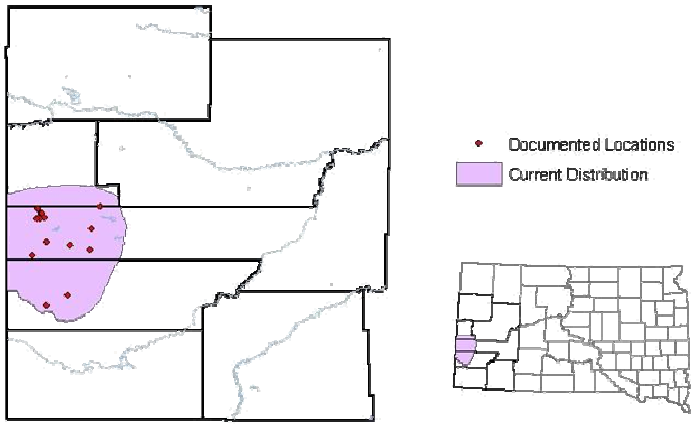
PROTECTION STATUS

Federal: None
State: None
Global Rank: G3G4Q
State Rank: S1

DISTRIBUTION

Historical: Black Hills Ecoregion

Current: Black Hills Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – forests dominated by white spruce or ponderosa pine; north-facing slopes; limestone or schist substrates

Ecosystem diversity – Black Hills Ecoregion
Primary EDM – forested ecosystems, see Figure 4.5.4.4

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Timber harvest that opens the canopy and increases possibility of desiccation
  - Surface disturbance such as trail construction or maintenance, recreational area construction, road salting, road construction, etc.
  - Fire impacts
  - Heavy livestock grazing
- Herbicides/pesticides

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

COMMON NAME: FRIGID AMBERSNAIL (FRAM)

Scientific Name: *Catinella gelida*

DESCRIPTION

Land snail

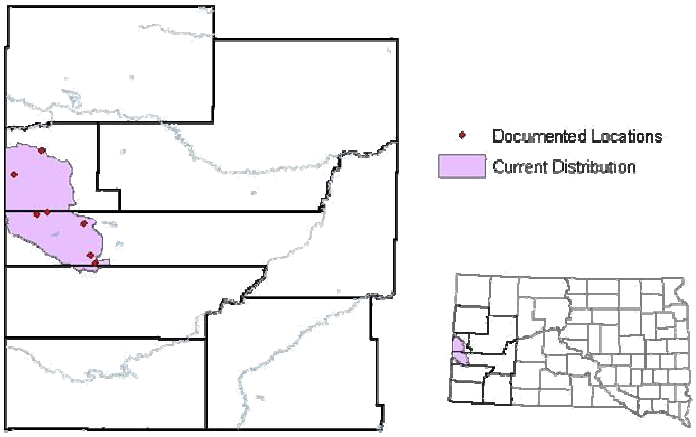
PROTECTION STATUS

Federal: None
State: None
Global Rank: G1
State Rank: S1

DISTRIBUTION

Historical: Black Hills Ecoregion

Current: Black Hills Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – low to medium elevation, dry wooded, limestone talus near the base of a slope

Ecosystem diversity – Black Hills Ecoregion
Primary EDM – forested ecosystems, see Figure 4.5.4.4

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Timber harvest that opens the canopy and increases possibility of desiccation
  - Surface disturbance such as trail construction or maintenance, recreational area construction, road salting, road construction, etc.
  - Fire impacts
  - Heavy livestock grazing
- Herbicides/pesticides

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: COOPER'S ROCKY MOUNTAINSNAIL (CRMO)

Scientific Name: *Oreohelix strigosa cooperi*

DESCRIPTION

Land snail

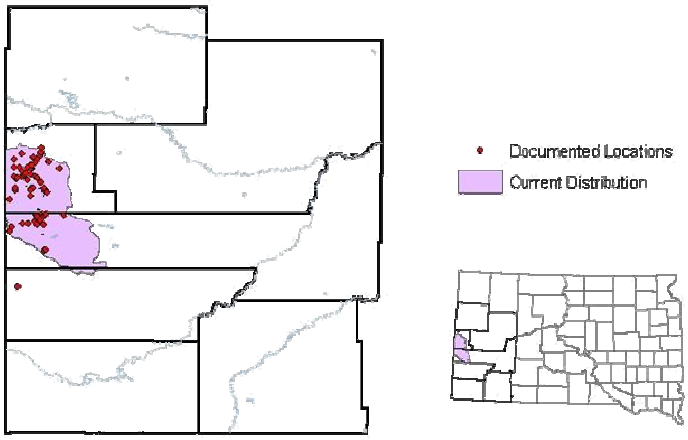
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5T2
State Rank: S2

DISTRIBUTION

Historical: Black Hills Ecoregion

Current: Black Hills Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – calcareous soils in moist ponderosa pine forests above 3000 feet; also found in white spruce/ponderosa pine riparian communities

Ecosystem diversity – Black Hills Ecoregion
Primary EDM's – forested ecosystems, see Figures 4.5.4.4

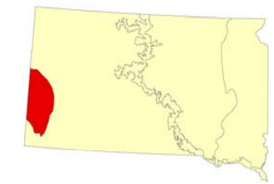
CAUSES OF CONCERN

- Habitat loss/degradation –
  - Timber harvest that opens the canopy and increases possibility of desiccation
  - Surface disturbance such as trail construction or maintenance, recreational area construction, road salting, road construction, etc.
  - Fire impacts
  - Heavy livestock grazing
- Herbicides/pesticides

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

Figure 4.5.4.4. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of gastropod species of greatest conservation need within forested ecosystems of the Black Hills Ecoregion.



ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

FORESTED ECOSYSTEMS

Disturbance Influenced Pathways	Warm, Dry Bur Oak	Xeric Ponderosa Pine	Warm, Dry Ponderosa Pine	Warm, Moist Ponderosa Pine	Warm, Moist Quaking Aspen	Cool, Moist White Spruce	High Elevation Limber Pine
SEEDLING-SHRUB							
SAPLING							
Stand conditions-structure PREDOMINANTLY influenced by short-interval fire regimes							
SMALL TREES							
MEDIUM TREES		FRAM	FRAM	FRAM			
LARGE TREES		FRAM	FRAM	FRAM			
Stand conditions-structure PREDOMINANTLY influenced by long-interval fire regimes							
SMALL TREES							
MEDIUM TREES				DAVE-MYVE-CRMO	DAVE-MYVE-CRMO	DAVE-MYVE-CRMO	
LARGE TREES				DAVE-MYVE-CRMO	DAVE-MYVE-CRMO	DAVE-MYVE-CRMO	

Species Codes
CRMO = Cooper's rocky mountainsnail
DAVE = Dakota vertigo
FRAM = Frigid ambersnail
MYVE = mystery vertigo

Insects

COMMON NAME: GHOST TIGER BEETLE (GTBE)

Scientific Name: *Cicindela lepida*

DESCRIPTION

A small tiger beetle, brown background with white markings that make it appear mostly white

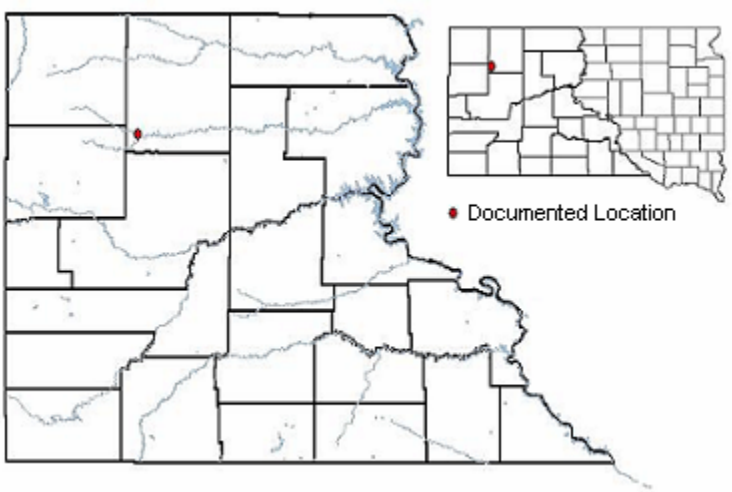
PROTECTION STATUS

Federal: None
State: None
Global Rank: G3G4
State Rank: S1

DISTRIBUTION

Historical: Missouri River Ecoregion and Great Plains Steppe Ecoregion

Current: Great Plains Steppe Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – prefers the open, blowing portion of large sand dunes or sand beaches

Ecosystem diversity –Great Plains Steppe Ecoregion; Missouri River Ecoregion
Primary EDM – grass/shrub ecosystems; riparian/wetland ecosystems, see Figures 4.3.2.5, 4.4.1.5, and 4.4.2.5

CAUSES OF CONCERN

- Habitat loss/degradation -
  - Tree planting or other sand dune stabilization practices

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: GREAT PLAINS TIGER BEETLE (GPTB)

Scientific Name: *Amblycheila cylindriformis*

DESCRIPTION

Largest North American tiger beetle; dark reddish brown to black in coloration

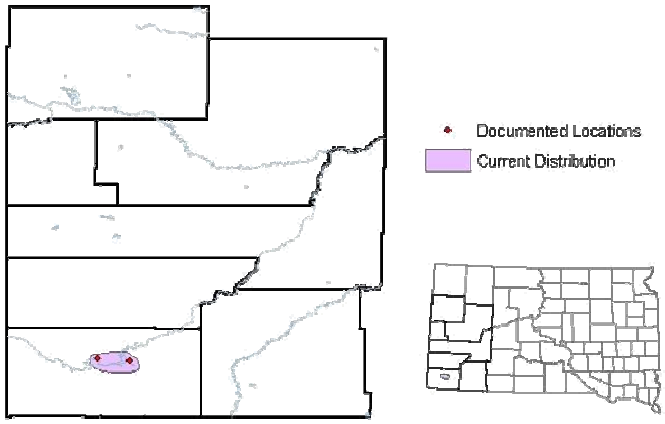
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S1

DISTRIBUTION

Historical: Southwestern corner of the Great Plains Steppe Ecoregion; northern extent of this species range

Current: Southwestern Great Plains Steppe Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

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

Ecosystem diversity – Great Plains Steppe Ecoregion
Primary EDM – grass/shrub ecosystems, see Figure 4.4.1.5

CAUSES OF CONCERN

- Habitat loss/degradation is probable cause for concern but habitat needs of this species are poorly understood at this time

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: AMERICAN BURYING BEETLE (AMBE)

Scientific Name: *Nicrophorus americanus*

DESCRIPTION

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

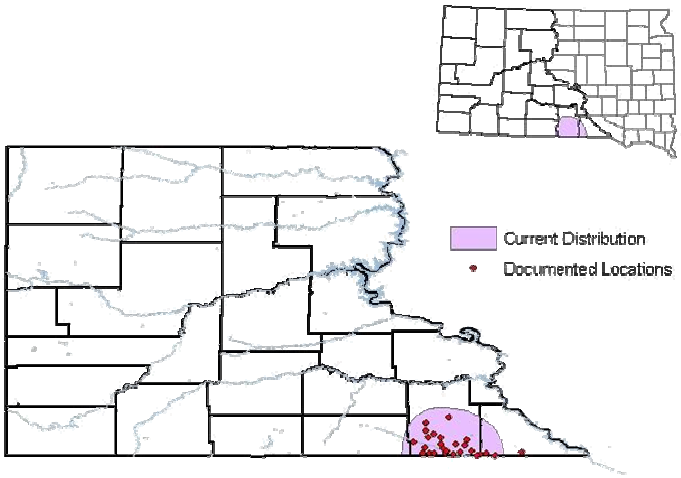
PROTECTION STATUS

Federal: Endangered
State: None
Global Rank: G2G3
State Rank: S1

DISTRIBUTION

Historical: Eastern Prairie Ecoregion, Great Plains Steppe Ecoregion

Current: Southeastern Great Plains Steppe, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – habitat generalist as long as there are abundant carrion sources and sandy soils; habitat must be a large landscape to allow sufficient distance for movements in search of carrion and mates (may move as a far as 2 miles in 24 hours); a small area of potential habitat will not support a population long term

Ecosystem diversity – Tallgrass Subregion; Mixed-grass Subregion; Great Plains Steppe Ecoregion
Primary EDM – grass/shrub ecosystems, see Figures 4.1.1.5, 4.2.1.5 and 4.4.1.5

CAUSES OF CONCERN

- Threats to this species are poorly understood at this time, however, speculation of threats include: Habitat loss/degradation, habitat fragmentation, carcass limitation, pesticides, disease, light pollution, or a combination of these factors.

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

U. S. Fish and Wildlife Service. 1991. American Burying Beetle (*Nicrophorus americanus*) Recovery Plan. Newton Corner, Massachusetts. 80 pp.

COMMON NAME: POWESHEIK SKIPPERLING (POSK)

Scientific Name: *Oarisma powesheik*

DESCRIPTION

Butterfly with very dark brown body and upper wings; orange suffusion along the costa

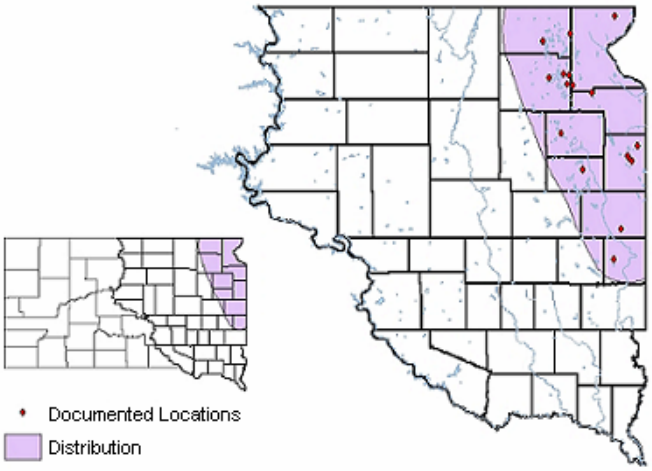
PROTECTION STATUS

Federal: None
State: None
Global Rank: G3
State Rank: S2

DISTRIBUTION

Historical: Tallgrass Subregion

Current: Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – tall grass ecosystems with a significant component of plants in the sunflower family; may use the edge of grass/sedge dominated riparian/wetland ecosystems, as well

Ecosystem diversity – Tallgrass Subregion
Primary EDM – grass/shrub ecosystems, see Figure 4.1.1.5

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Conversion for agricultural, urban development, and other purposes
  - Excessive prescribed burning (burn intervals of 3 –5 years or less, detrimental)
- Herbicide/pesticide application

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: OTTOE SKIPPER (OTSK)

Scientific Name: *Hesperia ottoe*

DESCRIPTION

Butterfly; males are yellowish orange, females are dull brown

PROTECTION STATUS

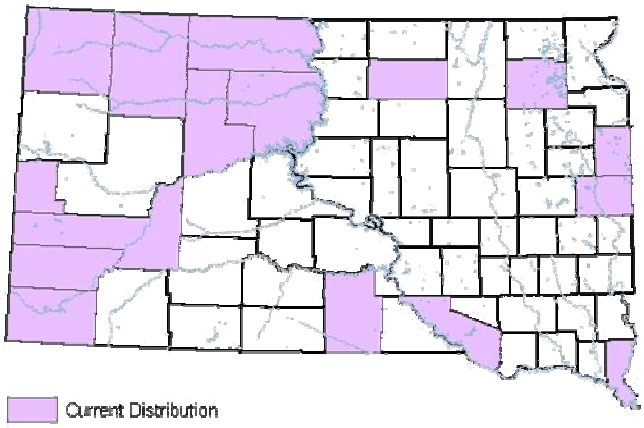
Federal: None
State: None
Global Rank: G3G4
State Rank: S2

DISTRIBUTION

Historical: Eastern Prairie Ecoregion, Great Plains Steppe Ecoregion

Current: Eastern Prairie Ecoregion, Great Plains Steppe Ecoregion; see Figure on right (range map over approximates distributions in the Black Hills due to mapping at county scale)

Source: Marrone, G. M. 2002. Field guide to butterflies of South Dakota. South Dakota Department of Game, Fish and Parks, Pierre, South Dakota, USA.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – mid- to tall-statured grass ecosystems

Ecosystem diversity – Tallgrass Subregion; Mixed-grass Subregion; Great Plains Steppe Ecoregion
Primary EDM – grass/shrub ecosystems, see Figure 4.1.1.5, 4.2.1.5 and 4.4.1.5

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Conversion for agricultural, urban development, or other purposes
  - Suppression of historical fire regime
  - Mowing/grazing/fire that removes nectar sources or vegetation during larval leaf-shelter phase
- Pesticide/herbicide application

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.

COMMON NAME: DAKOTA SKIPPER (DASK)

Scientific Name: *Hesperia dacotae*

DESCRIPTION

Small butterfly; males are tawny orange above; females are pale grayish brown above

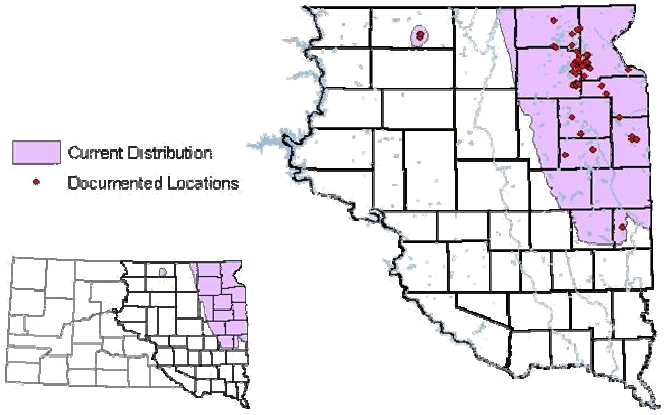
PROTECTION STATUS

Federal: Candidate
State: None
Global Rank: G2
State Rank: S2

DISTRIBUTION

Historical: Eastern Prairie Ecoregion

Current: Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – found in gravelly, calcareous, alkaline, dry to moist grass ecosystem; larvae feed on little bluestem; alkali grass may be a reliable indicator of habitat

Ecosystem diversity – Tallgrass Subregion; Mixed-grass Subregion
Primary EDM – riparian/wetland ecosystems, see Figures 4.1.2.5 and 4.2.2.5
Qualifier – may be associated with Saline Subirrigated ecological sites (NRCS)

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Conversion for agricultural, urban development, and other uses
  - Poorly timed prescribed fire that impacts habitat and results in direct mortality
  - Poorly timed mowing/haying/grazing
  - Heavy grazing that changes species composition of grassland
  - Exotic weed invasion
- Pesticide/herbicide application

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

COMMON NAME: IOWA SKIPPER (IOSK)

Scientific Name: *Atrytone arogos iowa*

DESCRIPTION

Butterfly with yellow-orange upperside and black wing borders

PROTECTION STATUS

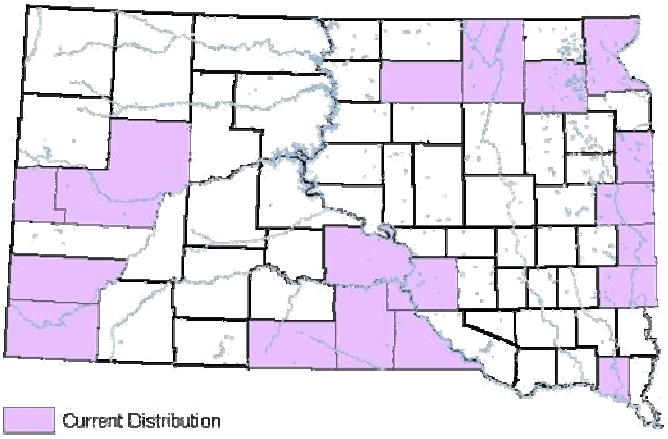
Federal: None
State: None
Global Rank: G3G4T3T4
State Rank: S2

DISTRIBUTION

Historical: Eastern Prairie Ecoregion, Great Plains Steppe Ecoregion

Current: Eastern Prairie Ecoregion, Great Plains Steppe Ecoregion; see Figure on right (range map over approximates distributions in the Black Hills due to mapping methods)

Source: Marrone, G. M. 2002. Field guide to butterflies of South Dakota. South Dakota Department of Game, Fish and Parks, Pierre, South Dakota, USA.



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – ranges from short-statured to tall-statured grass ecosystems; larval hostplants include big bluestem, little bluestem, and sideoats grama; adult nectaring sources include yellow prickly pear, milkweeds, coneflowers, and wavy-leaf thistle

Ecosystem diversity – Tallgrass Subregion; Mixed-grass Subregion; Great Plains Steppe Ecoregion
Primary EDM – grass/shrub ecosystems, see Figures 4.1.1.5, 4.2.1.5 and 4.4.1.5

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Conversion for agricultural, urban development, and other uses
  - Poorly timed prescribed fire that impacts habitat and also results in direct mortality
  - Poorly timed mowing/haying/grazing
  - Heavy grazing that changes species composition of grassland
  - Exotic weed invasion
- Pesticide/herbicide application

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.

COMMON NAME: REGAL FRITILLARY (REFR)

Scientific Name: *Speyeria idalia*

DESCRIPTION

Large orange-black butterfly; sometimes confused with the monarch

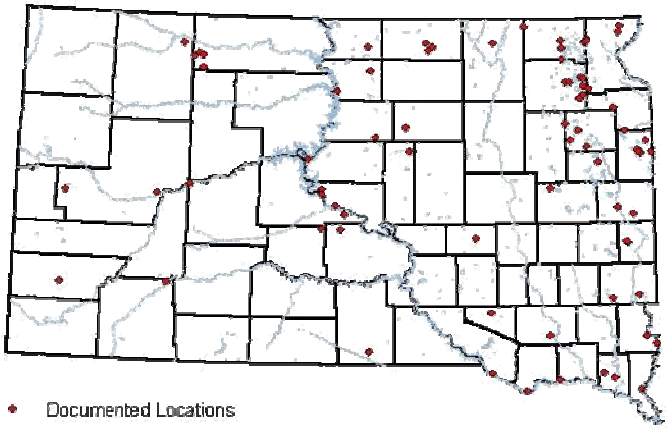
PROTECTION STATUS

Federal: None
State: None
Global Rank: G3
State Rank: S3

DISTRIBUTION

Historical: Eastern Prairie Ecoregion, Great Plains Steppe Ecoregion

Current: Eastern Prairie Ecoregion, Great Plains Steppe Ecoregion; see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – tall-statured or lightly grazed grass ecosystems containing violet species and nectar sources

Ecosystem diversity – Tallgrass Subregion, Mixed-grass Subregion; Great Plains Steppe Ecoregion
Primary EDM – grass/shrub ecosystems, see Figures 4.1.1.5, 4.2.1.5 and 4.4.1.5

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Conversion for agricultural, urban development, and other uses
  - Poorly timed prescribed fire that impacts habitat and also results in direct mortality
  - Poorly timed mowing/haying/grazing
  - Heavy grazing that changes species composition of grassland
  - Exotic weed invasion
- Pesticide/herbicide application

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

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.

COMMON NAME: BLACK HILLS FRITILLARY (BHFR)

Scientific Name: *Speyeria atlantis pahasapa*

DESCRIPTION

Butterfly with orange-brown color above and a complex black pattern of spots, bars, and chevrons

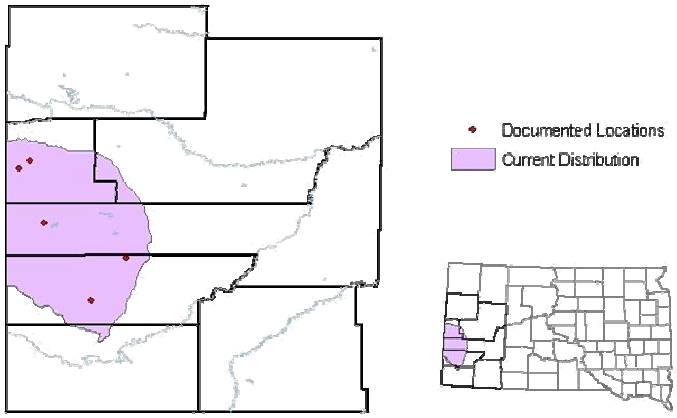
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5T3
State Rank: S3

DISTRIBUTION

Historical: Black Hills Ecoregion

Current: Black Hills Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – openings in coniferous forest ecosystems; riparian/wetland ecosystems with wet meadows and abundant violets; may be particularly associated with beaver ponds

Ecosystem diversity – Black Hills Ecoregion
Primary EDM's – riparian/wetland ecosystems, see Figure 4.5.2.5

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Conversion for agricultural, urban/residential development, or other purposes
- Heavy grazing

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

Figure 4.1.1.5. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of insect species of greatest conservation need within in grass/shrub ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

GRASS/SHRUB ECOSYSTEMS

	Clayey	Claypan	Thin Claypan	Loamy	Sandy	Thin Upland	Shallow
Early Seral				AMBE	AMBE		
Vegetative composition-structure primarily influenced by short-interval fire regimes (<8 yrs.)							
Light Grazing	POSK-OTSK-IOSK REFR	POSK-OTSK-IOSK REFR	POSK-OTSK-IOSK REFR	AMBE-POSK-OTSK IOSK-REFR	AMBE-POSK-OTSK IOSK-REFR	POSK-OTSK IOSK-REFR	POSK-OTSK-IOSK REFR
Moderate Grazing	IOSK	IOSK	IOSK	AMBE-IOSK	AMBE-IOSK	IOSK	IOSK
Heavy Grazing	IOSK	IOSK	IOSK	AMBE-IOSK	AMBE-IOSK	IOSK	IOSK
Vegetative composition-structure primarily influenced by long-interval fire regimes (≥ 8 yrs.)							
Light Grazing				**AMBE**	AMBE		
Moderate Grazing				AMBE	AMBE		
Heavy Grazing				AMBE	AMBE		

Species Codes	
AMBE = American burying beetle	OTSK = Ottoe skipper
IOSK - Iowa skipper	POSK = Powesheik skipperling
I	REFR = regal fritillary

Figure 4.1.2.5. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of insect species of greatest conservation need within riparian/wetland ecosystems of the Tallgrass Subregion. DASK = Dakota skipper

ECOSYSTEM DIVERSITY MATRIX - TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
			Geomorphic →								
			Water Regime →	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
			Slope →					Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent					DASK			
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent					DASK	DASK		
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent					DASK			
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent					DASK	DASK		
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								

Figure 4.2.1.5. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of insect species of greatest conservation need within grass/shrub ecosystems of the Mixedgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

GRASS/SHRUB ECOSYSTEMS

	Ecolological Site Class							
	Dense Clay	Clayey	Shallow Clayey	Claypan	Loamy	Sandy	Shallow	Very Shallow
Early Seral					AMBE		AMBE	
Prairie Dog Town, active		IOSK		IOSK	AMBE-IOSK			
Prairie Dog Town, inactive					AMBE			
Vegetative composition-structure primarily influenced by short-interval fire regimes (<10 yrs.)								
Light Grazing	OTSK-IOSK-REFR	OTSK-IOSK-REFR	OTSK-IOSK-REFR	OTSK-IOSK-REFR	AMBE-OTSK-IOSK REFR	OTSK-IOSK-REFR	AMBE-OTSK-IOSK REFR	OTSK-IOSK-REFR
Moderate Grazing	IOSK	IOSK	IOSK	IOSK	AMBE-IOSK	IOSK	AMBE-IOSK	IOSK
Heavy Grazing	IOSK	IOSK	IOSK	IOSK	AMBE-IOSK	IOSK	AMBE-IOSK	IOSK
Vegetative composition-structure primarily influenced by long-interval fire regimes (>10 yrs.)								
Light Grazing					AMBE		AMBE	
Moderate Grazing					AMBE		AMBE	
Heavy Grazing					AMBE		AMBE	

Ecosystems that do not occur

Species Codes
AMBE = American burying beetle
IOSK = Iowa skipper
OTSK = Ottoe skipper
REFR = regal fritillary

Figure 4.2.2.5. South Dakota Comprehensive Wildlife Conservation Strategy - expected distributions of insect species of greatest conservation need within riparian/wetland ecosystems of the Mixedgrass Subregion. DASK = Dakota skipper

ECOSYSTEM DIVERSITY MATRIX - MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
			Water Regime	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
			Slope					Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent					DASK			
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent					DASK	DASK		
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent					DASK			
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent					DASK	DASK		
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								

Figure 4.3.2.5. South Dakota Comprehensive Wildlife Conservation Plan- expected distributions of insect species of greatest conservation need within riparian/wetland ecosystems of the Missouri River Ecoregion. GTBE = ghost tiger beetle

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MISSOURI RIVER ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
			Geomorphic →							
			Water Regime →	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
			Slope →				Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore							
			Emergent							
			Scrub-Shrub							
			Forested							
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore							
			Emergent							
			Scrub-Shrub							
			Forested							
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore				GTBE	GTBE	GTBE	
			Emergent							
			Scrub-Shrub							
			Forested							
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore				GTBE	GTBE	GTBE	
			Emergent							
			Scrub-Shrub							
			Forested							
LATE SUCCESSIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore							
			Emergent							
			Scrub-Shrub							
			Forested							
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore							
			Emergent							
			Scrub-Shrub							
			Forested							
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore				GTBE	GTBE	GTBE	
			Emergent							
			Scrub-Shrub							
			Forested							
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore				GTBE	GTBE	GTBE	
			Emergent							
			Scrub-Shrub							
			Forested							

Figure 4.4.1.5. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of insect species of greatest conservation nee within grass/shrub ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

GRASS/SHRUB ECOSYSTEMS

Disturbance Influenced Pathways	Ecolological Site Class								
	Porous Clay	Dense Clay	Clayey	Claypan	Loamy	Shallow	Badlands	Sandy	Saline Upland
Early Seral					AMBE	AMBE	GPTB	GTBE	AMBE
Prairie Dog Town, active			IOSK	IOSK	AMBE-IOSK				AMBE-IOSK
Prairie Dog Town, inactive					AMBE				AMBE
Vegetative composition-structure primarily influenced by short-interval fire regimes (<15 yrs.)									
Light Grazing	OTSK-IOSK-REFR	OTSK-IOSK-REFR	OTSK-IOSK-REFR	OTSK-IOSK-REFR	AMBE-OTSK-IOSK REFR	AMBE-OTSK-IOSK REFR	GPTB-OTSK-IOSK REFR	OTSK-IOSK-REFR	AMBE-OTSK-IOSK REFR
Moderate Grazing	IOSK	IOSK	IOSK	IOSK	AMBE-IOSK	AMBE-IOSK	GPTB-IOSK	IOSK	AMBE-IOSK
Heavy Grazing	IOSK	IOSK	IOSK	IOSK	AMBE-IOSK	AMBE-IOSK	GPTB-IOSK	GTBE-IOSK	AMBE-IOSK
Vegetative composition-structure primarily influenced by long-interval fire regimes (>15 yrs.)									
Light Grazing					AMBE	AMBE	GPTB		AMBE
Moderate Grazing					AMBE	AMBE	GPTB		AMBE
Heavy Grazing					AMBE	AMBE	GPTB	GTBE	AMBE

Ecosystems that do not occur

Species Codes	
AMBE = American burying beetle	IOSK = Iowa skipper
GTBE = ghost tiger beetle	OTSK = Ottoe skipper
GPTB = Great Plains tiger beetle	REFR = regal fritillary

Figure 4.4.2.5. South Dakota Comprehensive Wildlife Conservation Plan- expected distributions of insect species of greatest conservation need within riparian/wetland ecosystems of the Great Plains Steppe Ecoregion. GTBE = ghost tiger beetle

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS				SLOPE SYSTEMS
			Geomorphic →									
			Water Regime →	Littoral	Temporary	Semi-permanent	Permanent	Perennial		Intermittent		
			Slope →					Low Gradient with floodplain	Mid-High Gradient without floodplain	Low Gradient with floodplain	Mid-High Gradient without floodplain	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore									
			Unconsolidated Shore	GTBE								
			Emergent									
			Scrub-Shrub									
			Forested									
		Heavy Bison Grazing	Rocky Shore									
			Unconsolidated Shore	GTBE								
			Emergent									
			Scrub-Shrub									
			Forested									
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore									
			Unconsolidated Shore	GTBE				GTBE	GTBE	GTBE	GTBE	
			Emergent									
			Scrub-Shrub									
			Forested									
		Heavy Bison Grazing	Rocky Shore									
			Unconsolidated Shore	GTBE				GTBE	GTBE	GTBE	GTBE	
			Emergent									
			Scrub-Shrub									
			Forested									
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore									
			Unconsolidated Shore	GTBE								
			Emergent									
			Scrub-Shrub									
			Forested									
		Heavy Bison Grazing	Rocky Shore									
			Unconsolidated Shore	GTBE								
			Emergent									
			Scrub-Shrub									
			Forested									
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore									
			Unconsolidated Shore	GTBE				GTBE	GTBE	GTBE	GTBE	
			Emergent									
			Scrub-Shrub									
			Forested									
		Heavy Bison Grazing	Rocky Shore									
			Unconsolidated Shore	GTBE				GTBE	GTBE	GTBE	GTBE	
			Emergent									
			Scrub-Shrub									
			Forested									

Figure 4.5.2.5. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of insect species of greatest conservation need within riparian/wetland ecosystems of the Black Hills Ecoregion. BHFR = Black Hills fritillary

ECOSYSTEM DIVERSITY MATRIX - BLACK HILLS ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS				SLOPE SYSTEMS
			Geomorphic →								
			Water Regime →	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*		*Intermittent*		
			Gradient →				Low Gradient < 2% slope	Mid-High Gradient > 2% slope	Low Gradient < 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent		BHFR	BHFR	BHFR				
			Scrub-Shrub								
			Forested								
		Heavy Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
	Beaver Unmodified System	Low to Moderate Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent	BHFR	BHFR	BHFR	BHFR				
			Scrub-Shrub								
			Forested								
		Heavy Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent		BHFR	BHFR	BHFR				
			Scrub-Shrub								
			Forested								
		Heavy Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								
	Beaver Unmodified System	Low to Moderate Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent	BHFR	BHFR	BHFR	BHFR				
			Scrub-Shrub								
			Forested								
		Heavy Grazing	Rocky Shore								
			Unconsolidated Shore								
			Emergent								
			Scrub-Shrub								
			Forested								

Fishes

COMMON NAME: BANDED KILLIFISH (BAKI)

Scientific Name: *Fundulus diaphanus*

DESCRIPTION

Adults between 2-2.5 in; body is light olive on the back and sides and yellow-white below with 12-20 narrow vertical bars

PROTECTION STATUS

Federal: None
State: Endangered
Global Rank: G5
State Rank: S1

DISTRIBUTION

Historical: Tallgrass Subregion

Current: Tallgrass Subregion, see Figure on right

KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – quiet waters of lakes and ponds with lots of vegetation; quiet backwaters and sections of slow current in medium to large streams; prefers open broad, sandy shallows during the warm season.

Ecosystem diversity – Tallgrass Subregion
Primary EDM – aquatic ecosystems, see Figure 4.1.3.6

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Conversion of wetlands for agricultural or other purposes
  - Shoreline development and modification of littoral zone habitat in lakes
- Pesticide and herbicide runoff from surrounding areas

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: BLACKNOSE SHINER (BLSH)

Scientific Name: *Notropis heterolepis*

DESCRIPTION

Small blackstripe minnow with olive-yellow on back, silvery sides, and whitish belly

PROTECTION STATUS

Federal: None
State: Endangered
Global Rank: G4
State Rank: S1

DISTRIBUTION

Historical: Eastern Prairie Ecoregion

Current: Southeastern portion of the Great Plains Steppe Ecoregion and Tallgrass Subregion, see Figure on right

KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – cool, weedy creeks, small rivers, and lakes; sand substrate; sensitive to low oxygen levels

Ecosystem diversity – Tallgrass Subregion; Mixed-grass Subregion
Primary EDM – aquatic ecosystems, see Figures 4.1.3.6 and 4.2.3.6

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Increased turbidity and siltation of stream and lake bottoms has reduced the amount of aquatic vegetation and available oxygen
  - Adjacent land disturbance such as residential development, agriculture, grazing, etc. that reduces streamside/lakeside vegetation and shading, may increase water temperatures

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: CENTRAL MUDMINNOW (CEMU)

Scientific Name: *Umbra limi*

DESCRIPTION

Small fish with a dark brown to olive green head and back, mottled sides and a white underside

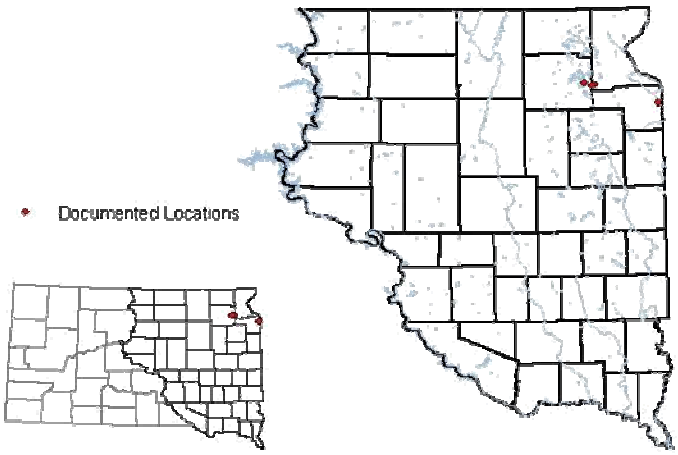
PROTECTION STATUS

Federal: None
State: Endangered
Global Rank: G5
State Rank: S1

DISTRIBUTION

Historical: Tallgrass Subregion, western edge of range

Current: Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – prefers cool marshes, weedy ponds, and slow-moving streams; survives low water by burrowing into bottom sediment

Ecosystem diversity – Tallgrass Subregion
Primary EDM – aquatic ecosystems, see Figure 4.1.3.6

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Conversion of wetlands for agricultural, urban development, and other purposes
  - Stream impoundments have reduced backwater sloughs
  - Reduction in number of beaver ponds

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: FINESCALE DACE (FIDA)

Scientific Name: *Phoxinus neogaeus*

DESCRIPTION

Small fish with a dark brown back, dark stripe extending from snout along the side and ending at base of tail

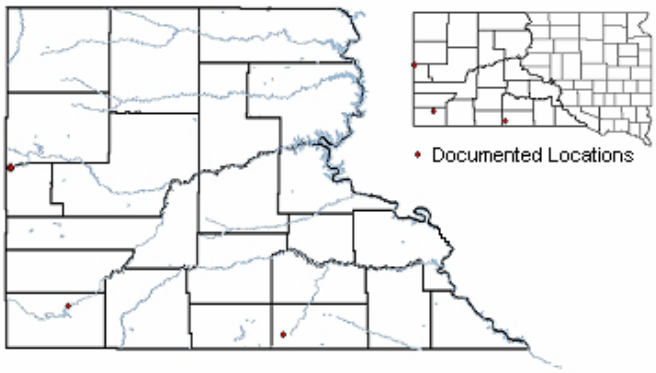
PROTECTION STATUS

Federal: None
State: Endangered
Global Rank: G5
State Rank: S1

DISTRIBUTION

Historical: Black Hills Ecoregion, Great Plains Steppe Ecoregion: edge of range, glacial relict

Current: Black Hills Ecoregion and Great Plains Steppe Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – pools of headwater streams, creeks, and small rivers; lakes and ponds; often common in beaver ponds; prefers silt substrate near vegetation

Ecosystem diversity – Black Hills Ecoregion; Great Plains Steppe Ecoregion
Primary EDM – aquatic ecosystems, see Figures 4.4.3.6 and 4.5.3.6

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Cool, spring fed streams appear to be increasingly degraded
  - Reduction in the number of beaver ponds on the landscape from historical
- Species is at the edge of its range making it more vulnerable to habitat loss due to smaller population size and the disjunctive nature of current populations

EXISTING RECOVERY PLANS/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.

COMMON NAME: LONGNOSE SUCKER (LOSU)

Scientific Name: *Catostomus catostomus*

DESCRIPTION

Elongated, cylindrical sucker; head tapers to a long snout overhanging the mouth

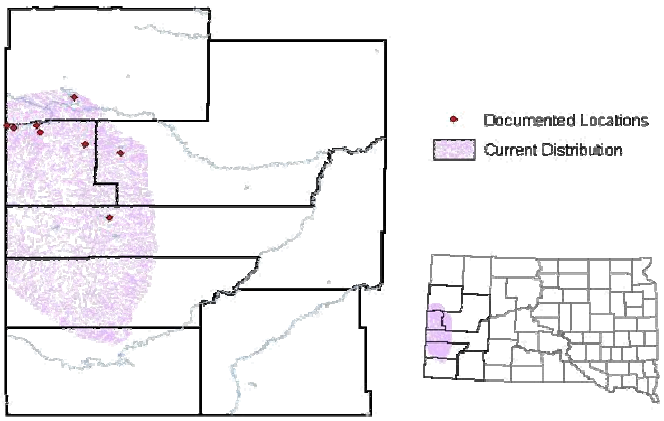
PROTECTION STATUS

Federal: None
State: Threatened
Global Rank: G5
State Rank: S1

DISTRIBUTION

Historical: Great Plains Steppe Ecoregion, Belle Fourche river drainage; eastern edge of range

Current: Black Hills Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – cool, spring-fed creeks; spawns in lakes or shallow-flowing streams over gravel

Ecosystem diversity – Great Plains Steppe Ecoregion
Primary EDM – aquatic ecosystems, see Figure 4.4.3.6
Qualifier – may have only been located in Belle Fourche drainage historically

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Activities such as mining, logging, road building, heavy grazing, etc. that can affect water quality and temperature

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: NORTHERN REDBELLY DACE (NRDA)

Scientific Name: *Phoxinus eos*

DESCRIPTION

Small fish with black, olive to dark brown back and silver to brilliant red below the dark band on the side

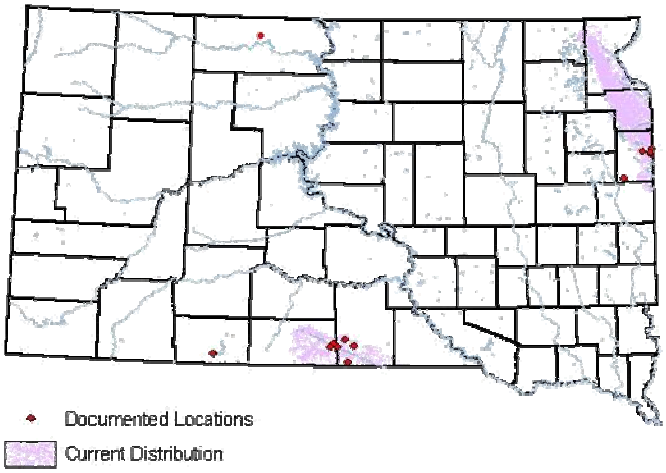
PROTECTION STATUS

Federal: None
State: Threatened
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Great Plains Steppe Ecoregion; Eastern Prairie Ecoregion; Missouri River Ecoregion

Current: Great Plains Steppe Ecoregion, and Tallgrass Subregion of the Eastern Prairie Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat - prefers quiet waters of beaver ponds, bogs and streams; often found in slightly acidic water; often near aquatic vegetation

Ecosystem diversity – Great Plains Steppe Ecoregion; Tallgrass Subregion; Mixed-grass Subregion; Missouri River Ecoregion
Primary EDM – aquatic ecosystems, see Figures 4.1.3.6, 4.2.3.6, 4.3.3.6 and 4.4.3.6

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Activities such as mining, logging, stream channelization, road building, heavy grazing, etc. that affect water quality or temperature of a stream or pond
  - Reduction in number of beaver ponds from historical

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: PALLID STURGEON (PAST)

Scientific Name: *Scaphirhynchus albus*

DESCRIPTION

Very large fish with a light brown dorsal surface and white underbelly; flattened, shovel-shaped snout

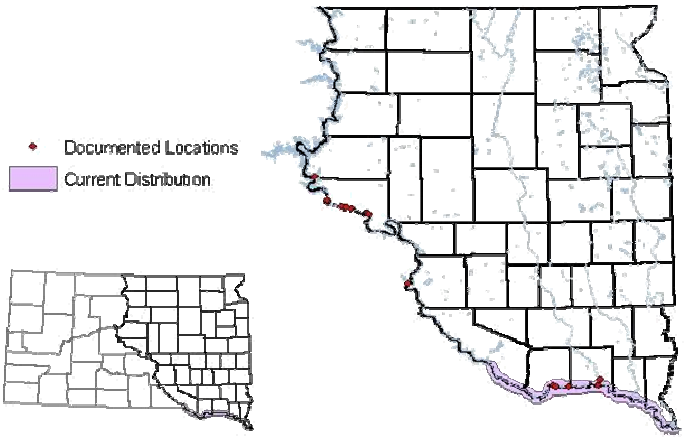
PROTECTION STATUS

Federal: Endangered
State: Endangered
Global Rank: G1
State Rank: S1

DISTRIBUTION

Historical: Missouri River Ecoregion

Current: Missouri River Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – bottom dweller found in areas of strong current and firm sand bottom in main channel of large turbid rivers

Ecosystem diversity – Missouri River Ecoregion
Primary EDM – aquatic ecosystems, see Figure 4.3.3.6

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Nearly 100% of historic range in South Dakota has been altered in some way including dam/reservoir construction, stream channelization, maintenance dredging, modified flow regime, pollution, barriers to movement, etc.
- Significant hybridization with shovelnose sturgeon

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

U.S. Fish and Wildlife Service. 1993. Pallid Sturgeon Recovery Plan. USFWS, Bismarck, North Dakota. 55 pp.

COMMON NAME: PADDLEFISH (PADD)

Scientific Name: *Polyodon spathula*

DESCRIPTION

Ancient, large fish with a greatly elongated paddle-shaped snout

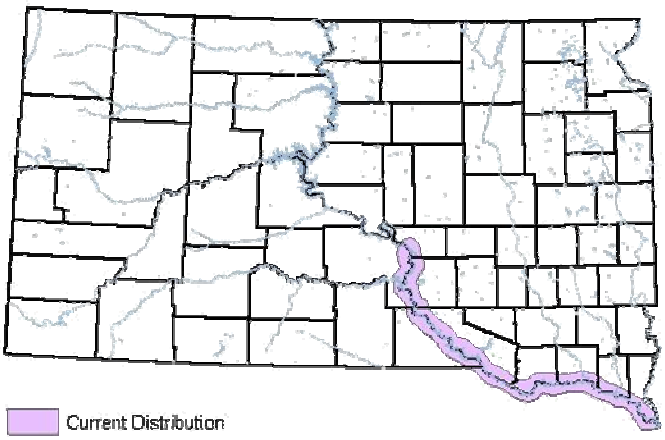
PROTECTION STATUS

Federal: None
State: None
Global Rank: G4
State Rank: S4

DISTRIBUTION

Historical: Missouri River Ecoregion

Current: Missouri River Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – quiet, slow-moving large to medium-sized rivers, oxbows, backwaters, and impoundments; prefers depths greater than 5 ft; spawn in fast shallow water over gravel bars

Ecosystem diversity – Missouri River Ecoregion
Primary EDM – aquatic ecosystems, see Figure 4.3.3.6

CAUSES OF CONCERN

- Habitat loss/degradation -
  - Impacts due to dam/reservoir construction, stream channelization, maintenance dredging, modified flow regime, pollution, barriers to movement, etc.
  - Water pollution
- Illegal poaching/snagging

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

Dillard, J. G., L. K. Graham, and T. R. Russell, editors. 1986. The paddlefish: status, management and propagation. American Fisheries Society, North Central Division, Bethesda, Maryland. Special Publication 7.

COMMON NAME: PEARL DACE (PEDA)

Scientific Name: *Margariscus margarita*

DESCRIPTION

Small, dark or dusky colored fish with a silver gray to white belly

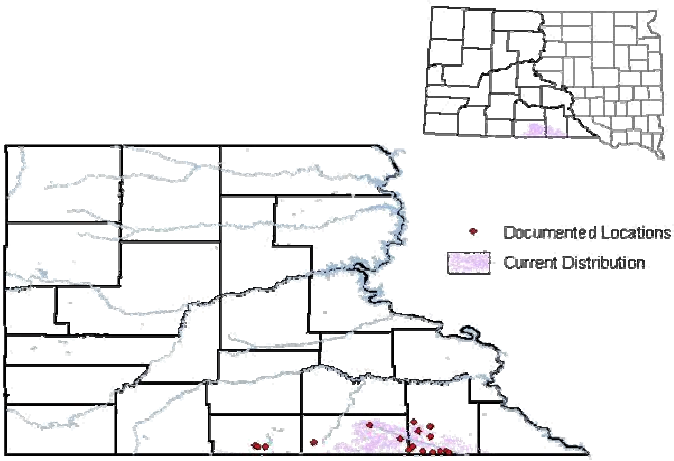
PROTECTION STATUS

Federal: None
State: Threatened
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Great Plains Steppe Ecoregion – Todd and Tripp counties, relict population

Current: southeastern Great Plains Steppe Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – occurs in cool bogs, ponds, beaver ponds, lakes, creeks and clear streams; spawns in clear water with a weak to moderate current over sand and gravel

Ecosystem diversity – Great Plains Steppe Ecoregion
Primary EDM – aquatic ecosystems, see Figure 4.4.3.6

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Conversion of adjacent stream vegetation for agricultural, urban/residential development, or other purposes
  - Drainage of ponds
  - Significant reduction in the occurrence of beaver ponds
  - Activities that impact water quality or temperature such as stream channelization, impoundments, point-source and non-point source pollution

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: SICKLEFIN CHUB (SICH)

Scientific Name: *Macrhybopsis meeki*

DESCRIPTION

Small, slender minnow with a yellowish brown back and sides and silvery reflections

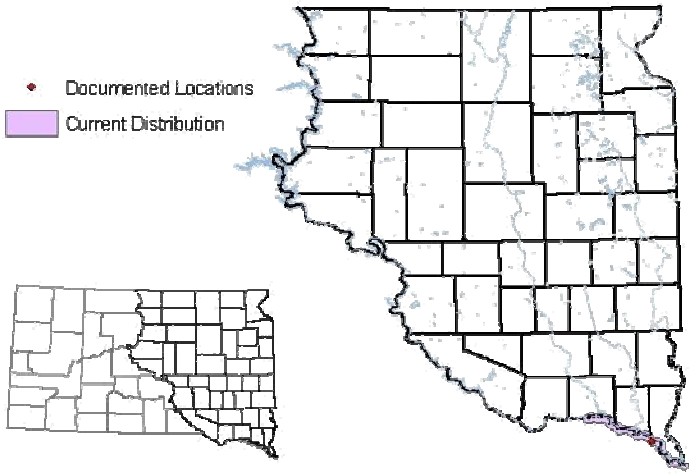
PROTECTION STATUS

Federal: None
State: Threatened
Global Rank: G3
State Rank: S1

DISTRIBUTION

Historical: Missouri River Ecoregion and its large tributaries in the Great Plains Steppe Ecoregion and Mixed-grass Subregion

Current: Missouri River Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – prefers continuously turbid, warm, large rivers with stable gravel and sand substrate

Ecosystem diversity – Missouri River Ecoregion
Primary EDM – aquatic ecosystems, see Figure 4.3.3.6

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Dams that flood river habitat, alter temperature and flow regimes, reduce sediment transport and turbidity, fragment populations, and reduce movement opportunities
  - Channelization that reduces habitat diversity and reduces overbank flooding
  - Water pollution that impacts water quality
- Competition with non-native fish

EXISTING RECOVERY PLANS/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.

COMMON NAME: STURGEON CHUB (STCH)

Scientific Name: *Macrhybopsis gelida*

DESCRIPTION

Small fish with a light brown back and fine dark specs, silvery sides and belly

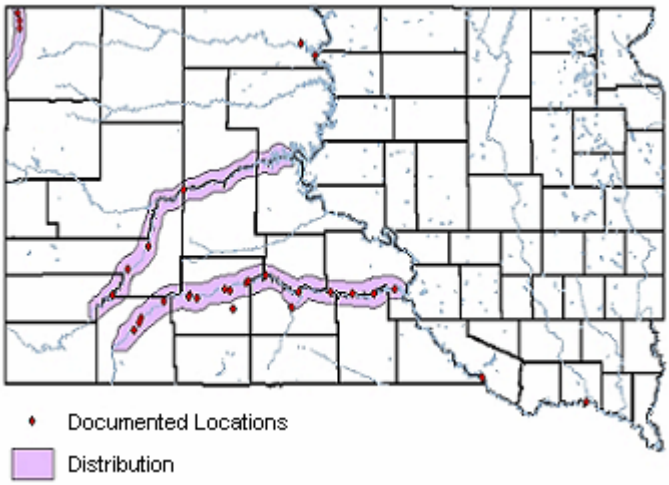
PROTECTION STATUS

Federal: None
State: Threatened
Global Rank: G3
State Rank: S2

DISTRIBUTION

Historical: Missouri River Ecoregion and its tributaries of the Great Plains Steppe Ecoregion and Mixed-grass Subregion

Current: Great Plains Steppe Ecoregion and Missouri River Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – prefers swift current areas of large silty river channels, usually over gravel bottoms

Ecosystem diversity – Missouri River Ecoregion, Great Plains Steppe Ecoregion
Primary EDM – aquatic ecosystems, see Figures 4.3.3.6 and 4.4.3.6

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Dams that flood river habitat, alter temperature and flow regimes, reduce sediment transport and turbidity, fragment populations, and reduce movement opportunities
  - Channelization that reduces habitat diversity and reduces overbank flooding
  - Water pollution that impacts water quality
- Competition with non-native fish

EXISTING RECOVERY PLANS/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.

COMMON NAME: TOPEKA SHINER (TOSH)

Scientific Name: *Notropis topeka*

DESCRIPTION

Minnow with an olive-yellow back and distinctly dark-edged scales

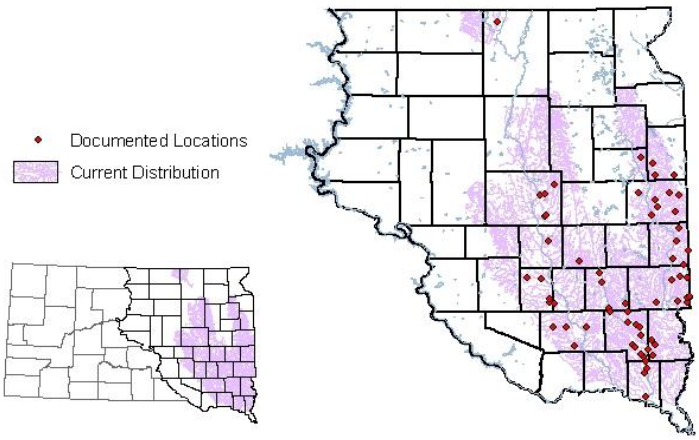
PROTECTION STATUS

Federal: Endangered
State: None
Global Rank: G3
State Rank: S3

DISTRIBUTION

Historical: Eastern Prairie Ecoregion

Current: Eastern Prairie Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – small streams with groundwater inputs and high water quality; pool substrate is gravel, rubble, or sand

Ecosystem diversity – Tallgrass Subregion, Mixed-grass Subregion
Primary EDM – aquatic ecosystems, see Figures 4.1.3.6 and 4.2.3.6

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Stream channelization, levee construction and impoundments that change water flows, temperature and water quality of streams
  - Land practices such as agriculture, urban/residential development, heavy grazing, etc., can increase silt and sediment load to streams, as well as remove streamside vegetation that moderates water temperature
  - Water diversion or excessive groundwater removal can reduce in-stream flows

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

Shearer, J.S. 2003. Topeka shiner (*Notropis topeka*) management plan for the state of South Dakota. South Dakota Department of Game, Fish and Parks, Pierre, Wildlife Division Report No. 2003-10, 82 pp. Online at: http://www.sdgfp.info/Wildlife/Diversity/Topeka%20Shiner/Topekashiner.htm

COMMON NAME: TROUT-PERCH (TRPE)

Scientific Name: *Percopsis omiscomaycus*

DESCRIPTION

Small, thick-bodied fish with a large head; silvery to almost transparent in color

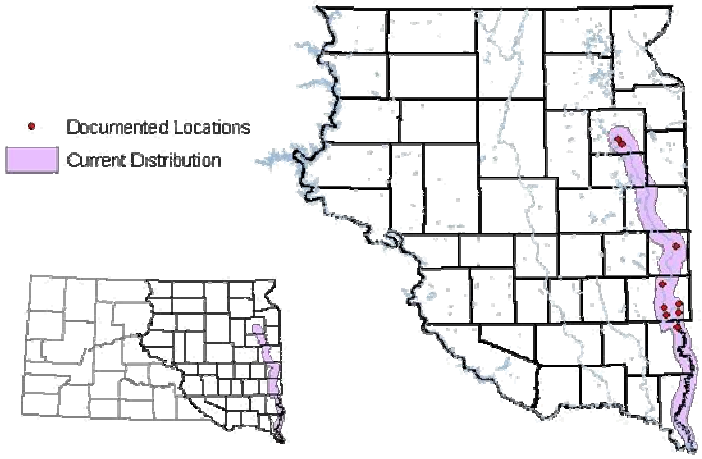
PROTECTION STATUS

Federal: None
State: Threatened
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Tallgrass Subregion – Big Sioux and Minnesota River drainages

Current: Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – frequently found in lakes but also in deep flowing pools of creek and small to large rivers; usually over sand

Ecosystem diversity – Tallgrass Subregion
Primary EDM – aquatic ecosystems, see Figure 4.1.3.6

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Stream channelization, levee construction and impoundments that change water flows, temperature and water quality of streams
  - Land practices such as agriculture, urban/residential development, heavy grazing, etc., can increase pollution, silt and sediment load to streams, as well as remove streamside vegetation that moderates water temperature
  - Water diversion or excessive groundwater removal can reduce in-stream flows
- Competition with non-native species

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: LAKE CHUB (LACH)

Scientific Name: *Couesius plumbeus*

DESCRIPTION

Small fish with a bluish gray to dark greenish back, lead-colored mid-lateral stripe, and silvery below

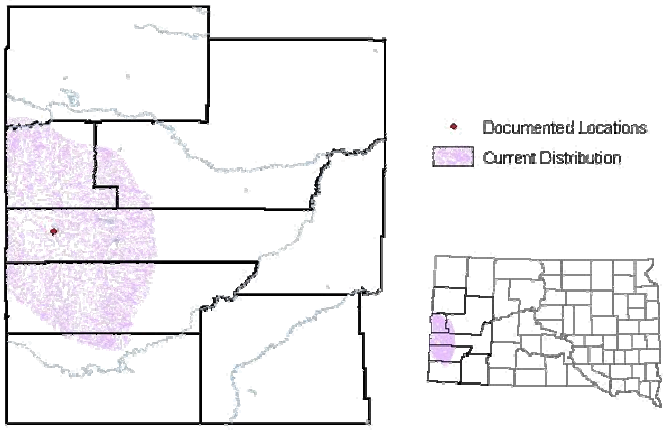
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S1

DISTRIBUTION

Historical: Black Hills Ecoregion, Great Plains Steppe Ecoregion; glacial relict population

Current: Black Hills Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – prefers large or small bodies of water; gravel-bottomed pools and runs of streams and along rocky lake margins; spawns in river shallows, along rocky shores, and shoals of lakes

Ecosystem diversity – Great Plains Steppe Ecoregion; Black Hills Ecoregion
Primary EDM – aquatic ecosystems, see Figures 4.4.3.6 and 4.5.3.6

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Historical fire suppression has resulted in decreased in-stream flows due to increased surface water and groundwater uptake by increasing numbers of adjacent ponderosa pine
  - Stream temperature increases due to impacts to adjacent riparian vegetation from logging, mining, and/or heavy grazing
- Possible predation by non-native fish

EXISTING RECOVERY PLANS/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.

COMMON NAME: MOUNTAIN SUCKER (MOSU)

Scientific Name: *Catostomus platyrhynchus*

DESCRIPTION

A stout sucker with a small, rounded head; dark brown or tan fading to white on the belly

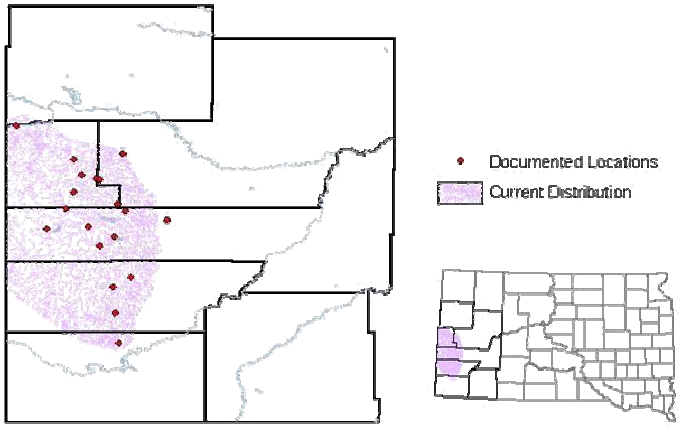
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S3

DISTRIBUTION

Historical: Black Hills Ecoregion

Current: Black Hills Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – prefers clear, cold creeks and small to medium sized rivers with clear rubble, gravel or sand substrate; young inhabit slower moving water in side channels, or weedy backwater areas; often found where there is cover over the water

Ecosystem diversity – Black Hills Ecoregion
Primary EDM – aquatic ecosystems, see Figure 4.5.3.6

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Historical fire suppression has resulted in decreased in-stream flows due to increased surface water and groundwater uptake by increasing numbers of adjacent ponderosa pine
  - Stream temperature and turbidity increases due to impacts to adjacent uplands and riparian vegetation from logging, mining, and/or heavy grazing
- Possible predation by non-native fish

EXISTING RECOVERY PLANS/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.

COMMON NAME: SOUTHERN REDBELLY DACE (SRDA)

Scientific Name: *Phoxinus erythrogaster*

DESCRIPTION

Slender minnow with extremely small scales and two narrow dusky stripes along its side

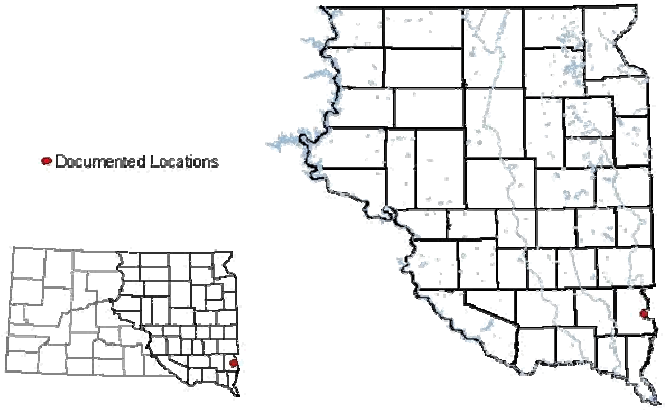
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S1

DISTRIBUTION

Historical: Tallgrass Subregion

Current: Southeastern Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – prefers cool, spring-fed headwater streams; substrate gravel, rubble, and sand; spawns in shallow water riffles over gravel

Ecosystem diversity – Tallgrass Subregion
Primary EDM – aquatic ecosystems, see Figure 4.1.3.6

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Land activities such as agriculture, as well as urban and industrial development can convert cool, shaded, clear streams to warm, unshaded, and turbid systems
- Nature of preferred habitat makes this species susceptible to extinction because of losses due to localized natural disturbances and human-induced disturbance

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: HORNYHEAD CHUB (HOCH)

Scientific Name: *Nocomis biguttatus*

DESCRIPTION

Stout fish with a coppery back and upper sides, shading to silvery on the sides and whitish-yellow on the belly

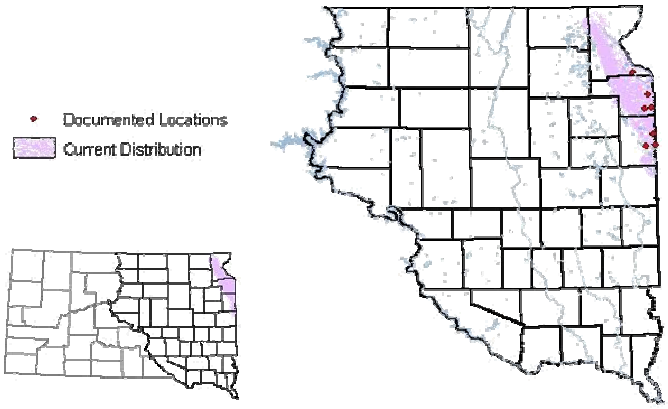
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S3

DISTRIBUTION

Historical: Tallgrass Subregion

Current: Northeastern Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – small to medium size, moderate to low gradient, clear, gravelly streams; in pools and slow to moderate runs

Ecosystem diversity – Tallgrass Subregion
Primary EDM – aquatic ecosystems, see Figure 4.1.3.6

CAUSES OF CONCERN

- Habitat loss/degradation
  - Stream channelization and impoundments
  - Water pollution
  - Increased turbidity

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: ROSYFACE SHINER (ROSH)

Scientific Name: *Notropis rubellus*

DESCRIPTION

Small fish with a dark olive back and faint mid-dorsal stripe; sides are silvery and the belly is white

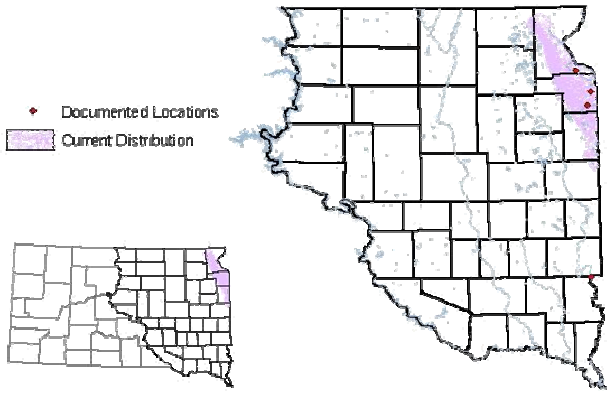
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Tallgrass Subregion

Current: Northeastern portion of the Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – clear, swift, large creeks and small rivers with bottoms of clean gravel or rubble; usually in and around riffles, rocky runs, or flowing pools

Ecosystem diversity – Tallgrass Subregion
Primary EDM – aquatic ecosystems, see Figure 4.1.3.6

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Stream channelization and impoundments
  - Water pollution
  - Increased turbidity from adjacent upland land practices such as agriculture, urban development, and grazing

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: LOGPERCH (LOGP)

Scientific Name: *Percina caprodes*

DESCRIPTION

Small fish with yellowish-green body and dark crossbands, top of head depressed between the eyes

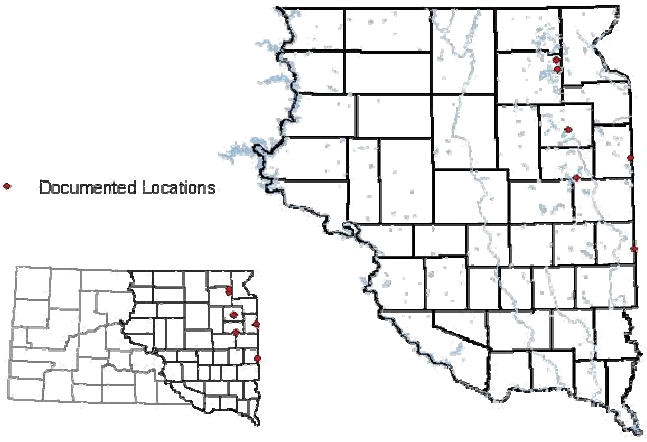
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S3

DISTRIBUTION

Historical: Tallgrass Subregion

Current: Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat — rivers, lakes, and reservoirs; prefers clean riffles and runs over mixed sand and gravel; often associated with bottom debris

Ecosystem diversity – Tallgrass Subregion
Primary EDM – aquatic ecosystems, see Figure 4.1.3.6

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Stream channelization and impoundments
  - Water pollution
  - Increased turbidity from adjacent upland land practices such as agriculture, urban development, grazing, etc.
- Population is vulnerable to extirpation due to its small, isolated range

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: BLACKSIDE DARTER (BLDA)

Scientific Name: *Percina maculata*

DESCRIPTION

Darter with green and gray sides and 6 to 8 large oblong dark blotches

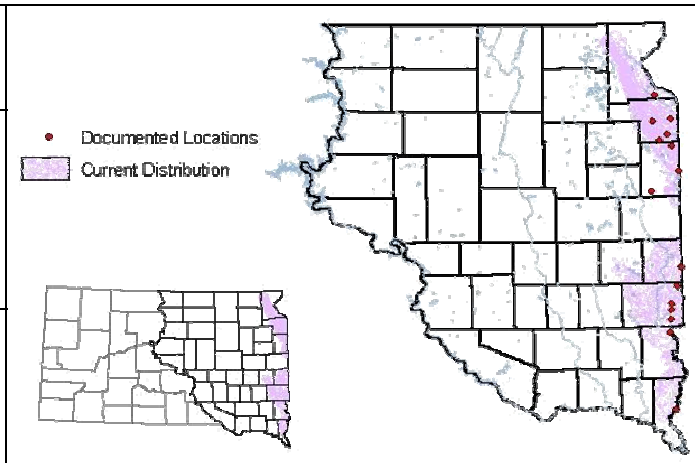
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Tallgrass Subregion

Current: Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – creeks and small to medium rivers; prefers quiet pools and pools with some current; gravel or sand bottoms

Ecosystem diversity – Tallgrass Subregion
Primary EDM – aquatic ecosystems, see Figure 4.1.3.6

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Stream channelization and impoundments
  - Water pollution
  - Increased turbidity from adjacent upland land practices such as agriculture, urban development, grazing, etc.
- Population is vulnerable to extinction due to its small, isolated range

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

Figure 4.1.3.6. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of species of greatest conservation need within aquatic ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

AQUATIC ECOSYSTEMS

Time Since Major Disturbance (i.e., flood)	Disturbance Influenced Pathways	Geomorphic Setting / Water Regime / Sizeclass / Habitat Descriptor	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS			
							Perennial			
			Limnetic	Littoral	Semi-permanent	Permanent	Large River	Small River	Creek	Headwater Stream
EARLY SUCCESSIONAL	Beaver Influenced System	Rock Bottom	LACH							
		Unconsolidated Bottom	TRPE	TRPE-LOGP			TRPE-SMSO	TOSH-TRPE-BLDA	TRPE	SRDA
		Aquatic Bed		BAKI-BLSH	BLTU	BAKI-CEMU-BLTU	BAKI-CEMU-BLTU	BAKI-BLSH-CEMU-NRDA-BLTU	BLSH-NRDA	
	Beaver Absent	Rock Bottom	LACH							
		Unconsolidated Bottom	TRPE	TRPE-LOGP			TRPE-LOGP-SMSO	TOSH-TRPE-HOCH-ROSH-BLDA	TRPE-	SRDA
		Aquatic Bed		BAKI-BLSH	BLTU	BAKI-CEMU-BLTU	BAKI-CEMU-BLTU	BAKI-BLSH-CEMU-NRDA-BLTU	BLSH-NRDA	
LATE SUCCESSIONAL	Beaver Influenced System	Rock Bottom	LACH							
		Unconsolidated Bottom	TRPE	TRPE-LOGP			TRPE-SMSO	TOSH-TRPE-BLDA	TRPE	SRDA
		Aquatic Bed		BAKI-BLSH	BLTU	BAKI-CEMU-BLTU	BAKI-CEMU-BLTU	BAKI-BLSH-CEMU-NRDA-BLTU	BLSH-NRDA	
	Beaver Absent	Rock Bottom	LACH							
		Unconsolidated Bottom	TRPE	TRPE-LOGP			TRPE-LOGP-SMSO	TOSH-TRPE-HOCH-ROSH-BLDA	TRPE	SRDA
		Aquatic Bed		BAKI-BLSH	BLTU	BAKI-CEMU-BLTU	BAKI-CEMU-BLTU	BAKI-BLSH-CEMU-NRDA-BLTU	BLSH-NRDA	

Species Codes
BAKI = Banded killifish
BLDA - Blackside Darter
BLTU = Blanding's Turtle
BLSH = Blacknose shiner
CEMU = Central mudminnow
HOCH = Hornyhead chub
LACH = Lake chub
LOGP = Logperch
NRDA = Northern redbelly dace
ROSH = Rosyface shiner
SMSO = Smooth Softshell
SRDA = Southern redbelly dace
TOSH = Topeka shiner
TRPE = Trout-perch

Figure 4.2.3.6. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of fish species of greatest conservation need within aquatic ecosystems of the Mixedgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

AQUATIC ECOSYSTEMS

Time Since Major Disturbance (i.e., flood)	Disturbance Influenced Pathways	Geomorphic Setting / Water Regime / Sizeclass / Habitat Descriptor	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS			
			Limnetic	Littoral	Semi-permanent	Permanent	Perennial			
							Large River	Small River	Creek	Headwater Stream
EARLY SUCCESSIONAL	Beaver Influenced System	Rock Bottom								
		Unconsolidated Bottom						TOSH		
		Aquatic Bed		BLSH				BLSH-NRDA	BLSH-NRDA	
	Beaver Absent	Rock Bottom								
		Unconsolidated Bottom						TOSH		
		Aquatic Bed		BLSH				BLSH-NRDA	BLSH-NRDA	
LATE SUCCESSIONAL	Beaver Influenced System	Rock Bottom								
		Unconsolidated Bottom						TOSH		
		Aquatic Bed		BLSH				BLSH-NRDA	BLSH-NRDA	
	Beaver Absent	Rock Bottom								
		Unconsolidated Bottom						TOSH		
		Aquatic Bed		BLSH				BLSH-NRDA	BLSH-NRDA	

Species Codes
BLSH = Blacknose shiner
NRDA = Northern redbelly dace
TOSH = Topeka shiner

Figure 4.3.3.6. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of species of greatest conservation ne within aquatic ecosystems of the Missouri River Ecoregior

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MISSOURI RIVER ECOREGION

AQUATIC ECOSYSTEMS

Time Since Major Disturbance (i.e., flood)	Disturbance Influenced Pathways	Habitat Descriptor	DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS			
		Geomorphic Setting						
		Water Regime	*Semi-permanent*	*Permanent*	*Perennial*			
		Sizeclass			*Large River*	*Small River*	*Creek*	*Headwater Stream*
EARLY SUCCESSIONAL	Beaver Influenced System	Streambed						
		Unconsolidated Bottom			SMSO			
		Aquatic Bed		NRDA	NRDA	NRDA	NRDA	
	Beaver Absent	Streambed						
		Unconsolidated Bottom			PAST-PADD-SICH-STCH-SMSO			
		Aquatic Bed		NRDA		NRDA	NRDA	
LATE SUCCESSIONAL	Beaver Influenced System	Streambed						
		Unconsolidated Bottom			SMSO			
		Aquatic Bed		NRDA	NRDA	NRDA	NRDA	
	Beaver Absent	Streambed						
		Unconsolidated Bottom			PAST-PADD-SICH-STCH-SMSO			
		Aquatic Bed		NRDA		NRDA	NRDA	

Species Codes
NRDA = Northern redbelly dace
PADD = Paddlefish
PAST = Pallid sturgeon
SICH = Sicklefin chub
SMSO = Smooth Softshell
STCH = Sturgeon chub

Figure 4.4.3.6. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of fish species of greatest conservation need within aquatic ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

AQUATIC ECOSYSTEMS

Time Since Major Disturbance (i.e., flood)	Disturbance Influenced Pathways	Habitat Descriptor	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS							
Geomorphic Setting			Limnetic	Littoral	Semi-permanent	Permanent	Perennial							
Water Regime							Large River		Small Rivers		Creeks		Headwater Stream	
Sizeclass							Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)
Gradient														
EARLY SUCCESSIONAL	Beaver Influenced System	Rock Bottom		LACH			LACH		LACH					
		Unconsolidated Bottom		LOSU					LOSU		LOSU			
		Aquatic Bed		FIDA-PEDA		FIDA-PEDA			FIDA-NRDA-PEDA		FIDA-NRDA-PEDA		FIDA	
	Beaver Absent	Rock Bottom		LACH			LACH		LACH					
		Unconsolidated Bottom		LOSU			STCH		LOSU		LOSU			
		Aquatic Bed		FIDA-PEDA		FIDA-PEDA			FIDA-NRDA-PEDA		FIDA-NRDA-PEDA		FIDA	
LATE SUCCESSIONAL	Beaver Influenced System	Rock Bottom		LACH			LACH		LACH					
		Unconsolidated Bottom		LOSU					LOSU		LOSU			
		Aquatic Bed		FIDA-PEDA		FIDA-PEDA			FIDA-NRDA-PEDA		FIDA-NRDA-PEDA		FIDA	
	Beaver Absent	Rock Bottom		LACH			LACH		LACH					
		Unconsolidated Bottom		LOSU			STCH		LOSU		LOSU			
		Aquatic Bed		FIDA-PEDA		FIDA-PEDA			FIDA-NRDA-PEDA		FIDA-NRDA-PEDA		FIDA	

Species Codes
FIDA = Finescale dace
LACH = Lake chub
LOSU = Longnose sucker
NRDA = Northern redbelly dace
PEDA = Pearl dace
STCH = Sturgeon chub

Figure 4.5.3.6. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of fish species of greatest conservation need within aqautic ecosystems of the Black Hills Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS STEPPE ECOREGION

AQUATIC ECOSYSTEMS

Disturbance Influenced Pathways			Habitat Descriptor	DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS							
Geomorphic Setting						Perennial							
Water Regime				Semi-permanent	Permanent	Large River		Small River		Creek		Headwater Stream	
Sizeclass													
Gradient						Low Gradient (≤ 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (≤ 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (≤ 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (≤ 2% slope)	Mid-High Gradient (>2% slope)
Time Since Major Disturbance (i.e., flood)	EARLY SUCCESSIONAL	Beaver Influenced System	Rock Bottom			LACH		LACH					
			Unconsolidated Bottom					MOSU	MOSU	MOSU	MOSU		
			Aquatic Bed		FIDA			FIDA		FIDA		FIDA	
		Beaver Absent	Rock Bottom			LACH		LACH					
			Unconsolidated Bottom					MOSU	MOSU	MOSU	MOSU		
			Aquatic Bed		FIDA			FIDA		FIDA		FIDA	
	LATE SUCCESSIONAL	Beaver Influenced System	Rock Bottom			LACH		LACH					
			Unconsolidated Bottom					MOSU	MOSU	MOSU	MOSU		
			Aquatic Bed		FIDA			FIDA		FIDA		FIDA	
		Beaver Absent	Rock Bottom			LACH		LACH					
			Unconsolidated Bottom					MOSU	MOSU	MOSU	MOSU		
			Aquatic Bed		FIDA			FIDA		FIDA		FIDA	

Species Codes
FIDA = Finescale dace
LACH = Lake chub
MOSU = Mountain sucker

Reptiles and Amphibians

COMMON NAME: BLANDING'S TURTLE (BLTU)

Scientific Name: *Emys blandingii*

DESCRIPTION

Medium, freshwater turtle with high-domed, slaty-colored carapace and variable yellow flecking, long neck and yellow throat.

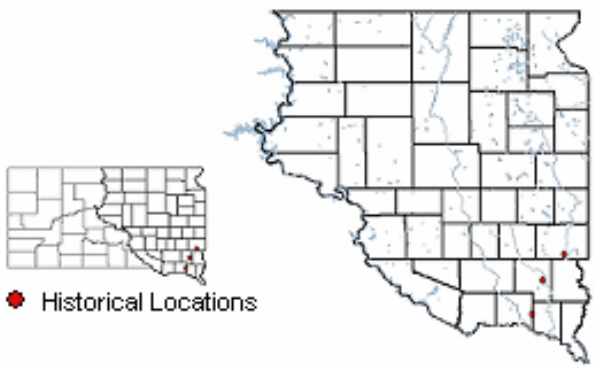
PROTECTION STATUS

Federal: None
State: Endangered
Global Rank: G4
State Rank: S1

DISTRIBUTION

Historical: Southeastern corner Tallgrass Subregion; western and northern edge of this species range

Current: Southern Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – calm, clean, shallow water with rich aquatic vegetation and soft mud bottoms, such as floodplain marsh, prairie marsh, wet prairie or small creeks and associated wetlands; associated with sandy upland areas for nesting

Ecosystem Diversity – Tallgrass Subregion
Primary EDM's –riparian/wetland ecosystems and aquatic ecosystems, see Figures 4.1.2.7 and 4.1.3.6 (see fishes section)

CAUSES OF CONCERN

- Habitat loss/degradation -
  - Drainage, inundation, or cultivation to the edge of wetlands for agriculture
  - River channelization
  - Water impoundment
- Nest depredation
- Road mortality
- Herbicides and Pesticides

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

Herman,T., J.S. Bleakney, J.S. Boates, C. Drysdale, J. Gilhen, I. Morrison, T. Power, K.L. Standing, and M. Elderkin. 1999. National Recovery Plan for Blanding's Turtle (*Emydoidea blandingii*) Nova Scotia population. Report No. 18. Ottawa: Recovery of Nationally Endangered Wildlife Committee, 39pp.

COMMON NAME: FALSE MAP TURTLE (FMTU)

Scientific Name: *Graptemys pseudogeographica*

DESCRIPTION

Medium, freshwater turtle; brown carapace with middorsal keel and subtle knobs, light speck/line behind eye.

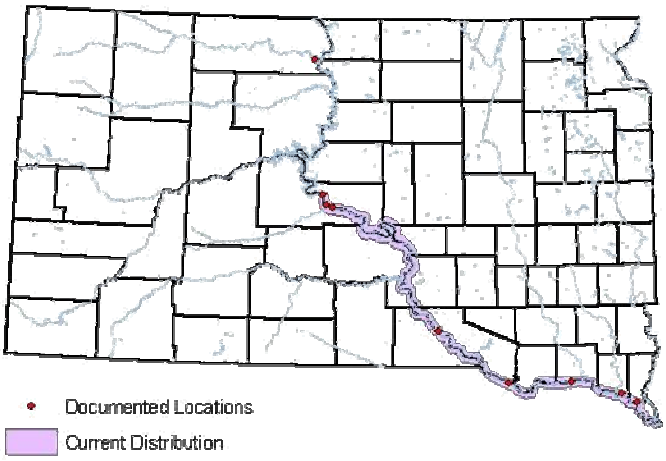
PROTECTION STATUS

Federal: None
State: Threatened
Global Rank: G5
State Rank: S3

DISTRIBUTION

Historical: Missouri River Ecoregion

Current: Missouri River Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

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.

Ecosystem Diversity – Missouri River Ecoregion
Primary EDM – riparian/wetland ecosystems, see Figure 4.3.2.7

CAUSES OF CONCERN

- Habitat loss/degradation -
  - Drainage, inundation, or cultivation to the edge of wetlands for agriculture
  - River channelization
  - Water impoundment
  - Water pollution
  - Herbicide/pesticide use
  - Removal of basking sites (deadwood)
  - Lack of nesting sites (e.g., sand bars)
- Nest disturbance by recreationists
- Unlawful shooting

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

National Resource Council. 2002. The Missouri River Ecosystem: exploring the prospects for recovery. National Academy Press, Washington, D. C., USA.

COMMON NAME: LINED SNAKE (LISN)

Scientific Name: *Tropidoclonion lineatum*

DESCRIPTION

Small snake resembling the garter snake; variable colored with light stripes running down the back and sides

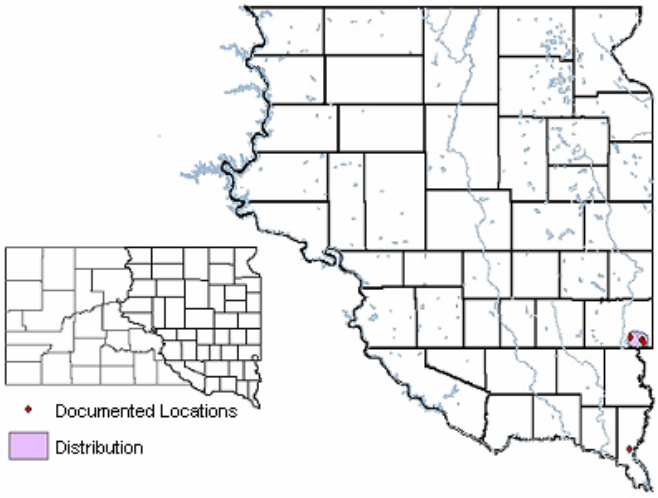
PROTECTION STATUS

Federal: None
State: Endangered
Global Rank: G5
State Rank: S1

DISTRIBUTION

Historical: southeastern corner of the Tallgrass Subregion; northernmost extent of range

Current: Tallgrass Subregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – open, grassy and sparsely wooded areas with deep, rich soils, often near hillsides or water sources.

Ecosystem diversity – Tallgrass Subregion
Primary EDM – riparian/wetland ecosystems, see Figure 4.1.2.7
Secondary EDM – may be associated with portions of grass/shrub ecosystems adjacent to riparian/wetland areas.

CAUSES OF CONCERN

- Habitat loss/degradation
  - Conversion/draining of wetlands for agriculture, urban development or other uses.

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: EASTERN HOGNOSE SNAKE (EHSN)

Scientific Name: *Heterodon platirhinos*

DESCRIPTION

Medium-sized, harmless snake with a heavy body and an upturned snout; variable colors include tan, yellow, and brown

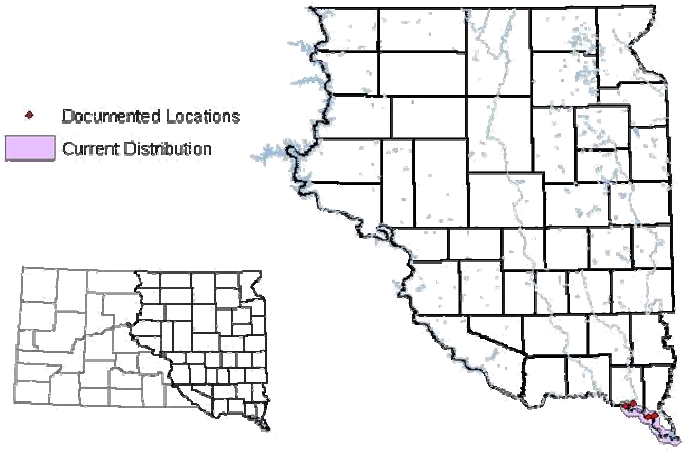
PROTECTION STATUS

Federal: None
State: Threatened
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Southern tip of the Eastern Prairie Ecoregion and Missouri River Ecoregion; northern edge of range

Current: See Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat - found in sandy floodplains of rivers and streams and sandy upland grasslands

Ecosystem diversity – Tallgrass Subregion; Mixed-grass Subregion; Missouri River Ecoregion
Primary EDM's – grass/shrub ecosystems; riparian/wetland ecosystems, see Figures 4.1.1.7, 4.2.1.7, 4.1.2.7, 4.2.2.7 and 4.3.2.7

CAUSES OF CONCERN

- Habitat loss/degradation
  - Destruction/disturbance of sand dune habitat by recreationists and commercial and recreational development
- Possibly pesticides/herbicides

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

National Resource Council. 2002. The Missouri River Ecosystem: exploring the prospects for recovery. National Academy Press, Washington, D. C., USA.

COMMON NAME: BLACK HILLS REDBELLY SNAKE (BHRS)

Scientific Name: *Storeria occipitomaculata pahasapae*

DESCRIPTION

Small woodland snake that is gray or reddish brown; four narrow dark stripes on its back and one pale stripe down middle

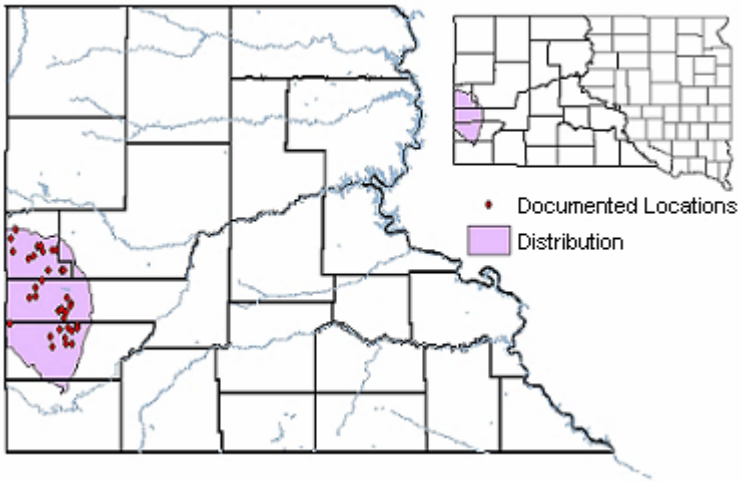
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5T3
State Rank: S3

DISTRIBUTION

Historical: Black Hills Ecoregion

Current: Black Hills Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat - deciduous and mixed woodlands; damp, moist, and cool environments of riparian/wetland ecosystems; hide under bark, logs, rocks, and leaf litter

Ecosystem diversity – Black Hills Ecoregion
Primary EDM – riparian/wetland ecosystems, see Figure 4.5.2.7

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Land conversion/impacts that include logging, heavy grazing, urban development, road construction, etc.
- Road mortality during migrations to and from their hibernacula.

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.

COMMON NAME: COPE'S GRAY TREEFROG (CGTR)

Scientific Name: *Hyla chrysoscelis*

DESCRIPTION

Tree frog with yellow inner thigh markings on underside and solid lime green on the back (during breeding)

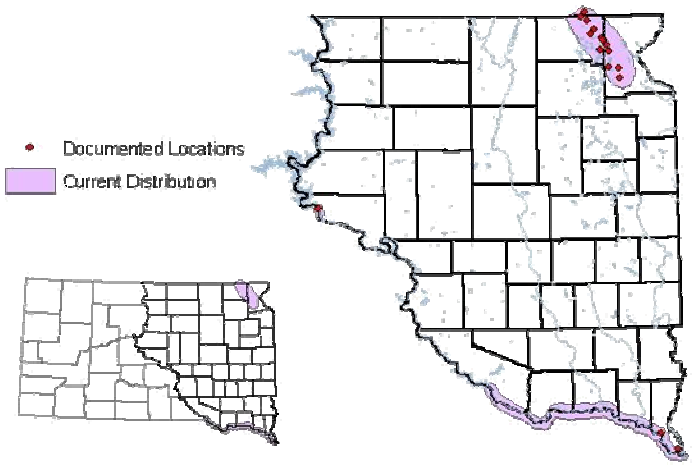
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Southeastern corner of Tallgrass Subregion; western extreme of its range

Current: Missouri River Ecoregion and northern Tallgrass Subregion, and see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat - 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

Ecosystem diversity – Tallgrass Subregion
Primary EDM – Riparian/wetland ecosystems, see Figure 4.1.2.7

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Drainage of aquatic areas
  - Timber harvest/brush clearing
- Pesticide application
- Predation by non-native species
- Introduction of fish into formerly fishless areas

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

National Resource Council. 2002. The Missouri River Ecosystem: exploring the prospects for recovery. National Academy Press, Washington, D. C., USA.

COMMON NAME: SMOOTH SOFTSHELL (SMSO)

Scientific Name: *Apalone mutica*

DESCRIPTION

Turtle that is easily recognized by its long pointed snout and heavily webbed feet

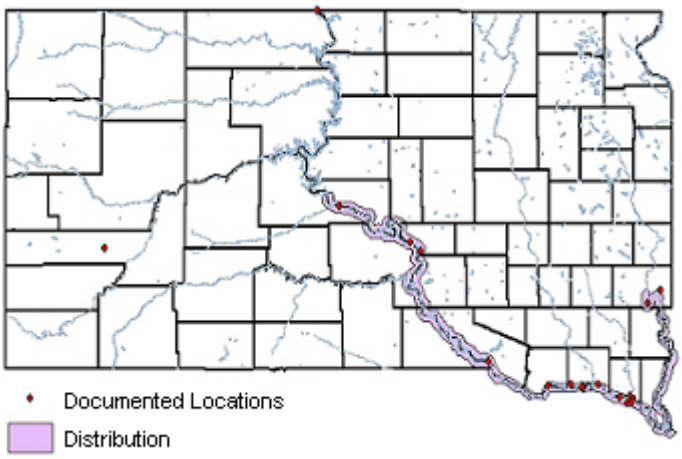
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Missouri River Ecoregion; Big Sioux River floodplain of the Tallgrass Subregion

Current: See Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat - rivers, 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

Ecosystem diversity – Missouri River Ecoregion, Tallgrass Subregion
Primary EDM –riparian/wetland ecosystems and aquatic ecosystems, see Figures 4.1.2.7, 4.3.2.7, 4.1.3.6 (fishes section), 4.3.3.6 (fishes section)

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Stream channelization and impoundment
  - Water pollution
  - Removal of basking sites (e.g., deadwood)
  - Lack of nesting sites (e.g., sandbars)
- Herbicide and pesticide use
- Nest disturbance by recreationists

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

National Resource Council. 2002. The Missouri River Ecosystem: exploring the prospects for recovery. National Academy Press, Washington, D. C., USA.

COMMON NAME: WESTERN BOX TURTLE (WBTU)

Scientific Name: *Terrapene ornata*

DESCRIPTION

Shell is dark brown or black with bright yellow lines that radiate to form a star burst pattern

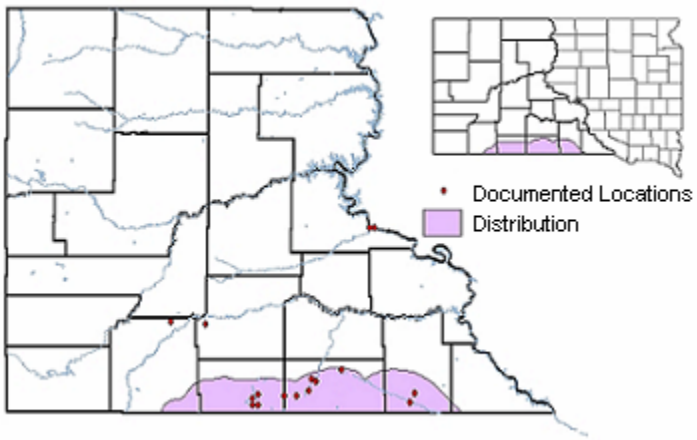
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Southern third of the Great Plains Steppe Ecoregion

Current: Southern Great Plains Steppe Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – 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

Ecosystem diversity – Great Plains Steppe Ecoregion
Primary EDM – grass/shrub ecosystems, see Figure 4.4.1.7

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Conversion of habitat due to agricultural, urban development, or other purposes
- Road mortality
- Pet trade

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: LESSER EARLESS LIZARD (LELI)

Scientific Name: *Holbrookia maculata*

DESCRIPTION

Small gray to brownish lizard with lengthwise rows of dark blotches separated by pale stripe down center of back

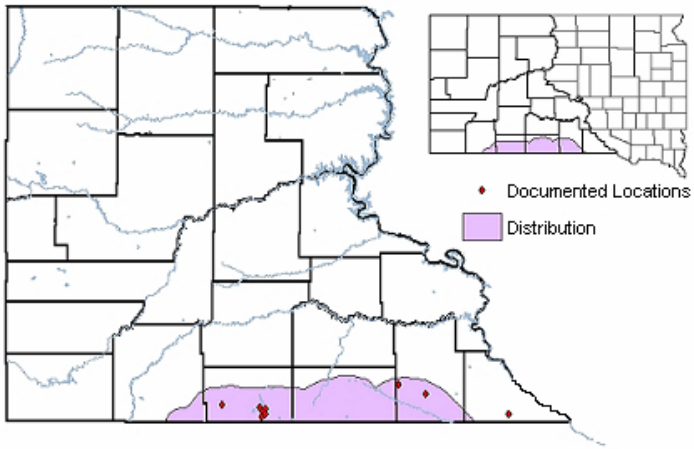
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Southern quarter of the Great Plains Steppe Ecoregion; northern extent of this species range

Current: Southern Great Plains Steppe Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – sandhills; sandy or gravelly areas along streams; sparsely vegetated or short-statured grass ecosystems; prairie dog towns

Ecosystem diversity – Great Plains Steppe Ecoregion
Primary EDM's – grass/shrub ecosystems, see Figure 4.4.1.7

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Stabilization of sand dunes
  - Loss of habitat due to land conversion to agriculture and urban development

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: NORTHERN CRICKET FROG (NCFR)

Scientific Name: *Acris crepitans*

DESCRIPTION

Small, semi-aquatic, brown-gray frog with a "warty" appearance and pointed snout

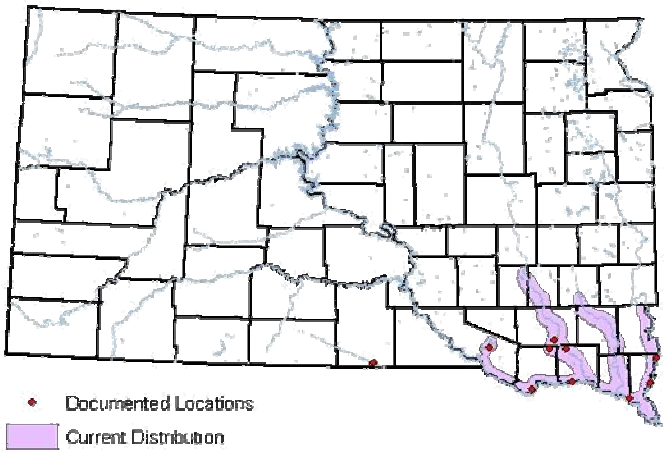
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S1

DISTRIBUTION

Historical: Southeastern corner of the Eastern Prairie Ecoregion and Missouri River Ecoregion ; northwestern edge of range.

Current: Southeastern corner of the Eastern Prairie Ecoregion and Missouri River Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat - margins of permanent marshes, fens, wet meadows, including slow moving streams and rivers, and lakes; narrow mudflats at waters edge, or on floating vegetation in shallow water; open mud flats and stream banks with abundant, low emergent vegetation are preferred

Ecosystem diversity – Tallgrass Subregion; Mixed-grass Subregion; Missouri River Ecoregion
Primary EDM – riparian/wetland ecosystems, see Figures 4.1.2.7, 4.2.2.7 and 4.3.2.7

CAUSES OF CONCERN

- Habitat loss/degradation –
  - Fewer opportunities for heterogeneous successional conditions due to suppression of historical disturbance regimes such as fire, flooding, beaver ponds, and varied grazing levels
- Predation by non-native species
- Water pollution caused by pesticides/herbicides and other pollutants

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: MANY-LINED SKINK (MLSK)

Scientific Name: *Eumeces multivirgatus*

DESCRIPTION

Long-bodied skink, with many alternating light and dark stripes

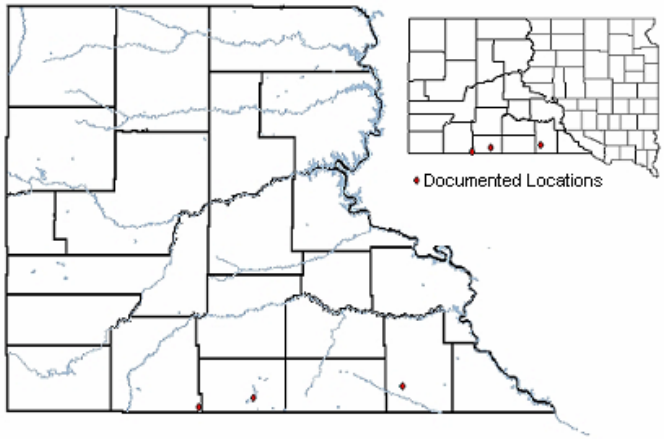
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S1

DISTRIBUTION

Historical: Southern quarter of the Great Plains Steppe Ecoregion; northernmost fringe of range

Current: Southern Great Plains Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat – areas of loose sandy soil and prairie dog towns; often found beneath rocks or logs; sandhills and open plains habitats of Great Plains.

Ecosystem diversity – Great Plains Steppe Ecoregion
Primary EDM – grass/shrub ecosystems, see Figure 4.4.1.7

CAUSES OF CONCERN

- Habitat loss/degradation -
  - Conversion of habitat due to agricultural, urban development, or other purposes

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

COMMON NAME: SHORT-HORNED LIZARD (SHLI)

Scientific Name: *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

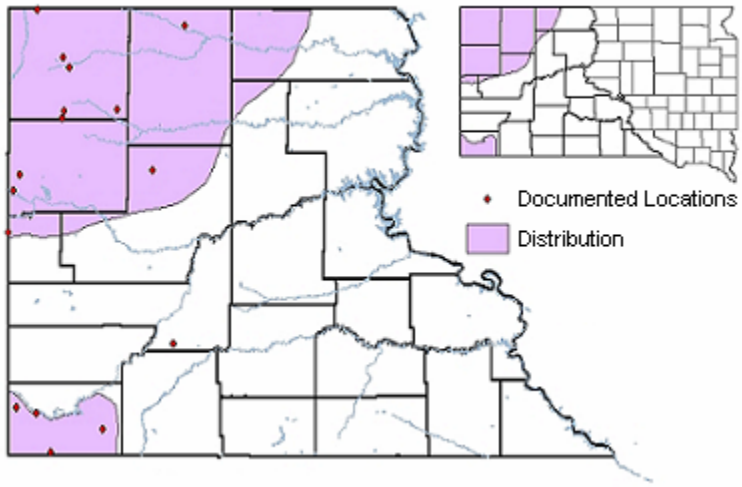
PROTECTION STATUS

Federal: None
State: None
Global Rank: G5
State Rank: S2

DISTRIBUTION

Historical: Great Plains Steppe Ecoregion

Current: Great Plains Steppe Ecoregion, see Figure on right



KEY HABITAT – LINKAGE TO ECOSYSTEM DIVERSITY

Key habitat - 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

Ecosystem diversity – Great Plains Steppe Ecoregion
Primary EDM – grass/shrub ecosystems, see Figure 4.4.1.7

CAUSES OF CONCERN

- Habitat loss/degradation-
  - Conversion of grassland to cropland or other purposes
  - Pest control programs have reduced the distribution and extent of prairie dog colonies
- Off-road recreational vehicle traffic and increased traffic associated with road building to oil and gas developments could also have negative impacts on some populations
- Indiscriminant use of insecticides to control some insect species could also affect the food supply

EXISTING RECOVERY PLANS/CONSERVATION STRATEGIES

None

Figure 4.1.1.7. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of amphibian and reptile species of greatest conservation need within grass/shrub ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

GRASS/SHRUB ECOSYSTEMS

	Clayey	Claypan	Thin Claypan	Loamy	Sandy	Thin Upland	Shallow
Early Seral					EHSN		
Vegetative composition/structure primarily influenced by short-interval fire regimes (<8 yrs.)							
Light Grazing					EHSN		
Moderate Grazing					EHSN		
Heavy Grazing					EHSN		
Vegetative composition/structure primarily influenced by long-interval fire regimes (≥ 8 yrs.)							
Light Grazing					EHSN		
Moderate Grazing					EHSN		
Heavy Grazing					EHSN		

Species Code
EHSN = Eastern Hognose Snake

Figure 4.1.2.7. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of amphibian and reptile species of greatest conservation need within riparian/wetland ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways	Habitat Descriptors	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
		Geomorphic →								
		Water Regime →	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
		Slope →					Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing								
		Rocky Shore								
		Unconsolidated Shore	EHSN-BLTU			BLTU	EHSN - SMSO-BLTU			
		Emergent			LISN	LISN-NCFR	LISN-NCFR			
		Scrub-Shrub								
		Forested	CGTR		CGTR	CGTR	CGTR			
		Heavy Bison Grazing								
		Rocky Shore								
		Unconsolidated Shore	EHSN-BLTU			BLTU	EHSN-SMSO-BLTU			
		Emergent				NCFR	NCFR			
		Scrub-Shrub								
		Forested								
	Beaver Unmodified System	Low to Moderate Bison Grazing								
		Rocky Shore								
		Unconsolidated Shore	EHSN-BLTU			BLTU	EHSN-SMSO	EHSN		
		Emergent		LISN	LISN	LISN-NCFR	LISN-NCFR	LISN	LISN	
		Scrub-Shrub								
		Forested	CGTR	CGTR	CGTR	CGTR	CGTR	CGTR		CGTR
		Heavy Bison Grazing								
		Rocky Shore								
		Unconsolidated Shore	EHSN-BLTU			BLTU	EHSN-SMSO	EHSN		
		Emergent				NCFR	NCFR			
		Scrub-Shrub								
		Forested								
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing								
		Rocky Shore								
		Unconsolidated Shore	EHSN-BLTU			BLTU	EHSN-SMSO-BLTU			
		Emergent			LISN	LISN-NCFR	LISN-NCFR			
		Scrub-Shrub								
		Forested	CGTR		CGTR	CGTR	CGTR			
		Heavy Bison Grazing								
		Rocky Shore								
		Unconsolidated Shore	EHSN-BLTU			BLTU	EHSN -SMSO-BLTU			
		Emergent				NCFR	NCFR			
		Scrub-Shrub								
		Forested								
	Beaver Unmodified System	Low to Moderate Bison Grazing								
		Rocky Shore								
		Unconsolidated Shore	EHSN-BLTU			BLTU	EHSN-SMSO	EHSN		
		Emergent		LISN	LISN	LISN-NCFR	LISN-NCFR	LISN	LISN	
		Scrub-Shrub								
		Forested	CGTR	CGTR	CGTR	CGTR	CGTR	CGTR		CGTR
		Heavy Bison Grazing								
		Rocky Shore								
		Unconsolidated Shore	EHSN-BLTU			BLTU	EHSN-SMSO	EHSN		
		Emergent				NCFR	NCFR			
		Scrub-Shrub								
		Forested								

Species Codes

- BLTU = Blanding's Turtle
- CGTR = Cope's Gray Treefrog
- EHSN = Eastern Hognose Snake
- LISN = Lined Snake
- NCFR = Northern Cricket Frog
- SMSO = Smooth Softshell

Figure 4.2.1.7. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of amphibian and reptile species of greatest conservation need within grass/shrub ecosystems of the Mixedgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

GRASS/SHRUB ECOSYSTEMS

	Ecolological Site Class							
	Dense Clay	Clayey	Shallow Clayey	Claypan	Loamy	Sandy	Shallow	Very Shallow
Early Seral						EHSN		
Prairie Dog Town, active								
Prairie Dog Town, inactive								
Vegetative composition/structure primarily influenced by short-interval fire regimes (<10 yrs.)								
Light Grazing						EHSN		
Moderate Grazing						EHSN		
Heavy Grazing						EHSN		
Vegetative composition/structure primarily influenced by long-interval fire regimes (>10 yrs.)								
Light Grazing						EHSN		
Moderate Grazing						EHSN		
Heavy Grazing						EHSN		

Ecosystems that do not occur

Species Codes
EHSN = Eastern Hognose Snake

Figure 4.2.2.7. South Dakota Comprehensive Wildlife Conservation Strategy - expected distributions of amphibian and reptile species of greatest conservation need within riparian/wetland ecosystems of the Mixedgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
			Geomorphic →								
			Water Regime →	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
			Slope →					Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore	EHSN							
			Emergent				NCFR	NCFR			
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore	EHSN							
			Emergent				NCFR	NCFR			
			Scrub-Shrub								
			Forested								
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore	EHSN				EHSN	EHSN		
			Emergent				NCFR	NCFR			
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore	EHSN				EHSN	EHSN		
			Emergent				NCFR	NCFR			
			Scrub-Shrub								
			Forested								
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore	EHSN							
			Emergent				NCFR	NCFR			
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore	EHSN							
			Emergent				NCFR	NCFR			
			Scrub-Shrub								
			Forested								
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore								
			Unconsolidated Shore	EHSN				EHSN	EHSN		
			Emergent				NCFR	NCFR			
			Scrub-Shrub								
			Forested								
		Heavy Bison Grazing	Rocky Shore								
			Unconsolidated Shore	EHSN				EHSN	EHSN		
			Emergent				NCFR	NCFR			
			Scrub-Shrub								
			Forested								

Species Codes
EHSN = Eastern Hognose Snake
NCFR = Northern Cricket Frog

Figure 4.3.2.7. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of amphibian and reptile species of greatest conservation need within riparian/wetland ecosystems of the Missouri River Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MISSOURI RIVER ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
			Geomorphic →							
			Water Regime →	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
			Slope →				Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore				EHSN-SMSO			
			Emergent			FMTU-NCFR	FMTU-NCFR			
			Scrub-Shrub							
			Forested							
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore				EHSN-SMSO			
			Emergent			FMTU-NCFR	FMTU-NCFR			
			Scrub-Shrub							
			Forested							
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore				EHSN-SMSO	EHSN		
			Emergent			FMTU-NCFR	FMTU-NCFR			
			Scrub-Shrub							
			Forested							
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore				EHSN-SMSO	EHSN		
			Emergent			FMTU-NCFR	FMTU-NCFR			
			Scrub-Shrub							
			Forested							
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore				EHSN-SMSO			
			Emergent			FMTU-NCFR	FMTU-NCFR			
			Scrub-Shrub							
			Forested							
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore				EHSN-SMSO			
			Emergent			FMTU-NCFR	FMTU-NCFR			
			Scrub-Shrub							
			Forested							
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore							
			Unconsolidated Shore				EHSN-SMSO	EHSN		
			Emergent			FMTU-NCFR	FMTU-NCFR			
			Scrub-Shrub							
			Forested							
		Heavy Bison Grazing	Rocky Shore							
			Unconsolidated Shore				EHSN-SMSO	EHSN		
			Emergent			FMTU-NCFR	FMTU-NCFR			
			Scrub-Shrub							
			Forested							

Species Codes
EHSN = Eastern Hognose Snake
FMTU = False Map Turtle
NCFR = Northern Cricket Frog
SMSO = Smooth Softshell

Figure 4.4.1.7. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of amphibian and reptile species of greatest conservation need within grass/shrub ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

GRASS/SHRUB ECOSYSTEMS

Disturbance Influenced Pathways ↓	Ecolological Site Class								
	Porous Clay	Dense Clay	Clayey	Claypan	Loamy	Shallow	Badlands	Sandy	Saline Upland
Early Seral	SHLI	SHLI	SHLI	SHLI	SHLI	SHLI	SHLI	WBTU-LELI-SHLI-MLSK	SHLI
Prairie Dog Town, active			WBTU-LELI-MLSK	WBTU-LELI-MLSK	WBTU-LELI-MLSK				WBTU-LELI-MLSK
Prairie Dog Town, inactive			WBTU-LELI-MLSK	WBTU-LELI-MLSK	WBTU-LELI-MLSK				WBTU-LELI-MLSK
Vegetative composition-structure primarily influenced by short-interval fire regimes (<15 yrs.)									
Light Grazing								MLSK	
Moderate Grazing	SHLI	SHLI	SHLI	SHLI	SHLI	SHLI	SHLI	WBTU-LELI-SHLI-MLSK	SHLI
Heavy Grazing	SHLI	SHLI	SHLI	SHLI	SHLI	SHLI	SHLI	WBTU-LELI-SHLI-MLSK	SHLI
Vegetative composition-structure primarily influenced by long-interval fire regimes (>15 yrs.)									
Light Grazing								MLSK	
Moderate Grazing	SHLI	SHLI	SHLI	SHLI	SHLI	SHLI	SHLI	WBTU-LELI-SHLI-MLSK	SHLI
Heavy Grazing	SHLI	SHLI	SHLI	SHLI	SHLI	SHLI	SHLI	WBTU-LELI-SHLI-MLSK	SHLI

Ecosystems that do not occur

Species Codes
LELI = Lesser Earless Lizard
MLSK = Many-lined Skink
SHLI = Short-horned Lizard
WBTU = Western Box Turtle

Figure 4.5.2.7. South Dakota Comprehensive Wildlife Conservation Plan - expected distributions of amphibian and reptile species of greatest conservation need withn riparian/wetland ecosystems of the Black Hills Ecoregion. BHRS = Black Hills Redbelly Snake

ECOSYSTEM DIVERSITY MATRIX - BLACK HILLS ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways			Habitat Descriptors	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS				SLOPE SYSTEMS
				Geomorphic →								
				Water Regime →	Temporary	Semi-permanent	Permanent	Perennial		Intermittent		
				Gradient →				Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Grazing	Rocky Shore									
			Unconsolidated Shore									
			Emergent									
			Scrub-Shrub									
			Forested			BHRS	BHRS	BHRS	BHRS			
		Heavy Grazing	Rocky Shore									
			Unconsolidated Shore									
			Emergent									
			Scrub-Shrub									
			Forested			BHRS	BHRS	BHRS	BHRS			
	Beaver Unmodified System	Low to Moderate Grazing	Rocky Shore									
			Unconsolidated Shore									
			Emergent									
			Scrub-Shrub									
			Forested		BHRS	BHRS	BHRS	BHRS	BHRS	BHRS	BHRS	BHRS
		Heavy Grazing	Rocky Shore									
			Unconsolidated Shore									
			Emergent									
			Scrub-Shrub									
			Forested		BHRS	BHRS	BHRS	BHRS	BHRS	BHRS	BHRS	BHRS
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Grazing	Rocky Shore									
			Unconsolidated Shore									
			Emergent									
			Scrub-Shrub									
			Forested			BHRS	BHRS	BHRS	BHRS			
		Heavy Grazing	Rocky Shore									
			Unconsolidated Shore									
			Emergent									
			Scrub-Shrub									
			Forested			BHRS	BHRS	BHRS	BHRS			
	Beaver Unmodified System	Low to Moderate Grazing	Rocky Shore									
			Unconsolidated Shore									
			Emergent									
			Scrub-Shrub									
			Forested		BHRS	BHRS	BHRS	BHRS	BHRS	BHRS	BHRS	BHRS
		Heavy Grazing	Rocky Shore									
			Unconsolidated Shore									
			Emergent									
			Scrub-Shrub									
			Forested		BHRS	BHRS	BHRS	BHRS	BHRS	BHRS	BHRS	BHRS

5.0 PROBLEMS AND CAUSES OF CONCERN

There are many problems and causes of concern associated with maintaining and conserving the biological diversity of a state the size of South Dakota. The goal of a strategic plan is not to specifically address all problems and concerns occurring at a single point in time, but rather to provide a framework under which current and future problems and concerns can be identified and addressed.

The primary focus of the South Dakota CWCP is to provide for ecosystem diversity across all delineated ecoregions within South Dakota. The CWCP focuses on a process to identify and provide the appropriate diversity of ecosystems that in turn support the diversity of wildlife and fish species in South Dakota. This allows land managers, landowners, and stakeholders to focus on providing specific ecosystem conditions that benefit many species rather than focusing entirely on what is impacting a single species. However, some problems may not be addressed through an ecosystem diversity approach. Problems not addressed by the ecosystem diversity approach should be identified and a parallel framework should be developed to address the problems in the planning process.

Ecosystem Diversity

There are three primary problems and causes of concern associated with maintaining ecosystem diversity within South Dakota including: 1) the direct alteration or conversion of species compositions, structures, or functions; 2) the indirect alteration and/or suppression of historical disturbance processes; and 3) the indirect alteration of species compositions, structures, or functions through the introduction and spread of non-native species.

Direct alteration/conversion of ecosystems –

The primary causative agents for alteration/conversion of ecosystems within South Dakota include agriculture, and to a lesser degree urbanization (including roads and other infrastructure). For riparian/wetland and aquatic ecosystems, additional causative agents include draining, surface water diversion, water impoundments, dams, ponds for water supply, and stream channelization.

Indirect alteration and/or suppression of historical disturbances processes –

The primary causative agents for alteration and/or suppression of historical disturbance processes include fire suppression and altered grazing regimes in grass/shrub and forested ecosystems, prairie dog control in grass/shrub ecosystems, and flood control and beaver control/dam removal in riparian/wetland and aquatic ecosystems.

Indirect alteration caused by human activities –

Non-native species: The accidental or intentional introduction of non-native species that are invasive can have major impacts on native species and ecosystems. Non-native 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 historical ecosystems. Non-native 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 non-native 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. For a list of non-native plant species that can or have impacted South Dakota ecosystem diversity, see Appendix F.

Climate change: The possible effects of a changing global climate are poorly understood at this time. However, even small changes could threaten both ecosystems and species as their distribution is largely determined by climate. Climate change models predict that global warming could lead to drier conditions

in the Northern Great Plains. Under this scenario, some species will need to shift their ranges in response to these changes. Structural and environmental barriers, as well as human presence, may prohibit some species from making the necessary distributional shifts. For these reasons, some species and possibly some ecosystems are likely to be eliminated by climate change.

The following sections present a discussion of problems and causes of concern associated with both direct and indirect alteration/conversion of ecosystem diversity within each of the four ecoregions.

Great Plains Steppe Ecoregion

Grass/shrub ecosystems

Direct alteration/conversion: Overall land conversion of grass/shrub ecosystems in the Great Plains Steppe Ecoregion is relatively low at 17%, relative to other ecoregions of South Dakota. Table 5.1 illustrates a breakdown of acres converted by ecological site and type of conversion. Loamy and Clayey sites have received the highest amounts of conversion, 30 and 20%, respectively, mostly a result of agricultural conversion.

Table 5.1. Number of acres and percentage of each grass/shrub ecological site converted for agricultural, urbanization, and mining/gravel purposes in the Great Plains Steppe ecoregion.

	Porous Clay	Dense Clay	Clayey	Claypan	Loamy	Shallow	Badlands	Sandy	Saline Upland	Total
Agriculture	16	35,203	1,425,184	24,987	1,291,917	248,238	1,247	565,084	8	3,591,884
Urban/Rural Development	1	310	5,693	750	9,307	1,967	0	1,718	0	19,746
Mining/Gravel Operations	0	0	64	9.2	448	7	0	34	0	562
Total Acres	**17**	**35,513**	**1,430,941**	**25,746**	**1,301,672**	**250,212**	**1,247**	**566,836**	**8**	**3,612,192**
% of Ecological Site conversion	**<1%**	**3%**	**20%**	**10%**	**30%**	**9%**	**<1%**	**19%**	**1%**	**17%**

Source: SSURGO soils data (USDA Natural Resources Conservation Service) and South Dakota GAP Analysis (USDOI Geological Survey)

Historical disturbance processes: While the amount of conversion overall is relatively low compared to other ecoregions, the number of acres remaining that truly represent historical conditions is also in question, but likely to be very low. Since European settlement, many changes have occurred in the historical disturbance regimes that influenced ecosystem diversity within the Great Plains Steppe Ecoregion. Fire still occurs in the Great Plains Steppe Ecoregion, however fires that burn today are considerably different than those that occurred historically. The amount of land that is burned is greatly reduced due to wildfire suppression, and the timing and intensity of prescribed fires do not always replicate historical fire conditions. In addition, the historical interaction of fire and grazing animals has been altered. Historically, grazing animals like bison, would preferentially select recently burned areas, 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. In general, fire suppression and grazing alteration has had profound impact on landscape heterogeneity and dynamic ecosystem processes. The most common grazing approach of the 20th century promoted moderate, season-long levels of grazing. Grasses that benefit from this grazing approach have increased, while grasses that require different levels or timing of grazing have been reduced[1]. 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.

Riparian/wetland and aquatic ecosystems

Direct alteration/conversion: The results of a GIS assessment of GAP land cover data with SSURGO soil data indicated that 252,088 acres of riparian/wetland ecosystems have been converted for agricultural purposes within the Great Plains Steppe Ecoregion. Urban areas and residential development have

resulted in the conversion of 1,095 additional acres, while mining and gravel operations were identified for converting 71 acres. Water control structures, such as dams, have further altered aquatic ecosystems from flowing water to non-flowing water ecosystems on some of the larger rivers and streams within the Great Plains Steppe Ecoregion, while also inundating the adjacent riparian ecosystems. 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 flows impact the amount and quality of aquatic habitat 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[2]. 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 non-native 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.

Historical disturbance processes: Water control structures moderate the effects of flood events resulting in impacts to normal river dynamics and ecological processes as well as ecosystem structure and species composition. Grazing policies have promoted a season-long moderate grazing level that has reduced the diversity of species and structures within riparian/wetland communities. Beaver population control and beaver dam removal have reduced the overall heterogeneity of both aquatic and riparian ecosystems along perennial streams and rivers. A review of National Wetland Inventory data for the Great Plains Steppe Ecoregion identified only several acres in their mapping that exhibited modifications due to beaver influence, indicating the relatively rare occurrence of beaver ponds on the landscape today. The suppression of historical fire regimes has caused an increase in the number of tree and shrub species occurring on adjacent upland sites. This increase in the number of trees and shrubs can reduce the amount of water available for runoff to adjacent riparian zones and streams.

Forested ecosystems

Direct alteration/conversion: Overall land conversion of forested ecosystems in the Great Plains Steppe Ecoregion is very low at <1%. Table 5.2 illustrates a breakdown of acres converted by ecological site and type of conversion. Dry bur oak received the highest rate of conversion at 5%. Most of the ecosystem conversion has resulted from agriculture.

Table 5.2. Number of acres and percentages of each forested ecological site converted for agricultural, urbanization, and mining/gravel purposes in the Great Plains Steppe Ecoregion.

	Dry Bur Oak	Xeric Ponderosa Pine	Warm, Dry Ponderosa Pine	Total
Agriculture	1,082	5,594	7	6,683
Urban/Rural Development	0	40	0	40
Mining/Gravel Operations	0	1	0	1
Total Acres	**1,082**	**5,635**	**7**	**6,724**
% of Ecological Site conversion	**5%**	**<1%**	**<1%**	**1%**

Source: SSURGO soils data (USDA Natural Resources Conservation Service) and South Dakota GAP Analysis (USDOI Geological Survey)

Historical disturbance processes: The suppression of naturally occurring fire has resulted in an increase in the number of ponderosa pine and other tree species occurring on upland sites of the Great Plains Steppe Ecoregion relative to historical conditions.

Black Hills Ecoregion

Grass/shrub ecosystems

Direct alteration/conversion: Overall land conversion of grass/shrub ecosystems in the Black Hills Ecoregion is relatively low at 6% compared to other ecoregions of South Dakota. Table 5.3 illustrates a breakdown of acres converted by ecological site and type of conversion. Loamy and Claypan ecological sites have received the highest rates of conversion at 9% and 13%, respectively. Both agriculture and urbanization play a relatively equal role in the reason for conversion.

Table 5.3. Number of acres and percentages of each grass/shrub ecological site converted for agricultural, urbanization, and mining/gravel purposes in the Black Hills Ecoregion.

	Clayey	Claypan	Loamy	Shallow	Thin Upland	Sandy	High Country Loamy	Mountain Prairie	Total
Agriculture	480	184	3,601	1,802	2,347	187	10	87	8,698
Urban/Rural Development	131	< 1	3856	2226	925	0	0	83	7221
Mining/Gravel Operations	21	0	280	67	36	3	< 1	31	438
Total Acres	**632**	**184**	**7,737**	**4,095**	**3,308**	**190**	**10**	**201**	**16,357**
% of Ecological Site conversion	**4%**	**13%**	**9%**	**6%**	**7%**	**4%**	**<1%**	**1%**	**6%**

Source: SSURGO soils data (USDA Natural Resources Conservation Service) and South Dakota GAP Analysis (USDOI Geological Survey)

Historical disturbance processes: As with the Great Plains Steppe Ecoregion, the number of acres remaining that truly represent historical conditions is in question. Since European settlement, many changes have occurred in the historical disturbance regimes influencing the grass/shrub ecosystems of the Black Hills Ecoregion. Fire still occurs but is typically managed (prescribed) or suppressed, thereby changing the distribution, size, frequency, and timing of burns occurring on the landscape relative to historical fires. In addition, the historical interaction of fire and grazers is no longer occurring. The loss of frequent and widespread fires and changes in grazing has had profound impacts on landscape heterogeneity and dynamic ecosystem processes. Species composition and structure reflect the lack of frequent fire events and less heterogeneous grazing practices, i.e., uniformly applied grazing levels across all pastures. The amount of woody vegetation occurring on some ecological sites may be greater than occurred under more frequent fire regimes. In addition, the reduction in acres of prairie dog colonies in the southern grass/shrub ecosystems of the Black Hills foothills has further impacted many wildlife species dependent on their disturbance influence for suitable habitat conditions.

Riparian/wetland and aquatic ecosystems

Direct alteration/conversion: Results of a GIS assessment of GAP land cover data with SSURGO soil data indicated that 1,255 acres of riparian/wetland ecosystems have been converted for agricultural purposes within the Black Hills Ecoregion. Urban areas and residential development have resulted in the conversion of 449 acres, while mining and gravel operations have converted 144 acres.

Historical disturbance processes: The suppression or alteration of historical disturbance processes occurring in the Black Hills Ecoregion has reduced the heterogeneity of riparian/wetland and aquatic ecosystems. Dams have been placed on many of the streams to control flooding and store water for irrigation, hydroelectricity, and other human uses. Water management programs reduce the effects of flood events and thereby prevent many riparian species from occurring or regenerating. The result is more homogenous riparian/wetland ecosystems. Channelization and water diversion projects on other streams have further impacted the extent, species composition, and structure of the remaining riparian/wetland and aquatic ecosystems. Beaver populations have been significantly reduced on perennial systems from historical levels resulting in the loss of pond habitat for many aquatic species, and the overall amounts of adjacent riparian ecosystems. A review of National Wetland Inventory data indicates that while the Black Hills Ecoregion exhibits the greatest amount of beaver influenced ecosystems overall, beaver ponds are still relatively rare (<1%) in the landscape. Grazing policies have promoted a season-long moderate grazing level that has reduced the diversity of species and structures within riparian/wetland communities. In addition to groundwater pumping and water diversion projects, the large increase in adjacent upland ponderosa pine due to fire suppression policies has resulted in a reduction of overall 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 less soil moisture.

Forested Ecosystems

Direct alteration/conversion: Land conversion of forested ecosystems in the Black Hills Ecoregion is relatively low at 2% overall. Table 5.4 illustrates a breakdown of acres converted by ecological site and type of conversion. The Dry Bur Oak ecological sites have received the highest rate of conversion at 5%. The primary reason for conversion across all ecological sites is agriculture, but urbanization is a close second on the Xeric, Dry, and Moist Ponderosa Pine ecological sites.

Table 5.4. Number of acres and percentages of each forested ecological site converted for agricultural, urbanization, and mining/gravel purposes in the Black Hills Ecoregion.

	Dry Bur Oak	Xeric P.Pine	Warm, Dry P.Pine	Warm, Moist P.Pine	Warm, Moist Q. Aspen	Cool, Moist White Spruce	High Elev Limber Pine	Total
Agriculture	4,952	12,001	481	659	n/a	76	n/a	18,169
Urban/Rural Development	262	882	321	479	n/a	0	n/a	1944
Mining/Gravel Operations	25	92	91	173	n/a	9	n/a	390
Total Acres	**5,239**	**12,975**	**893**	**1,311**	**0**	**85**	**0**	**20,503**
% of Ecological Site conversion	**5%**	**3%**	**< 1%**	**<1 %**		**<1 %**		**2%**

Source: SSURGO soils data (USDA Natural Resources Conservation Service) and South Dakota GAP Analysis (USDOI Geological Survey)

Forest management alters the structure and plant species composition of forest ecosystems in the short- and potentially long-term and also alters their spatial arrangement on the landscape. Timber harvest requires the construction of roads to access harvest sites that can cause ecosystem conversion or degradation.

Historical disturbance processes: The suppression of natural fire over the last 100 or more years coupled with the emphasis for timber production in the Black Hills Ecoregion has caused significant changes to the ecological processes, structure, and species composition of the forest ecosystems, particularly in the low 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. Starting in the late 1800's, several activities occurred which changed these ecosystems. First, intensive grazing by cattle and sheep reduced the understory vegetation that carried fires across the landscape. Second, logging began with the removal of a majority of the large ponderosa pines. Third, fire exclusion policies initiated in the early 1900's 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, 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 frequently stress the trees, making them more vulnerable to insect outbreaks such as the pine beetle. The result is an overall decrease in plant species and structural diversity across low to mid elevation forest ecosystems. When fires do occur, they are usually catastrophic, 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.

Mid- to high-elevation forests have been less impacted by fire suppression activities as long-interval fires have still occurred within 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 has 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 ecosystem and biological diversity.

Missouri River Ecoregion

Riparian/wetland ecosystems

In the U.S., dams in the Missouri River basin have led to a recent U.S. National Academy of Sciences report warning that natural stream flows need to be restored to the Missouri River to avoid further ecological degradation and species endangerment in the river system. For a full discussion of the history, modifications, and ecological consequences of the changes to the Missouri River Ecoregion, refer to the report prepared by the Natural Research Council Committee on Missouri River Ecosystem Science - The Missouri River Ecosystem: Exploring the Prospects for Recovery (2002).

Direct alteration/conversion – Many of the historical riparian/wetland ecosystems of the Missouri River Ecoregion have been inundated and lost to the series of dams and large reservoirs now present on the Missouri River in South Dakota. 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 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 in the natural flow regime that eliminates the periodic flood pulse thereby substantially changing the annual hydrograph, sediment loads, temperature regime, and nutrient budgets.

Historical disturbance processes: In addition to the direct conversion of riparian/wetland ecosystems, river management activities have altered the species composition, structure and successional heterogeneity of the remaining riparian/wetland ecosystems through suppression and alteration of the historical flood regime. Cottonwood reproduction has been significantly impacted due to the 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/wetland ecosystems remaining that supports emergent and shrub plant communities that, in turn, support many wildlife species. Beaver population control and dam removal have reduced the overall heterogeneity of both aquatic and riparian ecosystems within the Missouri River floodplain. A review of National Wetland Inventory data for the Missouri River Ecoregion identifies only several mapped acres that exhibited modifications due to beaver influence, indicating the relative rarity of beaver ponds on the landscape today. Overall the Missouri River Ecoregion has lost much of its habitat heterogeneity that was its attraction for the vast multitudes of wildlife species that were historically dependent on this dynamic ecoregion. According to the U.S. Fish and Wildlife Service, more than 80 of these species are now rare or threatened with extinction.

Aquatic ecosystems

Direct alteration/conversion: Many of the river management activities discussed in the riparian/wetland ecosystems section, have also altered and converted the aquatic ecosystems of the Missouri River ecoregion. The establishment of the 4 large dams has blocked migration for many fish species. The resulting reservoirs have essentially changed the aquatic ecosystems from lotic (flowing water) to lentic (standing water) systems, or a hybrid of the two. The result has been a reduction in the annual water temperature range, changes in the bottom substrate from a dominance of silt, sand, and wood to a dominance of silt and riprap; and an overall increased water depth in the main channel. The loss and changes to the surrounding riparian/wetland ecosystems has reduced the occurrence of snags and coarse woody debris in the channel. Aquatic ecosystems were dramatically changed in terms of the benthic invertebrate community by increased light penetration due to less suspended sediment, less coarse woody debris, changes in water depth and substrate, and changes in flow velocity and average temperatures. The corresponding result was a decrease in the number of endemic fish species and an increase in the non-native introduced and invasive species. Roughly 75% of the native fish historically occurring in the main stem of the river are now listed as rare, uncommon, and/or decreasing over all or part of their ranges.

Historical disturbance processes: The suppression or alteration of historical flood regimes has further impacted fish migration, as well as spawning and rearing habitats through the loss of the river – floodplain connection.

Mixedgrass Subregion

Grass/shrub ecosystems

Direct alteration/conversion: Direct land conversion of grass/shrub ecosystems in the Mixedgrass Subregion is relatively high at 51% compared to other ecoregions of South Dakota. Table 5.5 illustrates a breakdown of acres converted by grass/shrub ecological site and type of conversion. Four of the eight ecological sites have received nearly 50% or more conversion of the historical ecosystems. Agriculture is by far the most common reason for land conversion. Loamy ecological sites are characterized by a 54%

conversion rate with over 4 million acres converted for agricultural purposes. Many of the remaining intact grass/shrub ecosystems are small and surrounded by agriculture, further altering their ecological contributions and functional value for biodiversity conservation.

Table 5.5. Number of acres and percentages of each grass/shrub ecological site converted for agricultural, urbanization, and mining/gravel purposes in the Mixedgrass Subregion.

	Dense Clay	Clayey	Shallow Clayey	Claypan	Loamy	Sandy	Shallow	Very Shallow	Total
Agriculture	7,785	733,931	5,808	293,664	4,036,382	200,259	64,060	85,629	5,427,518
Urban/Rural Development	0	3,652	0	271	8,806	2,632	231	400	15,992
Mining/Gravel Operations	0	0	0	0	0	0	0	0	0
Total Acres	**7,785**	**737,583**	**5,808**	**293,935**	**4,045,188**	**202,891**	**64,291**	**86,029**	**5,443,510**
% of Ecological Site conversion	**14%**	**48%**	**3%**	**46%**	**54%**	**53%**	**15%**	**34%**	**50%**

Source: SSURGO soils data (USDA Natural Resources Conservation Service) and South Dakota GAP Analysis (USDOI Geological Survey)

Historical disturbance regimes: Since European settlement, many changes have occurred in the historical disturbance regimes influencing the grass/shrub ecosystems of the Mixedgrass Subregion. Fire, frequent historically, rarely occurs and is typically managed (prescribed) or suppressed, thereby changing the distribution, size, timing and intensity of burns occurring on the landscape relative to historical fires. In addition, the historical interaction of fire and grazing on the grassland ecosystem is no longer typically practiced. The loss of fire and changes to grazing, have reduced landscape heterogeneity and dynamic ecosystem processes. Modern agricultural practices tend to spread grazing intensity evenly, producing a homogeneous landscape. Some grass species have benefited from this policy while other species of grass are more restricted than they have been for thousands of years prior to European settlement (Truett 2003). 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. As described previously, 39% of the Mixedgrass Subregion is currently characterized as being in idle grassland and pastureland. While these conditions still support grass dominated communities, it is unlikely that many of these acres support conditions that were present under historical disturbance regimes. The functional loss of these remaining grasslands, coupled with the 51% overall conversion of grassland ecological sites results in a likely loss of over 90% of functional historical ecosystems for grass/shrub ecosystems of the Mixedgrass Subregion.

Riparian/wetland and aquatic ecosystems

Direct alteration/conversion: Depressional wetlands were historically a common feature of the Mixedgrass Ecoregion. Many of these wetlands have been drained, filled, plowed, and excavated to meet the agricultural objectives of the landowner. Results of a GIS assessment of GAP land cover data with SSURGO soil data indicated that 774,310 acres or 35% of riparian/wetland ecosystems have been converted for agricultural purposes within the Mixedgrass Subregion. Urban areas and residential development have resulted in the conversion of an additional 1,537 acres or <1%.

Those wetlands remaining are often degraded by agricultural runoff from adjacent uplands, although current Farm Bill programs are helping reduce these impacts. Stock dams and impoundments are more common in the Mixedgrass Subregion than the Tallgrass Subregion. Problems and concerns associated with stock dams were discussed previously in the Great Plains Steppe Ecoregion. Impoundments and reservoirs convert flowing water systems to pond or lake systems, or a hybrid of the two.

Historical disturbance regimes: The suppression or alteration of historical disturbance processes occurring in the Mixedgrass Subregion has reduced the heterogeneity of both riparian/wetland and aquatic ecosystems. Dams have been placed on some streams to control flooding and store water for irrigation, livestock water, recreation, and other human uses. Water management programs reduce the effects of flood events and thereby prevent many riparian species from regenerating. The result is more homogenous riparian/wetland ecosystems. Channelization and water diversion projects can impact the extent, species composition, and structure of the remaining riparian/wetland and aquatic ecosystems. Beaver populations have been significantly reduced on perennial systems from historical levels resulting in the loss of pond habitat for many aquatic species, and the overall amounts of adjacent riparian ecosystems. A review of National Wetland Inventory data indicates that beaver ponds are rare in the landscape. Grazing changes have resulted in a reduction in the diversity of species and structures within riparian/wetland communities. In addition to groundwater pumping and water diversion projects, the increase in adjacent woodlands due to fire suppression policies can result in reduced in-stream flows.

Tallgrass Subregion

Grass/shrub ecosystems

Direct alteration/conversion: Overall land conversion of grass/shrub ecosystems for agricultural and urban/residential purposes in the Tallgrass Subregion is the highest of all South Dakota's ecoregions at 65%. Table 5.6 illustrates a breakdown of acres converted by ecological site and type of conversion. Five of the seven ecological sites have received greater than 50% conversion of the historical ecosystems. Agriculture is the most common reason for land conversion in the Tallgrass Subregion. Loamy ecological sites represent the highest number of acres converted at 3.4 million and 69% overall conversion. Clayey ecological sites have received the highest percentage of conversion at 78%. Many of the remaining intact grass/shrub ecosystems are small and surrounded by agriculture, further altering their ecological contributions and functional value for biodiversity conservation.

Table 5.6. Number of acres and percentages of each grass/shrub ecological site converted for agricultural, urbanization, and mining/gravel purposes in the Tallgrass Subregion.

	Clayey	Claypan	Thin Claypan	Loamy	Sandy	Thin Upland	Shallow	Total
Agriculture	253,841	14,544	201	3,434,163	68,634	209,219	112,502	4,093,104
Urban/Rural Development	1,060	7	0	25,116	1,410	2,067	1,023	30,683
Mining/Gravel Operations	0	0	0	0	0	0	0	0
Total Acres	**254,901**	**14,551**	**201**	**3,459,279**	**70,044**	**211,286**	**113,525**	**4,123,787**
% of Ecological Site conversion	**78%**	**65%**	**75%**	**69%**	**59%**	**34%**	**45%**	**65%**

Source: SSURGO soils data (USDA Natural Resources Conservation Service) and South Dakota GAP Analysis (USDOI Geological Survey)

Historical disturbance regimes: Since European settlement, the Tallgrass Subregion has been the most impacted region in South Dakota, in terms of suppression or alteration of historical disturbance regimes. In many instances, the remaining scattered tracts of grass/shrub ecosystems have suffered the complete loss of historical disturbance regimes. Fire rarely occurs and is typically managed (prescribed) or suppressed, thereby changing the distribution, size and intensity of burns occurring on the landscape relative to historical fires. In addition, the historical interaction of fire and grazing on the grassland ecosystem is no longer possible due to the density of

agricultural fields, fenced pastures, controlled burning, and grazing practices. The loss of uncontrolled fire, and changes in grazing timing and intensity has reduced landscape heterogeneity and dynamic ecosystem processes. One pattern that has emerged has been the increased number of woodlands where grasslands would have occurred historically. Suppression of fire has allowed the expansion of trees and shrubs into ecological sites that would not have supported them historically. The result has been a change in habitat structure and a corresponding change in the wildlife species using those sites. As described previously, 26% of the Tallgrass Subregion is currently characterized as idle grassland and pastureland. While these conditions still support grass dominated communities, it is unlikely that many of these acres support conditions that were present under historical disturbance regimes. The functional loss of these remaining grasslands, coupled with the 65% overall conversion of grassland ecological sites, results in a greater than 90% loss of functional historical ecosystems for grass/shrub ecosystems of the Tallgrass Subregion.

Riparian/wetland and aquatic ecosystems

Direct alteration/conversion: Land use of the deep, fertile upland soils of the Tallgrass Subregion has been dominated by agriculture since European settlement. For many years the pothole wetlands have been drained to increase the amount of farmable acreage. The results of a GIS assessment of GAP land cover data with SSURGO soil data indicate that 1,095,144 acres, or 49%, of riparian/wetland ecosystems have been converted for agricultural purposes within the Tallgrass Subregion. The Wetland Reserve Program and Swampbuster provisions of the Farm Bill have helped to reduce this rate of conversion. However, spread of urban areas and residential development have resulted in continuing reductions in riparian/wetland ecosystems, with the conversion of an additional 6,395 acres, or <1%.

Many of the remaining pothole wetlands have also suffered degradation due to the surrounding land management practices. Sediment runoff from surrounding fields can change the hydrology and vegetation of a wetland site. Current Farm Bill Programs are helping reduce this level of runoff. Excavation, to increase water storage capacity for livestock water and irrigation purposes, can also change the hydrology and vegetation communities. Rivers and streams of the Tallgrass Subregion have been less impacted than pothole wetlands in terms of direct conversion but water diversion and groundwater pumping can reduce in-stream flows resulting in a lowering of the water Table and soil moisture for adjacent riparian vegetation and in-stream aquatic habitat.

Historical disturbance regimes: The suppression or alteration of historical disturbance processes occurring in the Tallgrass Subregion has reduced the heterogeneity of both riparian/wetland and aquatic 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 riparian species from regenerating. The result is more homogenous riparian/wetland ecosystems. Channelization and water diversion projects can impact the extent, species composition, and structure of the remaining riparian/wetland and aquatic ecosystems. Beaver populations have been significantly reduced on perennial systems from historical levels resulting in the loss of pond habitat for many aquatic species, and the overall amounts of adjacent riparian ecosystems. A review of National Wetland Inventory data indicates that beaver ponds are rare in the landscape. Grazing is no longer a common landuse, further reducing the diversity of species and structures within riparian/wetland communities. In addition to groundwater pumping and water diversion projects, the increase in adjacent woodland areas due to fire suppression can result in reduced in-stream flows. This can impact the water available to adjacent riparian vegetation and in-stream aquatic habitat.

Species of Greatest Conservation Need (SoGCN)

There are two primary problems and concerns associated with the persistence of species in South Dakota: 1) the loss or degradation of habitat, and 2) non-habitat related impacts. The loss/degradation of habitat is directly influenced by direct and indirect impacts to ecosystem diversity. These impacts have been addressed in the previous section on ecosystem diversity, and their potential influence on SoGCN identified in Section 4. A number of SoGCN have additional, non-habitat related impacts. Non-habitat

related impacts are typically characterized by direct human-influences on a species normal life cycles or existence.

Loss or degradation of habitat has resulted in the population declines of the majority of SoGCN in South Dakota. To illustrate this, the total number of SoGCN that are associated with an ecosystem are identified in the following Figures*:

Tallgrass Subregion
- Figure 5.1.1 – grass/shrub ecosystems
- Figure 5.1.2 – riparian/wetland ecosystems
- Figure 5.1.3 – aquatic ecosystems

Mixedgrass Subregion
- Figure 5.2.1 – grass/shrub ecosystems
- Figure 5.2.2 – riparian/shrub ecosystems
- Figure 5.2.3 – aquatic ecosystems

Missouri River Ecoregion
- Figure 5.3.1 -- riparian/wetland ecosystems
- Figure 5.3.2 – aquatic ecosystems

Great Plains Steppe Ecoregion
- Figure 5.4.1 -- grass/shrub ecosystems
- Figure 5.4.2 -- riparian/wetland ecosystems
- Figure 5.4.3 – aquatic ecosystems
- Figure 5.4.4 – forest ecosystems

Black Hills Ecoregion
- Figure 5.5.1 – grass/shrub ecosystems
- Figure 5.5.2 – riparian/wetland ecosystems
- Figure 5.5.3 – aquatic ecosystems
- Figure 5.5.4 – forest ecosystems

*Figures located at the end of this section.

Table 5.7 (see page 211) also presents a summary of the indirect and direct problems and concerns identified for SoGCN in South Dakota.

Non-habitat based problems and concerns

Mortality (Illegal harvest/trapping/poisoning and accidental killing) – Many species of greatest conservation need are experiencing low population numbers, and have population viability issues that are associated with these low numbers. Mortality beyond what is expected through natural processes can cause added pressures on an already compromised population. Illegal harvest, poisoning, vehicle collisions, or other human-caused accidental mortality can be the added factor(s) that makes a population unsustainable and therefore, may require human intervention and conservation actions to recover the species.

Land/water management impacts

In addition to their impacts on ecosystem diversity, the following land and water management practices can impact a species both directly and indirectly.

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, barn owls and free-ranging domestic cats

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 an animal that is 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
- windbreak/shelterbelt plantings

Forest management:
- direct disturbance by logging equipment and related activities in critical breeding areas during the breeding and nesting season
- soil erosion into surrounding riparian/wetland and aquatic habitats caused from surface soil disturbance by logging equipment and road construction

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 poorly placed wind generators

Water level management:
- 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

Movement barriers

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

Exotic/Introduced non-native species

The accidental or intentional introduction of non-native 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.

Human disturbance

Human 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, human

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 a particular threat 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.

Table 5.7. Summary of problems and concerns associated with South Dakota's Species of Greatest Conservation Need

PROBLEMS AND CONCERNS

Indirect impacts to ecosystem diversity
Direct impacts to ecosystem diversity
Direct impacts to species

	Modified/suppressed fire regimes	Modified grazing regimes	Modified flood regimes	Exotic/Introduced species impacts	Reduced number beavers/beaver ponds	Recuced number BT prairie dog colonies	Ecosystem/habitat conversion or loss	Ecosystem alteration/Habitat degradation	Human disturbance	Pollution/Pesticides/Herbicides	Mortality (illegal shooting/collisions/etc.)	Water management practices	Grazing/agricultural practices	Forest management practices	Exotic/introduced species impacts	Overharvest of food supply	Diseases
BIRDS																	
American White Pelican			X						X	X	X	X					X
Trumpeter Swan			X		X				X	X	X						
Osprey			X	X					X	X	X					X	
Bald Eagle			X	X					X	X	X					X	
Northern Goshawk	X						X		X					X			
Ferruginous Hawk	X	X				X	X		X	X	X						
Peregrine Falcon							X		X	X							
Greater Sage-Grouse							X				X		X				X
Greater Prairie-Chicken				X			X	X		X							X
Whooping Crane							X	X		X	X						
Piping Plover			X	X			X	X	X	X		X			X		
Willet		X					X		X				X		X		
Long-billed Curlew	X	X					X		X	X							
Marbled Godwit	X	X			X		X	X									
Wilson's Phalarope	X	X			X		X								X		
Interior Least Tern			X				X	X	X	X		X			X		
Black Tern			X				X			X		X	X		X		
Burrowing Owl						X	X	X		X	X				X		
Lewis's Woodpecker	X			X										X			
Three-toed Woodpecker	X													X			
Black-backed Woodpecker	X													X			
American Dipper	X		X				X	X	X			X	X				
Sprague's Pipit	X			X			X		X				X		X		
Lark Bunting							X			X			X		X		
Baird's Sparrow		X					X						X		X		
LeConte's Sparrow	X						X								X		
White-eyed Junco																	
Chestnut-collared Longspur		X					X			X					X		
MAMMALS																	
fringe-tailed myotis							X		X	X				X			
northern myotis	X						X		X	X				X			
Townsend's big-eared bat							X		X								
Franklin's ground squirrel							X	X							X		
Richardson's ground squirrel							X				X						
northern flying squirrel	X													X			
Bear Lodge meadow jumping mouse	X			X	X		X	X	X				X	X			
kit or swift fox		X				X	X	X			X		X		X		X
black -footed ferret		X				X	X	X					X		X		X
northern river otter					X		X	X			X					X	X
FRESHWATER MUSSELS																	
elktoe			X	X			X	X		X		X			X		
rock pocketbook			X	X			X	X		X					X		
creek heelsplitter			X	X			X	X		X					X		
Higgins eye			X	X			X	X		X							
scaleshell			X	X			X	X		X							
hickorynut			X	X			X	X		X							
mapleleaf			X	X			X	X		X							
GASTROPODS																	
Dakota vertigo								X		X			X	X			
mystery vertigo								X		X			X	X			
frigid ambersnail								X		X			X	X			
Cooper's rocky mountainshell								X		X			X	X			
INSECTS																	
ghost tiger beetle							X	X									
Great Plains tiger beetle							X	X									
American burying beetle							X	X		X							X
Powesheik skipperling	X	X					X			X							
Ottoe skipper	X	X					X			X							
Dakota skipper	X	X		X			X			X			X				
Iowa skipper	X	X		X			X			X			X				
regal fritillary	X	X		X			X			X			X				
Black Hills fritillary	X				X		X						X				
FISHES																	
Banded killifish			X				X	X		X							
Blacknose shiner								X					X				
Central mudminnow					X		X	X									
Finescale dace					X			X									
Longnose sucker								X					X				
Northern redbelly dace					X			X									
Pallid sturgeon			X				X	X		X							
Paddlefish			X				X			X	X						
Pearl dace					X		X	X		X							
Sicklefin chub			X	X			X	X		X			X				
Sturgeon chub			X	X			X	X		X			X				
Topeka shiner				X			X	X		X			X				
Trout-perch				X			X	X		X			X				
Lake chub	X							X		X			X	X	X		
Mountain sucker	X							X		X			X	X	X		
Southern redbelly dace								X		X			X				
Hornyhead chub							X	X		X			X				
Rosyface shiner			X					X		X			X				
Logperch			X		X		X	X		X			X				
Blackside darter			X		X		X	X		X			X				
REPTILES AND AMPHIBIANS																	
Blanding's Turtle			X				X	X		X	X		X				
False Map Turtle			X				X		X	X	X				X		
Lined Snake							X	X									
Eastern Hognose Snake			X					X	X	X							
Black Hills Redbelly Snake							X				X		X	X			
Cope's Gray Treefrog			X				X	X		X				X	X		
Smooth Softshell			X				X	X		X							
Western Box Turtle		X				X	X				X		X				
Lesser Earless Lizard		X	X			X	X	X				X					
Northern Cricket Frog	X	X	X		X			X		X					X		
Many-lined Skink						X	X	X									
Short-horned Lizard		X				X	X		X	X							

Figure 5.1.1. South Dakota Comprehensive Wildlife Conservation Plan - total number of species of greatest conservation need within each disturbance influenced pathway of the ecosystem diversity matrix for the grass/shrub ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

GRASS/SHRUB ECOSYSTEMS

Disturbance Influenced Pathways	Clayey	Claypan	Thin Claypan	Loamy	Sandy	Thin Upland	Shallow
Early Seral	0	0	0	2	2	0	0
Vegetative composition-structure primarily influenced by short-interval fire regimes (<8 yrs.)							
Light Grazing	7	7	6	8	8	6	6
Moderate Grazing	6	6	6	7	8	6	6
Heavy Grazing	7	7	6	8	9	6	6
Vegetative composition-structure primarily influenced by long-interval fire regimes (≥8 yrs.)							
Light Grazing	1	1	1	2	3	1	1
Moderate Grazing	1	1	1	2	3	1	1
Heavy Grazing	0	0	0	1	2	0	0

Figure 5.1.2. South Dakota Comprehensive Wildlife Conservation Plan - total number of species of greatest conservation need associated with each habitat descriptor (some species may be associated with more than one habitat descriptor) of the ecosystem diversity matrix for riparian/wetland ecosystems of the Great Plains Steppe Ecoregion. Totals (in red) reflect the number of individual species of greatest conservation need associated with the overall habitat complex (i.e., primary cell as defined by the solid black line).

KEY

Ecosystems that do not occur

ECOSYSTEM DIVERSITY MATRIX - TALLGRASS PRAIRIE SUBREGION (EASTERN PRAIRIE ECOREGION)

RIPARIAN-WETLAND ECOSYSTEMS

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways			Habitat Descriptors	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
				Geomorphic								
				Water Regime	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
				Slope					Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing		Rocky Shore	0		0	0	1			
				Unconsolidated Shore	4		0	1	5			
				Emergent	5		4	6	9			
				Scrub-Shrub	0		0	0	1			
				Forested	2		1	2	3			
					11		5	9	14			
		Heavy Bison Grazing		Rocky Shore	0		0	0	1			
				Unconsolidated Shore	4		1	2	5			
				Emergent	3		3	4	5			
				Scrub-Shrub	0		0	0	1			
				Forested	1		0	1	2			
					6		3	6	9			
	Beaver Unmodified System	Low to Moderate Bison Grazing		Rocky Shore	0	0	0	0	1	0	0	0
				Unconsolidated Shore	4	0	0	1	4	1	0	0
				Emergent	5	4	4	6	9	2	1	1
				Scrub-Shrub	0	0	0	0	1	0	0	0
				Forested	2	1	1	2	3	1	0	1
					9	5	5	9	13	4	1	2
		Heavy Bison Grazing		Rocky Shore	0	0	0	0	1	0	0	0
				Unconsolidated Shore	4	1	1	2	4	1	0	0
				Emergent	3	3	3	4	5	2	0	0
				Scrub-Shrub	0	0	0	0	1	0	0	0
				Forested	1	0	0	1	2	0	0	0
					6	3	3	6	8	3	0	0
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing		Rocky Shore	0		0	0	1			
				Unconsolidated Shore	4		0	1	5			
				Emergent	5		4	6	9			
				Scrub-Shrub	0		0	0	1			
				Forested	2		1	2	3			
					9		5	9	14			
		Heavy Bison Grazing		Rocky Shore	0		0	0	1			
				Unconsolidated Shore	4		1	2	5			
				Emergent	3		3	4	5			
				Scrub-Shrub	0		0	0	1			
				Forested	1		0	1	2			
					6		3	6	9			
	Beaver Unmodified System	Low to Moderate Bison Grazing		Rocky Shore	0	0	0	0	1	0	0	0
				Unconsolidated Shore	4	0	0	1	4	1	0	0
				Emergent	5	4	4	6	9	2	1	1
				Scrub-Shrub	0	0	0	0	1	0	0	0
				Forested	3	2	2	3	4	2	1	2
					10	6	6	10	14	5	2	3
		Heavy Bison Grazing		Rocky Shore	0	0	0	0	1	0	0	0
				Unconsolidated Shore	4	1	1	2	4	1	0	0
				Emergent	3	3	3	4	5	2	0	0
				Scrub-Shrub	0	0	0	0	1	0	0	0
				Forested	2	1	1	2	3	1	1	1
					7	4	4	7	8	4	1	1

Figure 5.1.3. South Dakota Comprehensive Wildlife Conservation Plan - total number of species of greatest conservation need associated with each habitat descriptor (some species may be associated with more than one habitat descriptor) of the ecosystem diversity matrix for riparian/wetland ecosystems of the Great Plains Steppe Ecoregion. Totals (in red) reflect the number of individual species of greatest conservation need associated with the overall habitat complex (i.e., primary cell as defined by the solid black line).

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

AQUATIC ECOSYSTEMS

Disturbance Influenced Pathways			Geomorphic Setting / Water Regime / Sizeclass / Habitat Descriptor	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS			
				Limnetic	Littoral	Semi-permanent	Permanent	Perennial			
								Large River	Small Rivers	Creeks	Headwater Stream
Time Since Major Disturbance (i.e., flood)	EARLY SUCCESSIONAL	Beaver Influenced System	Streambed	1	0	0	0	0	0	0	0
			Unconsolidated Bottom	1	2	0	0	4	4	1	2
			Aquatic Bed	0	2	0	3	3	5	2	0
				2	4	1	3	7	9	3	2
		Beaver Absent	Streambed	1	0	0	0	0	0	0	0
			Unconsolidated Bottom	1	2	0	0	8	6	1	2
			Aquatic Bed	0	2	1	3	3	5	2	0
				2	4	1	3	11	11	3	2
	LATE SUCCESSIONAL	Beaver Influenced System	Streambed	1	0	0	0	0	0	0	0
			Unconsolidated Bottom	1	2	0	0	4	4	1	2
			Aquatic Bed	0	2	1	3	3	5	2	0
				2	4	1	3	7	9	3	2
		Beaver Absent	Streambed	1	0	0	0	0	0	0	0
			Unconsolidated Bottom	1	2	0	0	8	6	1	2
			Aquatic Bed	0	2	1	3	3	5	2	0
				2	4	1	3	10	11	3	2

Figure 5.2.1. South Dakota Comprehensive Wildlife Conservation Strategy - total number of species of greatest conservation need within each disturbance influenced pathway of the ecosystem diversity matrix for grass/shrub ecosystems of the Mixedgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

GRASSLAND-SHRUB ECOSYSTEMS

Disturbance Influenced Pathways	Ecolological Site Class							
	Dense Clay	Clayey	Shallow Clayey	Claypan	Loamy	Sandy	Shallow	Very Shallow
Early Seral	0	0	0	0	1	1	1	0
Prairie Dog Town, active		6		6	7			
Prairie Dog Town, inactive		2		2	3			
Vegetative composition-structure primarily influenced by short-interval fire regimes (<10 yrs.)								
Light Grazing	7	7	7	7	8	8	8	7
Moderate Grazing	6	6	6	6	7	7	7	6
Heavy Grazing	5	6	5	6	7	7	6	5
Vegetative composition-structure primarily influenced by long-interval fire regimes (>10 yrs.)								
Light Grazing	2	2	2	2	3	3	3	2
Moderate Grazing	2	2	2	2	3	3	3	2
Heavy Grazing	0	0	0	0	1	1	1	0

KEY

Ecosystems that do not occur

Figure 5.2.2. South Dakota Comprehensive Wildlife Conservation Strategy - total number of species of greatest conservation need associated with each habitat descriptor (some species may be associated with more than one habitat descriptor) of the ecosystem diversity matrix for riparian/wetland ecosystems of the Mixedgrass Subregion. Totals (in red) reflect the number of individual species of greatest conservation need associated with the overall habitat complex (i.e., primary cell as defined by the solid black line).

ECOSYSTEM DIVERSITY MATRIX - MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
			Geomorphic →								
			Water Regime →	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
			Slope →					Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore	0		0	0	1			
			Unconsolidated Shore	3		0	0	2			
			Emergent	5		3	5	8			
			Scrub-Shrub	0		0	0	1			
			Forested	1		0	1	2			
				7		3	6	9			
		Heavy Bison Grazing	Rocky Shore	0		0	0	1			
			Unconsolidated Shore	3		1	1	2			
			Emergent	3		3	4	5			
			Scrub-Shrub	0		0	0	1			
			Forested	1		0	1	2			
				5		3	5	6			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore	0	0	0	0	1	0	0	0
			Unconsolidated Shore	3	0	0	0	3	1	0	0
			Emergent	5	3	3	5	8	4	0	1
			Scrub-Shrub	0	0	0	0	1	0	0	0
			Forested	1	0	0	1	2	0	0	0
				7	3	3	6	10	5	0	1
		Heavy Bison Grazing	Rocky Shore	0	0	0	0	1	0	0	0
			Unconsolidated Shore	2	1	1	1	3	2	0	0
			Emergent	3	3	3	4	5	3	0	0
			Scrub-Shrub	0	0	0	0	1	0	0	0
			Forested	1	0	0	1	2	0	0	0
				5	3	3	4	6	4	0	0
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore	0		0	0	1			
			Unconsolidated Shore	3		0	0	2			
			Emergent	5		3	5	8			
			Scrub-Shrub	0		0	0	1			
			Forested	1		0	1	2			
				7		3	6	9			
		Heavy Bison Grazing	Rocky Shore	0		0	0	1			
			Unconsolidated Shore	3		1	1	2			
			Emergent	3		3	4	5			
			Scrub-Shrub	0		0	0	1			
			Forested	1		0	1	2			
				5		3	5	6			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore	0	0	0	0	1	0	0	0
			Unconsolidated Shore	3	0	0	0	3	1	0	0
			Emergent	5	3	3	5	8	5	0	1
			Scrub-Shrub	0	0	0	0	1	0	0	0
			Forested	2	1	1	2	3	1	1	1
				8	4	4	7	11	6	1	2
		Heavy Bison Grazing	Rocky Shore	0	0	0	0	1	0	0	0
			Unconsolidated Shore	3	1	1	1	3	2	0	0
			Emergent	3	3	3	4	5	3	0	0
			Scrub-Shrub	0	0	0	0	1	0	0	0
			Forested	2	1	1	2	3	1	1	1
				6	4	4	6	8	5	1	1

Figure 5.2.3. South Dakota Comprehensive Wildlife Conservation Strategy - total number of species of greatest conservation need associated with each habitat descriptor (some species may be associated with more than one habitat descriptor) of the ecosystem diversity matrix for riparian/wetland ecosystems of the Great Plains Steppe Ecoregion. Totals (in red) reflect the number of individual species of greatest conservation need associated with the overall habitat complex (i.e., primary cell as defined by the solid black line).

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

AQUATIC ECOSYSTEMS

Time Since Major Disturbance (i.e., flood)	Disturbance Influenced Pathways	Habitat Descriptor (Geomorphic Setting / Water Regime / Sizeclass)	LAKE SYSTEMS: Limnetic	LAKE SYSTEMS: Littoral	DEPRESSIONAL SYSTEMS: Semi-permanent	DEPRESSIONAL SYSTEMS: Permanent	RIVERINE SYSTEMS, Perennial: Large River	RIVERINE SYSTEMS, Perennial: Small River	RIVERINE SYSTEMS, Perennial: Creek	RIVERINE SYSTEMS, Perennial: Headwater Stream
EARLY SUCCESSIONAL	Beaver Influenced System	Streambed	0	0	0	0	0	0	0	0
		Unconsolidated Bottom	0	0	0	0	2	2	0	0
		Aquatic Bed	0	1	0	0	0	2	2	0
			0	**1**	**0**	**0**	**2**	**4**	**2**	**0**
	Beaver Absent	Streambed	0	0	0	0	0	0	0	0
		Unconsolidated Bottom	0	0	0	0	3	2	0	0
		Aquatic Bed	0	1	0	0	0	2	2	0
			0	**1**	**0**	**0**	**3**	**4**	**2**	**0**
LATE SUCCESSIONAL	Beaver Influenced System	Streambed	0	0	0	0	0	0	0	0
		Unconsolidated Bottom	0	0	0	0	2	2	0	0
		Aquatic Bed	0	1	0	0	0	2	2	0
			0	**1**	**0**	**0**	**2**	**4**	**2**	**0**
	Beaver Absent	Streambed	0	0	0	0	0	0	0	0
		Unconsolidated Bottom	0	0	0	0	3	2	0	0
		Aquatic Bed	0	1	0	0	0	2	2	0
			0	**1**	**0**	**0**	**3**	**4**	**2**	**0**

Figure 5.3.1. South Dakota Comprehensive Wildlife Conservation Strategy - total number of species of greatest conservation need associated with each habitat descriptor (some species may be associated with more than one habitat descriptor) of the ecosystem diversity matrix for riparian/wetland ecosystems of the Missouri River Ecoregion. Totals (in red) reflect the number of individual species of greatest conservation need associated with the overall habitat complex (i.e., primary cell as defined by the solid black line).

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MISSOURI RIVER ECOREGION

KEY

Ecosystems that do not occur

RIPARIAN-WETLAND ECOSYSTEMS

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
			Geomorphic →							
			Water Regime →	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittent*		
			Slope →				Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore		0	0	1			
			Unconsolidated Shore		0	1	5			
			Emergent		2	6	7			
			Scrub-Shrub		0	0	1			
			Forested		0	2	3			
					2	8	11			
		Heavy Bison Grazing	Rocky Shore		0	0	1			
			Unconsolidated Shore		1	1	5			
			Emergent		1	3	4			
			Scrub-Shrub		0	0	1			
			Forested		0	2	3			
					1	5	8			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore	0	0	0	4	1	0	0
			Unconsolidated Shore	0	0	3	7	0	0	0
			Emergent	2	2	4	5	0	0	0
			Scrub-Shrub	0	0	0	1	0	0	0
			Forested	0	0	4	8	1	0	0
				2	2	8	14	1	0	0
		Heavy Bison Grazing	Rocky Shore	0	0	0	4	1	0	0
			Unconsolidated Shore	1	1	3	7	0	0	0
			Emergent	1	1	1	2	0	0	0
			Scrub-Shrub	0	0	0	1	0	0	0
			Forested	0	0	4	8	1	0	0
				1	1	5	11	1	0	0
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore		0	0	2			
			Unconsolidated Shore		0	3	5			
			Emergent		2	4	5			
			Scrub-Shrub		0	0	1			
			Forested		0	4	7			
					2	8	11			
		Heavy Bison Grazing	Rocky Shore		0	0	3			
			Unconsolidated Shore		1	3	5			
			Emergent		1	1	2			
			Scrub-Shrub		0	0	1			
			Forested		0	4	7			
					1	5	8			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore	0	0	2	2	0	0	0
			Unconsolidated Shore	0	0	1	5	0	0	0
			Emergent	2	2	4	5	0	0	0
			Scrub-Shrub	0	0	2	6	1	0	0
			Forested	0	0	2	3	0	0	0
				3	3	9	15	1	0	1
		Heavy Bison Grazing	Rocky Shore	1	1	3	4	0	0	1
			Unconsolidated Shore	1	1	1	5	0	0	0
			Emergent	1	1	1	2	0	0	0
			Scrub-Shrub	0	0	2	6	1	0	0
			Forested	0	0	2	3	0	0	0
				2	2	6	12	1	0	1

Figure 5.3.2. South Dakota Comprehensive Wildlife Conservation Strategy - total number of species of greatest conservation need associated with each habitat descriptor (some species may be associated with more than one habitat descriptor) of the ecosystem diversity matrix for riparian/wetland ecosystems of the Missouri River Ecoregion. Totals (in red) reflect the number of individual species of greatest conservation need associated with the overall habitat complex (i.e., primary cell as defined by the solid black line).

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MISSOURI RIVER ECOREGION

AQUATIC ECOSYSTEMS

Disturbance Influenced Pathways			Habitat Descriptor	DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS			
			Geomorphic Setting						
			Water Regime	*Semi-permanent*	*Permanent*	*Perennial*			
			Sizeclass			*Large River*	*Small Rivers*	*Creeks*	*Headwater Stream*
Time Since Major Disturbance (i.e., flood)	EARLY SUCCESSIONAL	Beaver Influenced System	Streambed	0	0	0	0	0	0
			Unconsolidated Bottom	0	0	3	1	0	0
			Aquatic Bed	0	1	1	1	1	0
				0	**1**	**4**	**2**	**1**	**0**
		Beaver Absent	Streambed	0	0	1	1	1	0
			Unconsolidated Bottom	0	0	9	2	1	0
			Aquatic Bed	0	1	0	1	1	0
				0	**1**	**9**	**3**	**2**	**0**
	LATE SUCCESSIONAL	Beaver Influenced System	Streambed	0	0	0	0	0	0
			Unconsolidated Bottom	0	0	3	1	0	0
			Aquatic Bed	0	1	1	1	1	0
				0	**1**	**4**	**2**	**1**	**0**
		Beaver Absent	Streambed	0	0	1	1	1	0
			Unconsolidated Bottom	0	0	9	2	1	0
			Aquatic Bed	0	1	0	1	1	0
				0	**1**	**9**	**3**	**2**	**0**

Figure 5.4.1. South Dakota Comprehensive Wildlife Conservation Plan - total number of species of greatest conservation need within each disturbance influenced pathway of the ecosystem diversity matrix for grass/shrub ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

GRASSLAND-SHRUB ECOSYSTEMS

Disturbance Influenced Pathways	Ecolological Site Class: Porous Clay	Dense Clay	Clayey	Claypan	Loamy	Shallow	Badlands	Sandy	Saline Upland
Early Seral	1	1	1	1	2	2	3	5	2
Prairie Dog Town, active			9	9	10				10
Prairie Dog Town, inactive			5	5	6				6
Vegetative composition-structure primarily influenced by short-interval fire regimes (<15 yrs.)									
Light Grazing	7	7	7	7	8	8	8	8	8
Moderate Grazing	8	8	8	8	9	9	9	11	8
Heavy Grazing	6	6	6	6	7	7	8	10	7
Vegetative composition-structure primarily influenced by long-interval fire regimes (>15 yrs.)									
Light Grazing	1	2	2	2	3	3	3	3	2
Moderate Grazing	2	3	3	3	4	4	4	6	3
Heavy Grazing	1	2	2	2	3	3	4	5	2

KEY

Ecosystems that do not occur

Figure 5.4.2. South Dakota Comprehensive Wildlife Conservation Plan - total number of species of greatest conservation need within each habitat descriptor of the ecosystem diversity matrix for riparian/wetland ecosystems of the Great Plains Steppe Ecoregion. Totals (in red) reflect the number of individual species of greatest conservation need associated with the overall habitat complex (i.e., primary cell as defined by the solid black line).

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

KEY: Ecosystems that do not occur

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS				SLOPE SYSTEMS
			Geomorphic →									
			Water Regime →	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*		*Intermittent*		
			Slope →					Low Gradient with floodplain	Mid-High Gradient without floodplain	Low Gradient with floodplain	Mid-High Gradient without floodplain	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore	0		0	0	1	1			
			Unconsolidated Shore	2		0	0	2	1			
			Emergent	4		3	3	5	1			
			Scrub-Shrub	0		0	0	1	1			
			Forested	1		0	1	2	1			
				6		3	4	6	1			
		Heavy Bison Grazing	Rocky Shore	0		0	0	1	1			
			Unconsolidated Shore	2		1	1	2	1			
			Emergent	3		3	3	4	1			
			Scrub-Shrub	0		0	0	1	1			
			Forested	1		0	1	2	1			
				5		3	4	5	1			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore	0	0	0	0	1	1	0	0	0
			Unconsolidated Shore	3	0	0	0	4	2	1	1	0
			Emergent	4	3	3	3	5	1	3	0	0
			Scrub-Shrub	0	0	0	0	1	1	0	0	0
			Forested	1	0	0	1	2	1	0	0	0
				7	3	0	4	8	2	4	1	0
		Heavy Bison Grazing	Rocky Shore	0	0	0	0	1	1	0	0	0
			Unconsolidated Shore	3	1	1	1	4	2	1	1	0
			Emergent	3	3	3	3	4	1	3	0	0
			Scrub-Shrub	0	0	0	0	1	1	0	0	0
			Forested	1	0	0	1	2	1	0	0	0
				6	3	3	4	7	2	4	1	0
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore	0		0	0	1	1			
			Unconsolidated Shore	2		0	0	2	1			
			Emergent	4		3	3	5	1			
			Scrub-Shrub	0		0	0	1	1			
			Forested	1		0	1	2	1			
				6		3	4	6	1			
		Heavy Bison Grazing	Rocky Shore	0		0	0	1	1			
			Unconsolidated Shore	2		1	1	2	1			
			Emergent	3		3	3	4	1			
			Scrub-Shrub	0		0	0	1	1			
			Forested	1		0	1	2	1			
				5		3	4	5	1			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore	0	0	0	0	1	1	0	0	0
			Unconsolidated Shore	3	0	0	0	4	2	1	1	0
			Emergent	4	3	3	3	5	1	3	0	0
			Scrub-Shrub	0	0	0	0	1	1	0	0	0
			Forested	2	1	1	2	3	2	1	1	1
				8	1	1	5	9	3	5	2	1
		Heavy Bison Grazing	Rocky Shore	0	0	0	0	1	1	0	0	0
			Unconsolidated Shore	3	1	1	1	4	2	1	1	0
			Emergent	3	3	3	3	4	1	3	0	0
			Scrub-Shrub	0	0	0	0	1	1	0	0	0
			Forested	2	1	1	2	3	2	1	1	1
				7	4	4	5	8	3	5	2	1

Figure 5.4.3. South Dakota Comprehensive Wildlife Conservation Plan - total number of species of greatest conservation need within each habitat descriptor of the ecosystem diversity matrix for aquatic ecosystems of the Great Plains Steppe Ecoregion. Totals (in red) reflect the number of individual species of greatest conservation need associated with the overall habitat complex (i.e., primary cell as defined by the solid black line).

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

AQUATIC ECOSYSTEMS

Time Since Major Disturbance (i.e., flood)	Disturbance Influenced Pathways		Habitat Descriptor	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS							
			Geomorphic Setting					Perennial							
			Water Regime	Limnetic	Littoral	Semi-permanent	Permanent	Large River		Small Rivers		Creeks		Headwater Stream	
			Sizeclass												
			Gradient					Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)
EARLY SUCCESSIONAL	Beaver Influenced System		Streambed	0	1	0	0	1	0	1	0	0	0	0	0
			Unconsolidated Bottom	0	1	0	0	0	0	1	0	1	0	0	0
			Aquatic Bed	0	2	0	2	0	0	3	0	3	0	1	0
				0	4	0	2	1	0	5	0	4	0	1	0
	Beaver Absent		Streambed	0	1	0	0	1	0	1	0	0	0	0	0
			Unconsolidated Bottom	0	1	0	0	1	0	1	0	1	0	0	0
			Aquatic Bed	0	2	0	2	0	0	3	0	3	0	1	0
				0	4	0	2	2	0	5	0	4	0	1	0
LATE SUCCESSIONAL	Beaver Influenced System		Streambed	0	1	0	0	1	0	1	0	0	0	0	0
			Unconsolidated Bottom	0	1	0	0	0	0	1	0	1	0	0	0
			Aquatic Bed	0	2	0	2	0	0	3	0	3	0	1	0
				0	4	0	2	1	0	5	0	4	0	1	0
	Beaver Absent		Streambed	0	1	0	0	1	0	1	0	0	0	0	0
			Unconsolidated Bottom	0	1	0	0	1	0	1	0	1	0	0	0
			Aquatic Bed	0	2	0	2	0	0	3	0	3	0	1	0
				0	4	0	2	2	0	5	0	4	0	1	0

Figure 5.4.4 South Dakota Comprehensive Wildlife Conservation Plan - total number of species of greatest conservation need within each disturbance influenced pathway of the ecosystem matrix for forested ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

FORESTED ECOSYSTEMS

Disturbance Influenced Pathways	Warm, Dry Bur Oak	Xeric Ponderosa Pine	Warm, Dry Ponderosa Pine
SEEDLING/ SHRUB	0	0	1
SAPLING	0	0	1
Stand conditions/structure PREDOMINANTLY influenced by short-interval fire regimes			
SMALL TREES	0	0	0
MEDIUM TREES	0	0	0
LARGE TREES	0	0	1
Stand conditions/structure PREDOMINANTLY influenced by long-interval fire regimes			
SMALL TREES	0	0	0
MEDIUM TREES	0	1	1
LARGE TREES	0	1	1

Figure 5.5.1. South Dakota Comprehensive Wildlife Conservation Plan - total number of species of greatest conservation need within each disturbance influenced pathway of the ecosystem diversity matrix for grass/shrub ecosystems of the Black Hills Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

GRASSLAND-SHRUB ECOSYSTEMS

Disturbance Influenced Pathways	Ecolological Site Class: Clayey	Claypan	Loamy	Shallow	Thin Upland	Sandy	High Country Loamy	Mountain Prairie
Early Seral	0	0	0	0	0	0	0	0
Prairie Dog Town, active	3	3	3				3	3
Prairie Dog Town, inactive	1	1	1				1	1
Vegetative composition-structure primarily influenced by short-interval fire regimes (<25 yrs.)								
Light Grazing	0	0	0	0	0	0	0	0
Moderate Grazing	2	2	2	2	2	2	2	2
Heavy Grazing	3	3	3	3	3	3	3	3
Vegetative composition-structure primarily influenced by long-interval fire regimes (>25 yrs.)								
Light Grazing	0	0	0	0	0	0	0	0
Moderate Grazing	0	0	0	0	0	0	0	0
Heavy Grazing	0	0	0	0	0	0	0	0

KEY

Ecosystems that do not occur

Figure 5.5.2. South Dakota Comprehensive Wildlife Conservation Plan - total number of species of greatest conservation need associated with each habitat descriptor (some species may be associated with more than one habitat descriptor) of the ecosystem diversity matrix for riparian/wetland ecosystems of the Black Hills Ecoregion. Totals (in red) reflect the number of individual species of greatest conservation need associated with the overall habitat complex (i.e., primary cell as defined by the solid black line).

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

KEY

Ecosystems that do not

RIPARIAN-WETLAND ECOSYSTEMS

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptors	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS				SLOPE SYSTEMS
			Geomorphic →								
			Water Regime →	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*		*Intermittent*		
			Gradient →				Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Grazing	Rocky Shore		0	0	1	1			
			Unconsolidated Shore		0	0	1	1			
			Emergent		2	3	4	2			
			Scrub-Shrub		1	1	2	2			
			Forested		2	3	4	3			
					3	5	6	3			
		Heavy Grazing	Rocky Shore		0	0	1	1			
			Unconsolidated Shore		0	0	1	1			
			Emergent		0	0	1	1			
			Scrub-Shrub		0	0	1	1			
			Forested		1	2	3	2			
					1	2	3	2			
	Beaver Unmodified System	Low to Moderate Grazing	Rocky Shore	0	0	0	1	2	0	1	0
			Unconsolidated Shore	0	0	0	1	1	0	0	0
			Emergent	2	2	3	4	2	2	1	1
			Scrub-Shrub	1	1	1	2	2	1	1	1
			Forested	2	2	3	4	3	2	2	2
				3	3	5	6	4	3	3	2
		Heavy Grazing	Rocky Shore	0	0	0	1	1	0	0	0
			Unconsolidated Shore	0	0	0	1	1	0	0	0
			Emergent	0	0	0	1	1	0	0	0
			Scrub-Shrub	0	0	0	1	1	0	0	0
			Forested	1	1	2	3	2	1	1	1
				1	1	2	3	2	1	1	1
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Grazing	Rocky Shore		0	0	1	1			
			Unconsolidated Shore		0	0	1	1			
			Emergent		2	3	4	2			
			Scrub-Shrub		1	1	2	2			
			Forested		3	4	5	4			
					4	6	7	4			
		Heavy Grazing	Rocky Shore		0	0	1	1			
			Unconsolidated Shore		0	0	1	1			
			Emergent		0	0	1	1			
			Scrub-Shrub		0	0	1	1			
			Forested		2	3	4	3			
					2	3	4	1			
	Beaver Unmodified System	Low to Moderate Grazing	Rocky Shore	0	0	0	1	2	0	1	0
			Unconsolidated Shore	0	0	0	1	1	0	0	0
			Emergent	2	2	3	4	2	2	1	1
			Scrub-Shrub	1	1	1	2	2	1	1	1
			Forested	3	3	4	5	4	3	3	3
				4	4	6	7	2	4	4	1
		Heavy Grazing	Rocky Shore	0	0	0	1	1	0	0	0
			Unconsolidated Shore	0	0	0	1	1	0	0	0
			Emergent	0	0	0	1	1	0	0	0
			Scrub-Shrub	0	0	0	1	1	0	0	0
			Forested	2	2	3	4	3	2	2	2
				2	2	3	4	3	2	2	2

Figure 5.5.3. South Dakota Comprehensive Wildlife Conservation Plan - total number of species of greatest conservation need associated with each habitat descriptor (some species may be associated with more than one habitat descriptor) of the ecosystem diversity matrix for riparian/wetland ecosystems of the Black Hills Ecoregion. Totals (in red) reflect the number of individual species of greatest conservation need associated with the overall habitat complex (i.e., primary cell as defined by the solid black line).

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

AQUATIC ECOSYSTEMS

Time Since Major Disturbance (i.e., flood)	Disturbance Influenced Pathways	Habitat Descriptor	DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS							
		Geomorphic Setting			Perennial							
		Water Regime	Semi-permanent	Permanent	Large River		Small River		Creek		Headwater Stream	
		Sizeclass										
		Gradient			Low Gradient (≤ 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (≤ 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (≤ 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (≤ 2% slope)	Mid-High Gradient (>2% slope)
EARLY SUCCESSIONAL	Beaver Influenced System	Streambed	0	0	1	0	1	0	0	0	0	0
		Unconsolidated Bottom	0	0	0	0	1	1	1	1	0	0
		Aquatic Bed	0	1	0	0	1	0	1	0	1	0
			0	1	1	0	3	1	2	1	1	0
	Beaver Absent	Streambed	0	0	1	0	1	0	0	0	0	0
		Unconsolidated Bottom	0	0	0	0	1	1	1	1	0	0
		Aquatic Bed	0	1	0	0	1	0	1	0	1	0
			0	1	1	0	3	1	2	1	1	0
LATE SUCCESSIONAL	Beaver Influenced System	Streambed	0	0	1	0	1	0	0	0	0	0
		Unconsolidated Bottom	0	0	0	0	1	1	1	1	0	0
		Aquatic Bed	0	1	0	0	1	0	1	0	1	0
			0	1	1	0	3	1	2	1	1	0
	Beaver Absent	Streambed	0	0	1	0	1	0	0	0	0	0
		Unconsolidated Bottom	0	0	0	0	1	1	1	1	0	0
		Aquatic Bed	0	1	0	0	1	0	1	0	1	0
			0	1	1	0	3	1	2	1	1	0

Figure 5.5.4. South Dakota Comprehensive Wildlife Conservation Plan - total number of species of greatest conservation need within each disturbance influenced pathway of the ecosystem diversity matrix for forested ecosystems of the Black Hills Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

FORESTED ECOSYSTEMS

Disturbance Influenced Pathways	Warm, Dry Bur Oak	Xeric Ponderosa Pine	Warm, Dry Ponderosa Pine	Warm, Moist Ponderosa Pine	Warm, Moist Quaking Aspen	Cool, Moist White Spruce	High Elevation Limber Pine
SEEDLING-SHRUB	0	0	2	3	1	3	0
SAPLING	0	0	2	3	1	3	0
Stand conditions-structure PREDOMINANTLY influenced by short-interval fire regimes							
SMALL TREES	0	0	1	1	0	2	0
MEDIUM TREES	0	1	2	2	0	2	0
LARGE TREES	2	4	6	6	0	3	0
Stand conditions-structure PREDOMINANTLY influenced by long-interval fire regimes							
SMALL TREES	0	0	0	3	1	4	0
MEDIUM TREES	0	0	0	7	5	8	0
LARGE TREES	0	0	0	8	5	9	0

6.0 Conservation Goals and Actions

Using an appropriate classification system and accompanying analyses, the coarse filter strategy should function to identify appropriate objectives for conserving ecosystem diversity. However, the ecosystem representation that is sufficient to meet these objectives still remains a question. This CWCP does not attempt to return South Dakota to an "historical" condition. The plan focuses on providing sufficient amounts of functionally similar ecosystems represented across the ecoregions in order for native species to continue to persist in South Dakota. The term used to describe this sufficient level of representation is "adequate ecological representation". Adequate ecological representation under an historical range of variability-based approach identifies an estimate of the threshold level to "represent" each ecological community that occurred under historical disturbance regimes. This threshold level identifies the minimum amount of all ecological communities 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 ecological 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 ecological 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, that is "how much is enough", revolve around a discussion of the acceptable level of risk to ecosystem diversity and species persistence. Science based approaches strive to gather knowledge that eliminate these uncertainties. Although, the true answer will never be completely known, a science-based approach can place probabilities of risk on possible outcomes of 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 is acknowledged as one of the greatest threats to biological diversity at the species level[1,2]. Habitat loss and its effects on biological diversity can be viewed as having four aspects associated with it. First is the actual loss or conversion of habitat from conditions that support a species to unfavorable conditions that do not support a species. A second cause of habitat loss, alteration of disturbance processes, is often more difficult to recognize and quantify but this form of habitat loss can result in changes in ecosystem structure, function, or composition[2,3] . Such alterations can severely reduce the habitat quality of an ecosystem for a particular species. The third aspect of habitat loss that can affect species is the reduction in the size of remaining habitat patches for the occurrence of species, based on species-area relationships[4]. The fourth aspect of habitat loss is that of shifting populations from being a single population within the landscape to being a metapopulation consisting of many independent populations that only interact with occasional dispersal of individuals. These newly created metapopulations, or existing metapopulations within the landscape, might be influenced by habitat loss to the point that interruption of demographic or genetic support to the metapopulation occurs[5], resulting in the subsequent loss of the entire population.

Each of these four areas of concern 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 patch size or 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 so that isolating conditions are not produced. 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 adequate 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 adequate representation from a habitat standpoint also requires thorough evaluation of location, juxtaposition, and size of ecosystems selected for representation. 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.

Ecosystem Diversity

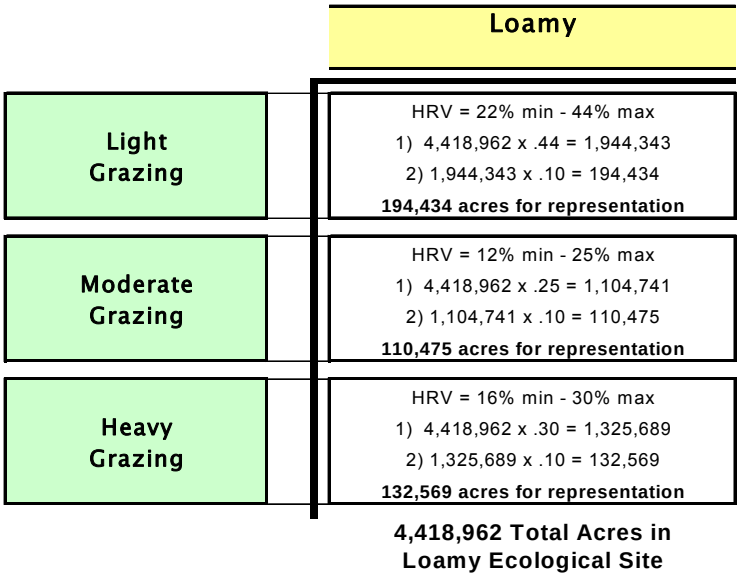
In this plan, a goal for adequate ecological representation will be identified as maintaining more than or restoring at least 10% of the historical occurrence for all ecosystems in each of South Dakota's five ecoregions for illustrative purposes. Although 10% is not necessarily a recommended level of 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 loss (>95%), loss of species is likely. A level of 10 -12% representation is consistent with several recommendations[6,7,8,9] but with the exception of one these sources[8], 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 Section 8. 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.

Conservation Goals

Two methods were used to quantify acres to demonstrate a conservation goal of 10% representation.

Method 1

The first method applies to only the grass/shrub ecosystems of the Great Plains Steppe Ecoregion and the Mixedgrass Subregion. In these instances, the historical range of variability was developed through the historical vegetation dynamics modeling using the computer model SIMPPLLE. The 10% goal was applied to the maximum amounts of the historical range of variability. Using the maximum amount of HRV to calculate 10% is considered more prudent to ensure adequate representation in widely variable ecosystems. For example, to calculate the goal of providing 10% representation of the maximum acres estimated to have occurred within the historical range of variability for each historical grass/shrub ecosystem, we would first (1) multiply the total number of acres of that ecological site by the maximum percentage of the historical range of variability and second (2), take the results from the calculation in (1) and multiply it by 10%. The following diagram uses a small subset of the Great Plains Steppe grass/shrub EDM to demonstrate this calculation:



This number is the conservation goal or the minimum number of acres for representation that should be maintained on the landscape to conserve ecosystem diversity. These ecosystems must be substantially similar to the historical condition and distributed in a manner that will provide effective benefits for biodiversity conservation. Using the historical range of variability to calculate conservation goals is the preferred method for conservation of biological diversity. This method ensures that historically common ecosystems are adequately represented. It should be emphasized that the coarse filter should not be used to over represent ecosystems that were uncommon historically, as native species would not be dependent on ecosystems that either did not occur or rarely occurred. This does not include those rare and unique ecosystems, such as caves, that were consistently present and are addressed as important management areas, as discussed previously.

Method 2

The second method applies to those ecosystems where historical range of variability has not been developed. In these instances, the goal of 10% representation is applied to the total acres of an ecological site. This number is then divided uniformly among the appropriate disturbance states or successional categories within the ecological site. This method is less desirable than Method 1 as it presents the opportunity to over represent historically uncommon ecosystems and under represent

historically common ecosystems. This may be particularly problematic for species that are dependent on the relatively larger blocks of contiguous habitat that is characteristic of the historically common ecosystems.

Management goals for black-tailed prairie dog colonies have been previously identified in the South Dakota Black-tailed Prairie Dog Conservation and Management Plan[10]. State agencies involved in prairie dog management are guided by this legislatively-approved plan. The prairie dog planning process involved extensive public involvement and a series of compromises to arrive at an acceptable legislatively-approved plan. This public involvement process heavily weighted private landowner tolerance for prairie dogs. Prairie dog distribution in South Dakota will ultimately be determined by a combination of social, philosophical, and political perspectives.

When considered from an ecological standpoint, the distribution of black-tailed prairie dog colonies should be viewed relative to appropriate ecological sites and their amounts within each ecoregion. To demonstrate this, we have calculated black-tailed prairie dog acreages based on 1% of the total number of acres in an ecological site for each of the grass/shrub ecosystems of the Great Plains Steppe Ecoregion and Mixedgrass Subregion. This amount was then divided between the active and in-active prairie dog categories using a 75% and 25% application, respectively.

Conservation Priorities

Identifying priorities for conserving ecosystem diversity is also approached using two methodologies, depending on the information available.

Method A

Method A is the preferred methodology and requires the knowledge of the historical range of variability and existing conditions relative to the coarse filter/EDM, to accomplish. The following example demonstrates the methodology and calculations for this preferred approach (note: this example is not based on actual data):

Where:

Red – number of acres existing today <= 10% maximum HRV
Orange – number of acres existing today > 10% but < 30% maximum HRV
Green – number of acres existing today >= 30% but < 100% maximum HRV
Blue – number of acres existing today > 100% maximum HRV

	Loamy
Vegetative composition/structure primarily influenced by short-interval fire regimes (<15 yrs.)	
Light Grazing	**97,217 acres for representation/ 7,891 existing acres = 8% max. HRV**
Moderate Grazing	**366,774 acres for representation/ 162,315 existing acres = 44% max. HRV**
Heavy Grazing	**123,731 acres for representation/ 38,640 existing acres = 31% max. HRV**
Vegetative composition/structure primarily influenced by long-interval fire regimes (>15 yrs.)	
Light Grazing	**416 acres for representation/ 33,215 existing acres > 100% max. HRV**
Moderate Grazing	**612 acres for representation/ 3,596,216 existing acres > 100 % max. HRV**
Heavy Grazing	**299 acres for representation/ 68,892 existing acres > 100% max. HRV**

Method B

Method B is used where information on historical range of variability and/or existing conditions is not available. This approach combines information on ecosystem conversion, both quantitative and qualitative, and number of species of greatest conservation need associated with each ecosystem, to develop a priority ranking for conservation actions. For those ecosystems that did not have sufficient information to delineate ecological sites, an initial amount of 500 acres was identified as a goal for ecosystem representation until better information can be obtained.

Each ecosystem is evaluated relative to the following parameters and assigned the corresponding priority value:

Altered or converted ecosystems		**Species of greatest conservation need (SoGCN)**	
>= 60%	= 5	> =5 species	= 5
>= 30% but <60%	= 3	>= 3 but <5	= 3
>=1 but < 30%	= 1	>=1 but < 3	= 1
More today than historically	= 0	= 0	= 0

The priority value for conversion is then added to the priority value for SoGCN to achieve a final value. This value is then ranked against the following scale:

High Priority >= 8

Medium Priority >= 5 but <8

Low Priority < 5

Priority levels are identified with the conservation goals using red, orange, and green background highlights. Red highlights identify the highest priority ecosystems for restoration or maintenance, orange highlights identify the second highest priority, and green represents the lowest priority. Priorities should be reassessed on a 5-year time frame as new information is obtained.

Due to the lack of information on existing conditions relative to the disturbance categories of the coarse filter/EDM for most ecosystems, method 2 was used to conduct the initial ecosystem prioritization for all ecosystems and ecoregions. Future efforts should strive to obtain the necessary information to prioritize ecosystem diversity using Method 1, as this is the most scientifically defensible and most beneficial for ensuring maintenance or restoration of adequate ecological representation for ecosystem diversity.

Great Plains Steppe Ecoregion

Grass/shrub ecosystems: Method 1 was used to calculate conservation goals for grass/shrub ecosystems of the Great Plains Steppe Ecoregion. Figure 6.1 presents the conservation goals as well as the priority levels, developed using method B, for implementation.

Riparian/wetland ecosystems: Method 2 was used to calculate conservation goals for riparian/wetland ecosystems of the Great Plains Steppe Ecoregion. Figure 6.2 presents the conservation goals as well as the priority levels, developed using method B, for implementation.

Aquatic ecosystems: Method 2 was used to calculate conservation goals for aquatic ecosystems of the Great Plains Steppe Ecoregion. Figure 6.3 presents the conservation goals as well as the priority levels , developed using method B, for implementation.

Forest ecosystems: Method 2 was used to calculate conservation goals for forest ecosystems of the Great Plains Steppe Ecoregion. Figure 6.4 presents the conservation goals as well as the priority levels , developed using method B, for implementation.

Black Hills Ecoregion

Grass/shrub ecosystems: Method 2 was used to calculate conservation goals for grass/shrub ecosystems of the Black Hills Ecoregion. Figure 6.5 presents the conservation goals as well as the priority levels, developed using method B, for implementation.

Riparian/wetland ecosystems: Method 2 was used to calculate conservation goals for riparian/wetland ecosystems of the Black Hills Ecoregion. Figure 6.6 presents the conservation goals as well as the priority levels, developed using method B, for implementation.

Aquatic ecosystems: Method 2 was used to calculate conservation goals for aquatic ecosystems of the Black Hills Ecoregion. Figure 6.7 presents the conservation goals as well as the priority levels, developed using method B, for implementation.

Forest ecosystems: Method 2 was used to calculate conservation goals for forest ecosystems of the Black Hills Ecoregion. Figure 6.8 presents the conservation goals as well as the priority levels, developed using method B, for implementation.

Missouri River Ecoregion

Riparian/Wetland and Aquatic ecosystems: The Missouri River Ecoregion presents a special challenge for setting conservation goals for ecosystem diversity of both riparian/wetland and aquatic ecosystems. The Ecoregion has been so altered that it will be impossible, at least in the short-term, to have an appropriate level of representation of historical conditions to support the wildlife species dependent on those conditions. Restoration of historical riparian/wetland ecosystems would require an enormous social will and monetary cost. The only alternative at this time is to use the coarse filter strategy to identify those areas that most closely resemble historical conditions and strive to maintain or improve conditions on those sites. Wherever possible, opportunities for river management and water flow programs that will improve or create more areas resembling historical conditions should be identified and pursued. In addition, South Dakota Game, Fish, and Parks is in the process of preparing endangered species management plans in anticipation of submitting a Habitat Conservation Plan to the U.S. Fish and Wildlife Service for the Missouri River Ecoregion.

Method 2 was used to calculate conservation goals for riparian/wetland and aquatic ecosystems of the Missouri River Ecoregion. Figures 6.9 and 6.10 present the conservation goals as well as the priority, developed using method B, levels for implementation, while recognizing the challenges that current land use objectives present to reaching the identified goals.

Mixedgrass Subregion

Grass/shrub ecosystems: Method 1 was used to calculate conservation goals for grass/shrub ecosystems of the Mixedgrass Subregion. Figure 6.11 presents the conservation goals as well as the priority levels, developed using method B, for implementation.

Riparian/wetland ecosystems: Method 2 was used to calculate conservation goals for riparian/wetland ecosystems of the Mixedgrass Subregion. Figure 6.12 presents the conservation goals as well as the priority levels, developed using method B, for implementation.

Aquatic ecosystems: Method 2 was used to calculate conservation goals for aquatic ecosystems of the Mixedgrass Subregion. Figure 6.13 presents the conservation goals as well as the priority levels, developed using method B, for implementation.

Tallgrass Subregion

Grass/shrub ecosystems: Method 2 was used to calculate conservation goals for grass/shrub ecosystems of the Tallgrass Subregion. Figure 6.14 presents the conservation goals as well as the priority levels, developed using method B, for implementation.

Riparian/wetland ecosystems: Method 2 was used to calculate conservation goals for riparian/wetland ecosystems of the Tallgrass Subregion. Figure 6.15 presents the conservation goals as well as the priority levels, developed using method B, for implementation.

Aquatic ecosystems: Method 2 was used to calculate conservation goals for aquatic ecosystems of the Tallgrass Subregion. Figure 6.16 presents the conservation goals as well as the priority levels, developed using method B, for implementation.

General Conservation Actions for Ecosystem Diversity

The following actions are recommended to help achieve the goals for ecosystem diversity identified in the previous section.

Management

1. Develop voluntary partnerships with landowners, agencies, and organizations to meet the conservation goals for ecosystem diversity identified for each of South Dakota's ecoregions.
2. Conduct an assessment of existing ecosystem conditions using the coarse filter/EDM framework to determine the amount of historical ecosystem conditions present today that can contribute to target goals for ecosystem diversity.
3. Develop new or use existing vegetation or other site management tools and techniques to maintain or restore desired ecosystem conditions.
4. Apply existing or develop new incentive programs that make it possible for landowners to participate in partnerships to meet conservation goals for ecosystem diversity (see Appendix G for a list of existing state and federal programs that could provide assistance).
5. Evaluate South Dakota State Parks and other state lands for opportunities to contribute toward ecosystem diversity goals.
6. 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.).
7. Continue or expand efforts to control exotic and invasive plant species across South Dakota.
8. Convert/relate the results of the native habitat evaluation for Game Production Areas in the Eastern Plains Ecoregion to the Mixedgrass and Tallgrass Subregions Ecosystem Diversity Matrix.

Research

1. Obtain 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 historical disturbance regimes on plant species compositions, structures, and functions of ecosystems.
3. Develop a better understanding of landscape patterns of heterogeneity resulting from historical disturbance regimes.
4. Develop prescribed burning and grazing methods and programs that better simulate historical disturbance regimes and their effects on South Dakota's ecosystem diversity.
5. Develop and refine landscape models to quantify historical range of variability in South Dakota
6. Identify the levels of risk associated with selected levels of representation.
7. Develop a better understanding of exotic and invasive plant species distributions and spread relative to priorities for ecosystem diversity.

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 and associated impacts on ecosystem diversity.

Figure 6.1. South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres for grass/shrub ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

GRASSLAND-SHRUB ECOSYSTEMS

Ecological Site Class

Disturbance Influenced Pathways	Porous Clay		Dense Clay		Clayey		Claypan		Loamy		Shallow		Badlands		Sandy		Saline Upland	
	Potential Dominant Species	Acres[a]	Potential Dominant Species	Acres[b]	Potential Dominant Species	Acres[b]	Potential Dominant Species	Acres[b]	Potential Dominant Species	Acres[b]	Potential Dominant Species	Acres[b]	Potential Dominant Species	Acres[b]	Potential Dominant Species	Acres[b]	Potential Dominant Species	Acres[a]
Early Seral	1 + 1 = 2	66	1 + 1 = 2	na	1 + 1 = 2	na	1 + 1 = 2	na	1 + 2 = 3	na	1 + 2 = 3	na	1 + 3 = 4	na	1 + 5 = 6	na	1 + 2 = 3	637
Prairie Dog Town, active		0		0	3 + 9 = 12	54,599	3 + 9 = 12	18,486	5 + 10 = 15	33,142		0		0		0	5 + 10 = 15	287
Prairie Dog Town, inactive		0		0	3 + 5 = 8	18,200	3 + 5 = 10	6,162	5 + 6 = 10	11,047		0		0		0	5 + 5 = 10	96
Vegetative composition/structure primarily influenced by short-interval fire regimes (<15 yrs.)																		
Light Grazing	1 + 7 = 8	66	1 + 7 = 8	14,635	1 + 7 = 8	283,915	1 + 7 = 8	113,378	3 + 8 = 11	194,434	1 + 8 = 9	180,800	1 + 8 = 9	29,985	1 + 8 = 9	228,334	1 + 8 = 9	637
Moderate Grazing	1 + 8 = 9	66	1 + 8 = 9	50,924	1 + 8 = 9	298,475	1 + 8 = 9	98,590	3 + 9 = 12	110,474	1 + 9 = 10	75,819	1 + 9 = 10	1,558	1 + 11 = 12	93,136	1 + 8 = 9	637
Heavy Grazing	1 + 6 = 7	66	1 + 6 = 7	41,881	1 + 6 = 7	313,035	1 + 6 = 7	88,731	3 + 7 = 10	132,569	1 + 7 = 8	131,226	1 + 8 = 9	17,913	1 + 10 = 11	48,070	1 + 7 = 8	637
Vegetative composition/structure primarily influenced by long-interval fire regimes (>15 yrs.)																		
Light Grazing	Rarely occurred 0 + 1 = 1	0	0 + 2 = 2	2,736	0 + 2 = 2	7,280	0 + 2 = 2	6,408	0 + 3 = 3	123,731	0 + 3 = 3	3,499	0 + 3 = 3	6,231	0 + 3 = 3	39,057	Rarely occurred 0 + 2 = 2	0
Moderate Grazing	Rarely occurred 0 + 2 = 2	0	Rarely occurred 0 + 3 = 3	0	Rarely occurred 0 + 3 = 3	0	Rarely occurred 0 + 3 = 3	0	Rarely occurred 0 + 4 = 4	0	Rarely occurred 0 + 4 = 4	0	Rarely occurred 0 + 4 = 4	0	Rarely occurred 0 + 6 = 6	0	Rarely occurred 0 + 3 = 3	0
Heavy Grazing	Rarely occurred 0 + 1 = 1	0	Rarely occurred 0 + 2 = 2	0	Rarely occurred 0 + 2 = 2	0	Rarely occurred 0 + 2 = 2	0	Rarely occurred 0 + 3 = 3	0	Rarely occurred 0 + 3 = 3	0	Rarely occurred 0 + 4 = 4	0	Rarely occurred 0 + 5 = 5	0	Rarely occurred 0 + 2 = 2	0
TOTAL ACRES IN EACH ECOLOGICAL SITE	2,632		1,189,816		7,279,882		2,464,738		4,418,962		2,916,133		389,420		3,004,394		38,244	

NRCS ECOLOGICAL/RANGE SITES

Porous Clay	Dense Clay	Clayey	Claypan	Loamy	Shallow	Badlands	Sandy	Saline Upland
R060 Porous Clay R060 Shallow Porous Clay R054 Sandy Claypan	R058D, R060A, R063A, R064 Dense Clay R058D, R060A Shallow Dense Clay	R054, R058D, R060A R063A, R064 Clayey 058D, 063A, R064 Shallow Clay R054, R060A Shallow Clayey	058D, 063A, R054, R060A, R064 Claypan 058D, 063A, R054, R060A, R064 Thin Claypan	R054, R060A, R064 Loamy 058D, 063A, R054, R060A, R064 Loamy Terrace	R054, R060A Shallow Loamy 058D, 063A, R054, R060A, R064 Very Shallow R054 Thin Loamy 058D, 063A, R060A, R064 Thin Upland 058D, 063A, R064 Shallow 058D, 063A Shallow to Gravel	R064 Badlands Terrace	058D, 063A, R054, R060A, R064 Sands 058D, 063A, R054, R060A, R064 Sandy R054, R060A Shallow Sandy 065 Choppy Sands	058D, R060A Saline Upland

KEY

- Ecosystems that do not occur
- High priority conservation goals
- Medium priority conservation goals
- Low priority conservation goals

na - information not available

[a] Calculated using Method 2 as described in text

[b] Calculated using Method 1 as described in text

Figure 6.2. South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres (ac) for riparian/wetland ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

RIPARIAN ECOSYSTEMS

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways			Habitat Descriptor	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS				SLOPE SYSTEMS
				Geomorphic →									
				Water Regime →	*Littoral*	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*		*Intermittant*		
				Slope →					Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing		Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	6 ac 5 + 6 = 11		316 ac 5 + 3 = 8	316 ac 5 + 4 = 9	1411 ac 5 + 6 = 11	1411 ac 5 + 1 = 6			
EARLY SUCCESSIIONAL	Beaver Modified System	Heavy Bison Grazing		Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	6 ac 5 + 5 = 10		316 ac 5 + 3 = 8	316 ac 5 + 4 = 9	1411 ac 5 + 5 = 10	1411 ac 5 + 1 = 6			
EARLY SUCCESSIIONAL	Beaver Unmodified System	Low to Moderate Bison Grazing		Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	6 ac 0 + 7 = 7	8639 ac 3 + 3 = 6	316 ac 3 + 0 = 3	316 ac 3 + 4 = 7	1411 ac 3 + 8 = 11	1411 ac 3 + 2 = 5	8920 ac 3 + 4 = 7	8920 ac 3 + 1 = 4	10 ac 3 + 0 = 3
EARLY SUCCESSIIONAL	Beaver Unmodified System	Heavy Bison Grazing		Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	6 ac 0 + 6 = 6	8639 ac 3 + 3 = 6	316 ac 3 + 3 = 6	316 ac 3 + 4 = 7	1411 ac 3 + 7 = 10	1411 ac 3 + 2 = 5	8920 ac 3 + 4 = 7	8920 ac 3 + 1 = 4	10 ac 3 + 0 = 3
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing		Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	6 ac 5 + 6 = 11		316 ac 5 + 3 = 8	316 ac 5 + 4 = 9	1411 ac 5 + 6 = 11	1411 ac 5 + 1 = 6			
LATE SUCCESSIIONAL	Beaver Modified System	Heavy Bison Grazing		Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	6 ac 5 + 5 = 10		316 ac 5 + 3 = 8	316 ac 5 + 4 = 9	1411 ac 5 + 5 = 10	1411 ac 5 + 1 = 6			
LATE SUCCESSIIONAL	Beaver Unmodified System	Low to Moderate Bison Grazing		Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	6 ac 0 + 8 = 8	8639 ac 3 + 1 = 4	316 ac 3 + 1 = 4	316 ac 3 + 5 = 8	1411 ac 3 + 9 = 12	1411 ac 3 + 3 = 6	8920 ac 3 + 5 = 8	8920 ac 3 + 2 = 5	10 ac 3 + 1 = 4
LATE SUCCESSIIONAL	Beaver Unmodified System	Heavy Bison Grazing		Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	6 ac 0 + 7 = 7	8639 ac 3 + 4 = 7	316 ac 3 + 4 = 7	316 ac 3 + 5 = 8	1411 ac 3 + 8 = 11	1411 ac 3 + 3 = 6	8920 ac 3 + 5 = 8	8920 ac 3 + 2 = 5	10 ac 3 + 1 = 4
	TOTAL ACRES IN EACH ECOLOGICAL SITE				4,274	345,575	50,546		225,777		713,587		Not available

KEY

- Ecosystems that do not occur
- High priority conservation goals
- Medium priority conservation goals
- Low priority conservation goals

References

Ecosystem Diversity Matrix concept described in:
1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes based on:
1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Core of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

Figure 6.3. South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres (ac) and stream miles (sm) for aquatic ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

AQUATIC ECOSYSTEMS

Time Since Major Disturbance (i.e., flood)	Disturbance Influenced Pathways	Habitat Descriptor	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS							
Geomorphic Setting			Limnetic	Littoral	Semi-permanent	Permanent	Perennial							
Water Regime							Large River		Small Rivers		Creeks		Headwater Stream	
Sizeclass														
Gradient							Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)
EARLY SUCCESSIONAL	Beaver Influenced System	Rock Bottom Unconsolidated Bottom Aquatic Bed	408 ac 5 + 0 = 5	353 ac 5 + 4 = 9	1900 ac 3 + 0 = 3	74 ac 5 + 2 = 7	25 sm 5 + 1 = 6	0.2 sm 5 + 0 = 5	50 sm 5 + 5 = 10	0.3 sm 5 + 0 = 5	41 sm 5 + 4 = 9	0.2 sm 5 + 0 = 5	16 sm 5 + 1 = 6	0.2 sm 5 + 0 = 5
EARLY SUCCESSIONAL	Beaver Absent	Rock Bottom Unconsolidated Bottom Aquatic Bed	408 ac 0 + 0 = 0	353 ac 0 + 4 = 4	1900 ac 3 + 0 = 3	74 ac 3 + 2 = 5	25 sm 3 + 2 = 5	0.2 sm 3 + 0 = 3	50 sm 3 + 5 = 8	0.3 sm 3 + 0 = 3	41 sm 3 + 4 = 7	0.2 sm 3 + 0 = 3	16 sm 3 + 1 = 4	0.2 sm 3 + 0 = 3
LATE SUCCESSIONAL	Beaver Influenced System	Rock Bottom Unconsolidated Bottom Aquatic Bed	408 ac 5 + 0 = 5	353 ac 5 + 4 = 9	1900 ac 3 + 0 = 3	74 ac 5 + 2 = 7	25 sm 5 + 1 = 6	0.2 sm 5 + 0 = 5	50 sm 5 + 5 = 10	0.3 sm 5 + 0 = 5	41 sm 5 + 4 = 9	0.2 sm 5 + 0 = 5	16 sm 5 + 1 = 6	0.2 sm 5 + 0 = 5
LATE SUCCESSIONAL	Beaver Absent	Rock Bottom Unconsolidated Bottom Aquatic Bed	408 ac 0 + 0 = 0	353 ac 0 + 4 = 4	1900 ac 3 + 0 = 3	74 ac 3 + 2 = 5	25 sm 3 + 2 = 5	0.2 sm 3 + 0 = 3	50 sm 3 + 5 = 8	0.3 sm 3 + 0 = 3	41 sm 3 + 4 = 7	0.2 sm 3 + 0 = 3	16 sm 3 + 1 = 4	0.2 sm 3 + 0 = 3
TOTAL ACRES IN EACH ECOLOGICAL SITE			16318 ac	14110 ac	75986 ac	2967 ac	1010 sm	9 sm	2007 sm	12 sm	1626 sm	7 sm	647 sm	9 sm

KEY

- Ecosystems that do not occur
- High priority conservation goals
- Medium priority conservation goals
- Low priority conservation goals

References

Ecosystem Diversity Matrix concept described in:
1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes based on:
1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Core of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

Figure 6.4. South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres (ac) for forested ecosystems of the Great Plains Steppe Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA GREAT PLAINS STEPPE ECOREGION

FORESTED ECOSYSTEMS

VEGETATION STRUCTURAL STAGES	Warm, Dry Bur Oak Potential Dominant Spp.	Acres	Xeric Ponderosa Pine Potential Dominant Spp.	Acres	Warm, Dry Ponderosa Pine Potential Dominant Spp.	Acres
SEEDLING/ SHRUB	1 + 0 = 1	2008	1 + 0 = 1	8138	1 + 1 = 2	3160
SAPLING	1 + 0 = 1	2008	1 + 0 = 1	8138	1 + 1 = 2	3160
Stand conditions/structure PREDOMINANTLY influenced by short-interval fire regimes	Non-lethal 10 yr. Mean Fire Interval		Non-lethal 3-23 yr. return interval		Non-lethal & Mix. Severity 10-43 yr. return interval	
SMALL TREES	1 + 0 = 1	2008	0 + 0 = 0	8138	0 + 0 = 0	3160
MEDIUM TREES	1 + 0 = 1	2008	0 + 0 = 0	8138	0 + 0 = 0	3160
LARGE TREES	1 + 0 = 1	2008	1 + 0 = 1	8138	1 + 1 = 2	3160
% Habitat Type Class by Historical Disturbance Regime	Non-lethal	98%	Non-lethal	90%	Non-lethal	90%
	Mixed Severity	2%	Mixed Severity	10%	Mixed Severity	10%
	Stand Replacing	0%	Stand Replacing	0%	Stand Replacing	0%
Stand conditions/structure PREDOMINANTLY influenced by long-interval fire regimes	Rarely Occurred		Rarely Occurred		Rarely Occurred	
SMALL TREES	0 + 0 = 0	0	0 + 0 = 0	0	0 + 0 = 0	0
MEDIUM TREES	0 + 0 = 0	0	0 + 1 = 1	0	0 + 1= 1	0
LARGE TREES	0 + 0 = 0	0	0 + 1= 1	0	0 + 1 = 1	0
TOTAL ACRES IN EACH ECOLOGICAL SITE	100,410		406,903		157,996	

KEY

- Ecosystems that do not occur
- High priority conservation goals
- Medium priority conservation goals
- Low priority conservation goals

Figure 6.5. South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres (ac) for grass/shrub ecosystems of the Black Hills ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

GRASSLAND-SHRUB ECOSYSTEMs

Disturbance Influenced Pathways	Clayey		Claypan		Loamy		Shallow		Thin Upland		Sandy		High Country Loamy		Mountain Prairie	
	Potential Dominant Species	Acres	Potential Dominant Species	Acres	Potential Dominant Species	Acres	Potential Dominant Species	Acres	Potential Dominant Species	Acres	Potential Dominant Species	Acres	Potential Dominant Species	Acres	Potential Dominant Species	Acres
Early Seral	1 + 0 = 1	268	1 + 0 = 1	23	1 + 0 = 1	1521	1 + 0 = 1	1861	1 + 0 = 1	1281	1 + 0 = 1	123	1 + 0 = 1	94	1 + 0 = 1	344
Prairie Dog Town, active	5 + 3 = 8	268**	5 + 3 = 8	23**	5 + 3 = 8	1521**		0		0		0	5 + 3 = 8	94**	5 + 3 = 8	344**
Prairie Dog Town, inactive	5 + 1 = 6	268**	5 + 1 = 6	23**	5 + 1 = 6	1521**		0		0		0	5 + 1 = 6	94**	5 + 1 = 6	344**
Vegetative composition/structure primarily influenced by short-interval fire regimes (<25 yrs.)																
Light Grazing	1 + 0 = 1	268	1 + 0 = 1	23	1 + 0 = 1	1521	1 + 0 = 1	1861	1 + 0 = 1	1281	1 + 0 = 1	123	1 + 0 = 1	94	1 + 0 = 1	344
Moderate Grazing	1 + 2 = 3	268	1 + 2 = 3	23	1 + 2 = 3	1521	1 + 2 = 3	1861	1 + 2 = 3	1281	1 + 2 = 3	123	1 + 2 = 3	94	1 + 2 = 3	344
Heavy Grazing	1 + 3 = 4	268	1 + 3 = 4	23	1 + 3 = 4	1521	1 + 3 = 4	1861	1 + 3 = 4	1281	1 + 3 = 4	123	1 + 3 = 4	63	1 + 3 = 4	344
Vegetative composition/structure primarily influenced by long-interval fire regimes (>25 yrs.)																
Light Grazing	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0
Moderate Grazing	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0
Heavy Grazing	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0	Rarely Occurred 0 + 0 = 0	0
TOTAL ACRES IN EACH ECOLOGICAL SITE	**16,088**		**1,377**		**91,272**		**74,420**		**51,235**		**4,921**		**5,661**		**20,650**	
	061 Clayey 061 Dense Clay		061 Thin Claypan		061, 062 Silty 061 Loamy Terrace		061, 062 Shallow 061 Shallow Clay		061 Thin Upland		061 Sandy		062 High Country Overflow 062 High Country Silty		062 Mountain Prairie	

KEY

- **Ecosystems that do not occur**
- **High priority conservation goals**
- **Medium priority conservation goals**
- **Low priority conservation goals**

** Conservation goals for restoration of black-tailed prairie dog colonies are identified in Cooper (2004) - "South Dakota Black-tailed Prairie Dog Conservation and Management Plan". The above number of acres of active and inactive colonies demonstrate possible distributions across ecological sites within the Black Hills Ecoregion.

Figure 6.6. South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres (ac) for riparian/wetland ecosystems of the Black Hills ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways			Habitat Descriptor	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS				SLOPE SYSTEMS
				Water Regime	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*		*Intermittant*		
				Slope				Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested			26 ac 5 + 3 = 8	26 ac 5 + 5 = 10	257 ac 5 + 6 = 11	257 ac 5 + 3 = 8			
EARLY SUCCESSIIONAL	Beaver Modified System	Heavy Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested			26 ac 5 + 1 = 6	26 ac 5 + 2 = 7	257 ac 5 + 3 = 8	257 ac 5 + 2 = 7			
EARLY SUCCESSIIONAL	Beaver Unmodified System	Low to Moderate Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested		19 ac 3 + 3 = 6	26 ac 3 + 3 = 6	26 ac 3 + 5 = 8	257 ac 3 + 6 = 9	257 ac 3 + 4 = 7	218 ac 3 + 3 = 6	218 ac 3 + 3 = 6	5 ac ? 1 + 2 = 3
EARLY SUCCESSIIONAL	Beaver Unmodified System	Heavy Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested		19 ac 3 + 1 = 4	26 ac 3 + 1 = 4	26 ac 3 + 2 = 5	257 ac 3 + 3 = 6	257 ac 3 + 2 = 5	218 ac 3 + 1 = 4	218 ac 3 + 1 = 4	5 ac ? 1 + 1 = 2
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested			26 ac 5 + 4 = 9	26 ac 5 + 6 = 11	257 ac 5 + 7 = 12	257 ac 5 + 4 = 9			
LATE SUCCESSIIONAL	Beaver Modified System	Heavy Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested			26 ac 5 + 2 = 7	26 ac 5 + 3 = 8	257 ac 5 + 4 = 9	257 ac 5 + 1 = 6			
LATE SUCCESSIIONAL	Beaver Unmodified System	Low to Moderate Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested		19 ac 3 + 4 = 7	26 ac 3 + 4 = 7	26 ac 3 + 6 = 9	257 ac 3 + 7 = 10	257 ac 3 + 2 = 5	218 ac 3 + 4 = 7	218 ac 3 + 4 = 7	5 ac ? 1 + 1 = 2
LATE SUCCESSIIONAL	Beaver Unmodified System	Heavy Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested		19 ac 3 + 2 = 5	26 ac 3 + 2 = 5	26 ac 3 + 3 = 6	257 ac 3 + 4 = 7	257 ac 3 + 3 = 6	218 ac 3 + 2 = 5	218 ac 3 + 2 = 5	5 ac ? 1 + 2 = 3
				TOTAL ACRES IN EACH ECOLOGICAL SITE	765	4129		41152		17442		Unknown

KEY

- Ecosystems that do not occur
- High priority conservation goals
- Medium priority conservation goals
- Low priority conservation goals

Figure 6.7 South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres (ac) and stream miles (sm) for aquatic ecosystems of the Black Hills ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

AQUATIC ECOSYSTEMS

Disturbance Influenced Pathways			Habitat Descriptor	DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS							
			Geomorphic Setting			Perennial							
			Water Regime	Semi-permanent	Permanent	Large River		Small Rivers		Creeks		Headwater Stream	
			Sizeclass										
			Gradient			Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)	Low Gradient (< 2% slope)	Mid-High Gradient (>2% slope)
Time Since Major Disturbance (i.e., flood)	EARLY SUCCESSIONAL	Beaver Influenced System	Rock Bottom Unconsolidated Bottom Aquatic Bed	10.8 ac 5 + 0 = 5	2 ac 5 + 1 = 6	0.5 sm 5 + 1 = 6	0.05 sm 5 + 0 = 5	1.7 sm 5 + 3 = 8	0.3 sm 5 + 1 = 6	5.7 sm 5 + 2 =7	1.5 sm 5 + 1 = 6	4 sm 5 + 1 = 6	3.4 sm 5 + 0 = 5
	EARLY SUCCESSIONAL	Beaver Absent	Rock Bottom Unconsolidated Bottom Aquatic Bed	10.8 ac 3 + 0 = 3	2 ac 3 + 1 = 4	0.5 sm 3 + 1 = 4	0.05 sm 3 + 0 = 3	1.7 sm 3 + 3 =6	0.3 sm 3 + 1 = 4	5.7 sm 3 + 2 = 5	1.5 sm 3 + 1 = 4	4 sm 3 + 1 = 4	3.4 sm 3 + 0 = 3
	LATE SUCCESSIONAL	Beaver Influenced System	Rock Bottom Unconsolidated Bottom Aquatic Bed	10.8 ac 5 + 0 = 5	2 ac 5 + 1 = 6	0.5 sm 5 + 1 = 6	0.05 sm 5 + 0 = 5	1.7 sm 5 + 3 = 8	0.3 sm 5 + 1 = 6	5.7 sm 5 + 2 =7	1.5 sm 5 + 1 = 6	4 sm 5 + 1 = 6	3.4 sm 5 + 0 = 5
	LATE SUCCESSIONAL	Beaver Absent	Rock Bottom Unconsolidated Bottom Aquatic Bed	10.8 ac 3 + 0 = 3	2 ac 3 + 1 = 4	0.5 sm 3 + 1 = 4	0.05 sm 3 + 0 = 3	1.7 sm 3 + 3 =6	0.3 sm 3 + 1 = 4	5.7 sm 3 + 2 = 5	1.5 sm 3 + 1 = 4	4 sm 3 + 1 = 4	3.4 sm 3 + 0 = 3
		TOTAL ACRES IN EACH ECOLOGICAL SITE		435 ac	79 ac	21 sm	2 sm	66 sm	12 sm	227 sm	61 sm	160 sm	135 sm

KEY

- Ecosystems that do not occur
- High priority conservation goals
- Medium priority conservation goals
- Low priority conservation goals

Figure 6.8 South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres (ac) for forested ecosystems of the Black Hills ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA BLACK HILLS ECOREGION

FORESTED ECOSYSTEMS

Disturbance Influenced Pathways	Warm, Dry Bur Oak		Xeric Ponderosa Pine		Warm, Dry Ponderosa Pine		Warm, Moist Ponderosa Pine		Warm, Moist Quaking Aspen		Cool, Moist White Spruce		High Elevation Limber Pine	
	Potential Dominant Spp.	Acres	Potential Dominant Spp.	Acres	Potential Dominant Spp.	Acres	Potential Dominant Spp.	Acres	Potential Dominant Spp.	Acres	Potential Dominant Spp.	Acres	Potential Dominant Spp.	Acres
SEEDLING/ SHRUB	1 + 0 = 1	2008	1 + 0 = 1	8138	1 + 2 = 3	3160	1 + 3 = 4	3960	1 + 1 = 2	500	1 + 3 = 4	2880	1 + 0 = 1	500
SAPLING	1 + 0 = 1	2008	1 + 0 = 1	8138	1 + 2 = 3	3160	1 + 3 = 4	3960	1 + 1 = 2	500	1 + 3 = 4	2880	1 + 0 = 1	500
Stand conditions/structure PREDOMINANTLY influenced by short-interval fire regimes	Non-lethal 10 yr. Mean Fire Interval		Non-lethal 3-23 yr. return interval		Non-lethal & Mix. Severity 10-43 yr. return interval		Non-lethal & Mix. Severity 11-74 yr. return interval		Rarely Occurred		Rarely Occurred		Mixed-Severity ? yr. return interval	
SMALL TREES	1 + 0 = 1	2008	1 + 0 = 1	8138	1 + 1 = 2	3160	1 + 1 = 2	3960	1 + 0 = 1	0	1 + 2 = 3	0	1 + 0 = 1	500
MEDIUM TREES	1 + 0 = 1	2008	1 + 1 = 2	8138	1 + 2 = 3	3160	1 + 2 = 3	3960	1 + 0 = 1	0	1 + 2 = 3	0	1 + 0 = 1	500
LARGE TREES	5 + 2 = 7	2008	5 + 4 = 9	8138	5 + 6 = 11	3160	5 + 6 = 11	3960	1 + 0 = 1	0	1 + 3 = 4	0	1 + 0 = 1	500
% Habitat Type Class by Historical Disturbance Regime	Non-lethal	98%	Non-lethal	90%	Non-lethal	90%	Non-lethal	?%	Non-lethal	0%	Non-lethal	0%	Non-lethal	?%
	Mixed Severity	2%	Mixed Severity	10%	Mixed Severity	10%	Mixed Severity	?%	Mixed Severity	65%	Mixed Severity	33%	Mixed Severity	?%
	Stand Replacing	0%	Stand Replacing	0%	Stand Replacing	0%	Stand Replacing	?%	Stand Replacing	35%	Stand Replacing	67%	Stand Replacing	?%
Stand conditions/structure PREDOMINANTLY influenced by long-interval fire regimes	Rarely Occurred		Rarely Occurred		Rarely Occurred		Stand Replace/ Mix-Severity >74 yr return interval		Stand Replace/ Mix-Severity 120 yr Mean Fire Interval		Stand Replace/ Mix-Severity 50-200 yr return interval		Stand Replace/ Mix-Severity ? yr. return interval	
SMALL TREES	0 + 0 = 0	0	0 + 0 = 0	0	0 + 0 = 0	0	1 + 3 = 4	3960	1 + 1 = 2	500	1 + 4 = 5	2880	1 + 0 = 1	500
MEDIUM TREES	0 + 0 = 0	0	0 + 0 = 0	0	0 + 0 = 0	0	1 + 7 = 8	3960	1 + 5 = 6	500	1 + 8 =9	2880	1 + 0 = 1	500
LARGE TREES	0 + 0 = 0	0	0 + 0 = 0	0	0 + 0 = 0	0	1 + 8 = 9	3960	1 + 5 = 6	500	1 + 9 = 10	2880	1 + 0 = 1	500
TOTAL ACRES IN EACH ECOLOGICAL SITE	100,410		406,903		157,996		316,756		Insufficient information for mapping		143,994		Insufficient information for mapping	

KEY

- Ecosystems that do not occur
- High priorityconservation goals
- Medium priority conservation goals
- Low priority conservation goals

Figure 6.9. South Dakota Comprehensive Wildlife Conservation Plan - ecosystem diversity matrix for riparian/wetland ecosystems of the Missouri River Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MISSOURI RIVER ECOREGION

RIPARIAN-WETLAND ECOSYSTEMS

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptor	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
			Geomorphic →							
			Water Regime →	*Temporary*	*Semi-permanent*	*Permanent*	*Perennial*	*Intermittant*		
			Slope →				Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested		74 ac 5 = 2 = 7	74 ac 5 + 8 = 13	1313 ac 5 + 11 = 16			
		Heavy Bison Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested		74 ac 5 + 1 = 6	74 ac 5 + 5 = 10	1313 ac 5 + 8 = 13			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested	1370 ac 5 + 2 = 7	74 ac 5 + 2 = 7	74 ac 5 + 8 = 13	1313 ac 5 + 14 = 19	716 ac 5 + 1 = 6	716 ac 5 + 0 = 0	50 ac 5 + 0 = 0
		Heavy Bison Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested	1370 ac 5 + 1 = 6	74 ac 5 + 1 = 6	74 ac 5 + 5 = 10	1313 ac 5 + 11 = 16	716 ac 5 + 1 = 6	716 5 + 0 = 0	50 ac 5 + 0 = 0
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested		74 ac 5 + 2 = 7	74 ac 5 + 8 = 13	1313 ac 5 + 11 = 16			
		Heavy Bison Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested		74 ac 5 + 1 = 6	74 ac 5 + 5 = 10	1313 ac 5 + 8 = 13			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested	1370 ac 5 + 3 = 8	74 ac 5 + 3 = 8	74 ac 5 + 9 = 14	1313 ac 5 + 15 = 20	716 ac 5 + 1 = 6	716 ac 5 + 0 = 5	50 ac 5 + 1 = 6
		Heavy Bison Grazing	Rocky Shore Unconsolidated Shore Emergent Scrub-Shrub Forested	1370 ac 5 + 2 = 7	74 ac 5 + 2 = 7	74 ac 5 + 6 = 11	1313 ac 5 + 12 = 17	716 ac 5 + 1 = 6	716 ac 5 + 0 = 5	50 ac 5 + 1 = 6
		TOTAL ACRES IN EACH ECOLOGICAL SITE		5,482	11,785		105,066	28,625		Unknown

KEY

- Ecosystems that do not occur
- High priority conservation goals
- Medium priority conservation goals
- Low priority conservation goals

Figure 6.10. South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres (ac) and stream miles (sm) for aquatic ecosystems of the Missouri River Ecoregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MISSOURI RIVER ECOREGION

AQUATIC ECOSYSTEMS

Disturbance Influenced Pathways		Geomorphic Setting / Water Regime / Sizeclass	Habitat Descriptor	DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS			
				Semi-permanent	Permanent	Perennial			
						Large River	Small Rivers	Creeks	Headwater Stream
Time Since Major Disturbance (i.e., flood)	EARLY SUCCESSIONAL	Beaver Influenced System	Streambed	41 acres 5 + 0 = 5	3.2 acres 5 + 1 = 6	17 stream miles 5 + 4 = 9	3 stream miles 5 + 2 = 7	9 stream miles 5 + 1 = 6	4 stream miles 5 + 0 = 5
			Unconsolidated Bottom						
			Aquatic Bed						
		Beaver Absent	Streambed	41 acres 5 + 0 = 5	3.2 acres 5 + 1 = 6	17 stream miles 5 + 9 = 14	3 stream miles 5 + 3 = 8	9 stream miles 5 + 2 = 7	4 stream miles 5 + 0 = 5
			Unconsolidated Bottom						
			Aquatic Bed						
	LATE SUCCESSIONAL	Beaver Influenced System	Streambed	41 acres 5 + 0 = 5	3.2 acres 5 + 1 = 6	17 stream miles 5 + 4 = 9	3 stream miles 5 + 2 = 7	9 stream miles 5 + 1 = 6	4 stream miles 5 + 0 = 5
			Unconsolidated Bottom						
			Aquatic Bed						
		Beaver Absent	Streambed	41 acres 5 + 0 = 5	3.2 acres 5 + 1 = 6	17 stream miles 5 + 9 = 13	3 stream miles 5 + 3 = 8	9 stream miles 5 + 2 = 7	4 stream miles 5 + 0 = 5
			Unconsolidated Bottom						
			Aquatic Bed						
TOTAL ACRES/STREAM MILES IN ECOLOGICAL SITE				1628 acres	128 acres	669 stream miles	116 stream miles	350 stream miles	167 stream miles

KEY

- High priority conservation goals
- Medium priority conservation goals
- Low priority conservation goals

Figure 6.11. South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres for grass/shrub ecosystems of the Mixedgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

GRASS-SHRUB ECOSYSTEMS

Ecolological Site Class

Disturbance Influenced Pathways	Dense Clay		Clayey		Shallow Clayey		Claypan		Loamy		Sandy		Shallow		Very Shallow	
	Potential Dominant Species	Acres[a]	Potential Dominant Species	Acres[b]	Potential Dominant Species	Acres[a]	Potential Dominant Species	Acres[b]	Potential Dominant Species	Acres[b]	Potential Dominant Species	Acres[b]	Potential Dominant Species	Acres[b]	Potential Dominant Species	Acres[b]
Early Seral	1 + 0 = 1	1,400	3 + 0 = 3	na	1 + 0 = 1	4,404	3 + 0 = 3	na	3 + 1 = 4	na	3 + 1 =4	na	1 + 1 = 2	na	3 + 0 = 3	na
Prairie Dog Town, active		0	3 + 6 = 9	11,589		0	3 + 6 = 9	4,843	3 + 7 = 10	55,966		0		0		0
Prairie Dog Town, inactive		0	3 + 2 = 5	3,863		0	3 + 2 = 5	1,614	3 + 3 = 6	18,655		0		0		0
Vegetative composition/structure primarily influenced by short-interval fire regimes (<10 yrs.)																
Light Grazing	1 + 7 = 8	1,400	3 + 7 = 10	15,916	1 + 7 = 8	4,404	3 + 7 = 10	7,039	3 + 8 = 11	255,950	3 + 8 = 11	27,286	1 + 8 = 9	6,221	3 + 7 = 10	14,545
Moderate Grazing	1 + 6 = 7	1,400	3 + 6 = 9	33,069	1 + 6 = 7	4,404	3 + 6 = 9	15,627	3 + 7 = 10	334,302	3 + 7 = 10	4,958	1 + 7 = 8	11,331	3 + 6 = 9	2,596
Heavy Grazing	1 + 5 = 6	1,400	3 + 5 = 8	126,712	1 + 5 = 6	4,404	3 + 5 = 8	49,853	3 + 6 = 9	443,995	3 + 6 = 9	19,177	1 + 6 = 7	34,659	3 + 5 = 8	18,754
Vegetative composition/structure primarily influenced by long-interval fire regimes (>10 yrs.)																
Light Grazing	*Rarely occurred* 0 + 2 = 2	0	0 + 2 = 2	1,082	0 + 2 = 2	0	0 + 2 = 2	3,100	0 + 3 = 3	10,447	0 + 3 = 3	615	0 + 3 = 3	355	0 + 2 = 2	807
Moderate Grazing	*Rarely occurred* 0 + 2 = 2	0	*Rarely occurred* 0 + 2 = 2	0	*Rarely occurred* 0 + 2 = 2	0	0 + 2 = 2	387	*Rarely occurred* 0 + 3 = 3	0	*Rarely occurred* 0 + 3 = 3	0	*Rarely occurred* 0 + 3 = 3	0	*Rarely occurred* 0 + 2 = 2	0
Heavy Grazing	*Rarely occurred* 0 + 0 = 0	0	*Rarely occurred* 0 + 0 = 0	0	*Rarely occurred* 0 + 0 = 0	0	0 + 0 = 0	304	*Rarely occurred* 0 + 1 = 1	0	*Rarely occurred* 0 + 1 = 1	0	*Rarely occurred* 0 + 1 = 1	0	*Rarely occurred* 0 + 0 = 0	0
TOTAL ACRES IN EACH ECOLOGICAL SITE	**55,978**		**1,545,265**		**176,149**		**645,762**		**7,462,109**		**384,305**		**444,351**		**252,076**	
NRCS ECOLOGICAL/RANGE SITES	053C Dense Clay		053B, R053B Clayey		053C Shallow Clay		053B, R053B Claypan 053B, R053B Thin Claypan		053B Silty		053B, R053B Sands 053B, R053B Sandy		053B Thin Upland 053B Shallow		053B, R053B Very Shallow 053B, R053B Shallow to Gravel	

KEY

- Ecosystems that do not occur
- High priority conservation goals
- Medium priority conservation goals
- Low priority conservation goals

na - information not available

[a] Calculated using Method 2 as described in text
[b] Calculated using Method 1 as described in text

Figure 6.12. South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres (ac) for riparian/wetland ecosystems of the Mixedgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

RIPARIAN-WETLAND ECOSYSTEMS

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways		Habitat Descriptor	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
			Geomorphic →								
			Water Regime →	Littoral	Temporary	Semi-permanent	Permanent	Perennial	Intermittant		
			Slope →					Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient > 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	2 ac 5 + 7 = 12		2185 ac 5 + 3 = 8	2185 ac 5 + 6 = 11	4214 ac 5 + 9 = 14			
		Heavy Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	2 ac 5 + 5 = 10		2185 ac 5 + 3 = 8	2185 ac 5 + 5 = 10	4214 ac 5 + 6 = 11			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	2 ac 0 + 7 = 7	23064 ac 5 + 3 = 8	2185 ac 3 + 3 = 6	2185 ac 3 + 6 = 9	4214 ac 1 + 10 = 11	11185 ac 1 + 5 = 6	11185 ac 1 + 0 = 1	5 ac ? 3 + 1 = 4
		Heavy Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	2 ac 0 + 5 = 5	23064 ac 5 + 3 = 8	2185 ac 3 + 3 = 6	2185 ac 3 + 4 = 7	4214 ac 1 + 6 = 7	11185 ac 1 + 4 = 5	11185 ac 1 + 0 = 1	5 ac ? 3 + 0 = 3
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	2 ac 5 + 7 = 12		2185 ac 5 + 3 = 8	2185 ac 5 + 6 = 11	4214 ac 5 + 9 = 14			
		Heavy Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	2 ac 5 + 5 = 10		2185 ac 5 + 3 = 8	2185 ac 5 + 5 = 10	4214 ac 5 + 6 = 11			
	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	2 ac 0 + 8 = 8	23064 ac 5 + 4 = 9	2185 ac 3 + 4 = 7	2185 ac 3 + 7 = 10	4214 ac 1 + 11 = 12	11185 ac 1 + 6 = 7	11185 ac 1 + 1 = 2	5 ac ? 3 + 2 = 5
		Heavy Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested	2 ac 0 + 6 = 6	23064 ac 5 + 4 = 12	2185 ac 3 + 4 = 7	2185 ac 3 + 6 = 9	4214 ac 1 + 8 = 9	11185 ac 1 + 5 = 6	11185 ac 1 + 1 = 2	5 ac ? 3 + 1 = 4
	TOTAL ACRES IN EACH ECOLOGICAL SITE			154	922,583	349,560		337,166	894,802		Not available

KEY

- Ecosystems that do not occur
- High priority conservation goals
- Medium priority conservation goals
- Low priority conservation goals

References

Ecosystem Diversity Matrix concept described in:
1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes similar to:
1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Core of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

Figure 6.13. South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres (ac) and stream miles (sm) for aquatic ecosystems of the Mixedgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA MIXEDGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

AQUATIC ECOSYSTEMS

Disturbance Influenced Pathways			Geomorphic Setting / Water Regime / Sizeclass / Habitat Descriptor	LAKE SYSTEMS		DEPRESSIONAL SYSTEMS		RIVERINE SYSTEMS			
				Limnetic	Littoral	Semi-permanent	Permanent	Perennial			
								Large River	Small Rivers	Creeks	Headwater Stream
Time Since Major Disturbance (i.e., flood)	EARLY SUCCESSIONAL	Beaver Influenced System	Rock Bottom	189 ac 5 + 0 = 5	939 ac 5 + 1 = 6	471 ac 5 + 0 = 5	843 ac 5 + 0 = 5	3 sm 5 + 2 = 7	14 sm 5 + 4 = 9	10 sm 5 + 2 = 7	10 sm 5 + 0 = 5
			Unconsolidated Bottom								
			Aquatic Bed								
		Beaver Absent	Rock Bottom	189 ac 0 + 0 = 0	939 ac 0 + 1 = 1	471 ac 3 + 0 = 3	843 ac 3 + 0 = 3	3 sm 3 + 3 = 6	14 sm 5 + 4 = 9	10 sm 3 + 2 = 5	10 sm 3 + 0 = 3
			Unconsolidated Bottom								
			Aquatic Bed								
	LATE SUCCESSIONAL	Beaver Influenced System	Rock Bottom	189 ac 5 + 0 = 5	939 ac 5 + 1 = 6	471 ac 5 + 0 = 5	843 ac 5 + 0 = 5	3 sm 5 + 2 = 7	14 sm 5 + 4 = 9	10 sm 5 + 2 = 7	10 sm 5 + 0 = 5
			Unconsolidated Bottom								
			Aquatic Bed								
		Beaver Absent	Rock Bottom	189 ac 0 + 0 = 0	939 ac 0 + 1 = 1	471 ac 3 + 0 = 3	843 ac 3 + 0 = 3	3 sm 1 + 3 = 4	14 sm 1 + 4 = 5	10 sm 1 + 2 = 3	10 sm 1 + 0 = 1
			Unconsolidated Bottom								
			Aquatic Bed								
		TOTAL ACRES/STREAM MILES IN ECOLOGICAL SITE		7579 ac	37541 ac	18824 ac	33723 ac	109 sm	550 sm	388 sm	382 sm

KEY

- High priority conservation goals
- Medium priority conservation goals
- Low priority conservation goals

Figure 6.14. South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres (ac) for grass/shrub ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

GRASSLAND-SHRUB ECOSYSTEMS

	Clayey		Claypan		Thin Claypan		Loamy		Sandy		Thin Upland		Shallow	
	Potential Dominant Species	Acres	Potential Dominant Species	Acres	Potential Dominant Species	Acres	Potential Dominant Species	Acres	Potential Dominant Species	Acres	Potential Dominant Species	Acres	Potential Dominant Species	Acres
Early Seral	*5 + 0 = 5*	8143	*5 + 0 = 5*	562	*5 + 0 = 5*	7	*5 + 2 = 7*	125460	*3 + 2 = 5*	2946	*3 + 0 = 3*	15760	*3 + 0 = 3*	6380
Vegetative composition/structure primarily influenced by short-interval fire regimes (<8 yrs.)														
Light Grazing	*5 + 7 = 12*	8143	*5 + 7 = 12*	562	*5 + 6 = 11*	7	*5 + 8 = 13*	125460	*3 + 8 =11*	2946	*3 + 6 = 9*	15760	*3 + 6 = 9*	6380
Moderate Grazing	*5 + 6 = 11*	8143	*5 + 6 = 11*	562	*5 + 6 = 11*	7	*5 + 7 = 12*	125460	*3 + 8 = 11*	2946	*3 + 6 = 9*	15760	*3 + 6 = 9*	6380
Heavy Grazing	*5 + 7 = 12*	8143	*5 + 7 = 12*	562	*5 + 6 = 11*	7	*5 + 8 = 13*	125460	*3 + 9 = 12*	2946	*3 + 6 = 9*	15760	*3 + 6 = 9*	6380
Vegetative composition/structure primarily influenced by long-interval fire regimes (≥8 yrs.)														
Light Grazing	*Rarely occurred 0 + 1 = 1*	0	*Rarely occurred 0 + 1 = 1*	0	*Rarely occurred 0 + 1 = 1*	0	*Rarely occurred 0 + 2 = 2*	0	*Rarely occurred 0 + 3 = 3*	0	*Rarely occurred 0 + 1 = 1*	0	*Rarely occurred 0 + 1 = 1*	0
Moderate Grazing	*Rarely occurred 0 + 1 = 1*	0	*Rarely occurred 0 + 1 = 1*	0	*Rarely occurred 0 + 1 = 1*	0	*Rarely occurred 0 + 2 = 2*	0	*Rarely occurred 0 + 3 = 3*	0	*Rarely occurred 0 + 1 = 1*	0	*Rarely occurred 0 + 1 = 1*	0
Heavy Grazing	*Rarely occurred 0 + 0 = 0*	0	*Rarely occurred 0 + 0 = 0*	0	*Rarely occurred 0 + 0 = 0*	0	*Rarely occurred 0 + 1 = 1*	0	*Rarely occurred 0 + 2 = 2*	0	*Rarely occurred 0 + 1 = 1*	0	*Rarely occurred 0 + 0 = 0*	0
TOTAL ACRES IN EACH ECOLOGICAL SITE	**325,715**		**22,496**		**270**		**5,018,394**		**117,832**		**630,414**		**255,188**	

KEY

- **Ecosystems that do not occur**
- **High priority conservation goals**
- **Medium priority conservation goals**
- **Low priority conservation goals**

Figure 6.15. South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres (ac) for riparian/wetland ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

RIPARIAN-WETLAND ECOSYSTEMS

Time Since Major Disturbance (i.e., flood, fire, etc.)	Disturbance Influenced Pathways			Habitat Descriptor	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
				Geomorphic →	LAKE SYSTEMS	DEPRESSIONAL SYSTEMS			RIVERINE SYSTEMS			SLOPE SYSTEMS
				Water Regime →	Littoral	Temporary	Semi-permanent	Permanent	Perennial	Intermittant		
				Slope →					Low Gradient ≤ 2% slope	Low Gradient ≤ 2% slope	Mid-High Gradient ≥ 2% slope	
EARLY SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested		2 ac 5 + 11= 16		1688 ac 5 + 5 =10	1688 ac 5 + 9 = 14	7281 ac 5 + 14 = 19			
EARLY SUCCESSIIONAL	Beaver Modified System	Heavy Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested		2 ac 5 + 6 = 11		1688 ac 5 + 3 = 8	1688 ac 5 + 6 = 11	7281 ac 5 + 9 = 14			
EARLY SUCCESSIIONAL	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested		2 ac 0 + 9 = 9	13804 ac 5 + 6 = 11	1688 ac 3 + 5 = 8	1688 ac 3 + 9 =12	7281 ac 1 + 13 = 14	10745 ac 1 + 4 = 5	10745 ac 1 + 1 = 2	500 ac 3 + 2 = 5
EARLY SUCCESSIIONAL	Beaver Unmodified System	Heavy Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested		2 ac 0 + 6 = 6	13804 ac 5 + 3 = 8	1688 ac 3 + 3 = 6	1688 ac 3 + 6 = 9	7281 ac 1 + 8 = 9	10745 ac 1 + 3 = 4	10745 ac 1 + 0 = 1	500 ac 3 + 0 = 3
LATE SUCCESSIIONAL	Beaver Modified System	Low to Moderate Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested		2 ac 5 + 9 = 14		1688 ac 5 + 5 = 10	1688 ac 5 + 9 = 14	7281 ac 5 + 14 = 19			
LATE SUCCESSIIONAL	Beaver Modified System	Heavy Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested		2 ac 5 + 6 = 11		1688 ac 5 + 3 = 8	1688 ac 5 + 6 = 11	7281 ac 5 + 9 = 14			
LATE SUCCESSIIONAL	Beaver Unmodified System	Low to Moderate Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested		2 ac 0 + 10 = 10	13804 ac 5 + 6 = 11	1688 ac 3 + 6 = 9	1688 ac 3 + 10 = 13	7281 ac 1 + 14 = 15	10745 ac 1 + 5 = 6	10745 ac 1 + 2 = 3	500 ac 3 + 3= 6
LATE SUCCESSIIONAL	Beaver Unmodified System	Heavy Bison Grazing	Rocky Shore, Unconsolidated Shore, Emergent, Scrub-Shrub, Forested		2 ac 0 + 7 = 7	13804 ac 5 + 4 = 9	1688 ac 3 + 4 = 7	1688 ac 3 + 7 = 10	7281 ac 1 + 8 = 9	10745 ac 1 + 4 = 5	10745 ac 1 + 1 = 2	500ac 3 + 1 =4
	TOTAL ACRES IN EACH ECOLOGICAL SITE				Not available	552,168	270,009		582,467	859,888	#	Not available

KEY

- Ecosystems that do not occur
- High priority conservation goals
- Medium priority conservation goals
- Low priority conservation goals

References

Ecosystem Diversity Matrix concept described in:
1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes based on:
1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Core of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

Figure 6.16. South Dakota Comprehensive Wildlife Conservation Plan - conservation goals in acres (ac) and stream miles (sm) for aquatic ecosystems of the Tallgrass Subregion.

ECOSYSTEM DIVERSITY MATRIX - SOUTH DAKOTA TALLGRASS SUBREGION (EASTERN PRAIRIE ECOREGION)

Disturbance Influenced Pathways			Habitat Descriptor	AQUATIC ECOSYSTEMS: LAKE SYSTEMS – Limnetic	LAKE SYSTEMS – Littoral	DEPRESSIONAL SYSTEMS – Semi-permanent	DEPRESSIONAL SYSTEMS – Permanent	RIVERINE SYSTEMS – Perennial – Large River	Small Rivers	Creeks	Headwater Stream
Time Since Major Disturbance (i.e., flood)	EARLY SUCCESSIONAL	Beaver Influenced System	Rock Bottom	669 ac (0 + 2 = 2)	1227 ac (0 + 4 = 4)	1137 ac (5 + 1 = 6)	30 ac (5 + 3 = 8)	0.5 sm (5 + 7 = 12)	12 sm (5 + 9 = 14)	13 sm (5 + 3 = 8)	10 sm (5 + 2 = 7)
			Unconsolidated Bottom								
			Aquatic Bed								
		Beaver Absent	Rock Bottom	669 ac (0 + 2 = 2)	1227 ac (0 + 4 = 4)	1137 ac (3 + 1 = 4)	30 ac (3 + 3 = 6)	0.5 sm (1 + 11 = 12)	12 sm (1 + 11 = 12)	13 sm (1 + 3 = 4)	10 sm (1 + 2 = 3)
			Unconsolidated Bottom								
			Aquatic Bed								
	LATE SUCCESSIONAL	Beaver Influenced System	Rock Bottom	669 ac (0 + 2 = 2)	1227 ac (0 + 4 = 4)	1137 ac (5 + 1 = 6)	30 ac (5 + 3 = 8)	0.5 sm (5 + 7 =12)	12 sm (5 + 9 = 14)	13 sm (5 + 3 = 8)	10 sm (5 + 2 = 7)
			Unconsolidated Bottom								
			Aquatic Bed								
		Beaver Absent	Rock Bottom	669 ac (0 + 2 = 2)	1227 ac (0 + 4 = 4)	1137 ac (3 + 1 = 4)	30 ac (3 + 3 = 6)	0.5 sm (1 + 10 = 11)	12 sm (1 + 11 = 12)	13 sm (1 + 3 = 4)	10 sm (1 + 2 = 3)
			Unconsolidated Bottom								
			Aquatic Bed								
TOTAL ACRES/STREAM MILES IN EACH ECOLOGICAL SITE				26766 ac	49073 ac	45474 ac	1204 ac	21 sm	484 sm	527 sm	388 sm

References

Ecosystem Diversity Matrix concept described in:
1) Haufler, J.B. et al. 2002. Performance measures for ecosystem management and ecological sustainability. The Wildlife Society Technical Review 02-1, 2002.
2) Haufler, J.B. et al. 1996. Using a coarse-filter approach with a species assessment for ecosystem management. Wildl. Soc. Bull. 24(2):200-208.
3) Haufler, J.B. et al. 1994. An ecological framework for planning for forest health. J. Sustainable Forestry. 2(3/4):307-316

Ecological Site Classes based on:
1) Brinson, M. M. 1993. A hydrogeomorphic classificaltion for wetlands. U. S. Army Core of Engineers, Wetlands Research Program Technical Report WRP-DE-4.

KEY

- Ecosystems that do not occur
- High priority conservation goals
- Medium priority conservation goals
- Low priority conservation goals

Conservation Actions for Species of Greatest Conservation Need

The habitat requirements for the majority of SoGCN will be addressed through the conservation goals for ecosystem diversity. By providing a minimum of 10% of the historical ecosystems within each of the four ecoregions, most SoGCN will benefit from sustained or improved habitat conditions. However, in South Dakota, several species are on the fringe of their historical range. 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. Addressing the habitat needs of these species by providing very high levels of representation (sometimes higher than occurred historically), could conflict with the conservation goals for 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. South Dakota will monitor the progress of adjacent states more centrally located to a species historical range toward recovery of a fringe SoGCN, to determine the appropriate level of participation by South Dakota in any conservation or recovery process.

The following section summarizes the conservation actions identified for each SoGCN. Each species is summarized by both habitat-based (as based on ecosystem diversity conservation goals and priority levels) and non-habitat (e.g., direct mortality, human disturbance, population status, etc.) conservation actions. Habitat-based conservation actions identify the number of acres and/or stream miles representing 10% of the ecosystems that could have occurred under historical disturbance regimes, as determined by either method 1 or 2. Note that method 1 does provide estimates of amounts of historical ecosystems. Method 2, however, allocates amounts of an ecological site across all possibly occurring ecosystems. Method 2 may therefore result in greatly overestimated or underestimated amounts of historical ecosystems. This is a major knowledge gap for conservation of ecosystem diversity in South Dakota and is identified as a priority for future research efforts. Therefore, while conservation goals are identified for the purpose of describing a strategy for conservation of ecosystem diversity in South Dakota, they should be viewed as examples or preliminary estimates that will require additional research and mapping efforts to refine and better quantify. The Missouri River Ecoregion, in particular, is especially problematic in our ability to estimate historical ecosystems due to the limitations of existing information as well as limitations in our ability to restore historical ecosystems at this time. All conservation goals should be viewed as starting points for discussion and would require additional data development to determine more realistic values relative to historical ecosystems.

Further, habitat-based conservation goals are identified for each SoGCN and are based on the conservation goals developed for ecosystem diversity. These numbers do not represent individual habitat restoration targets for each SoGCN. Rather, these numbers demonstrate how conservation goals for ecosystem diversity can benefit each SoGCN by restoring, improving, or maintaining current habitat conditions. It is important to recognize that these numbers may be duplicated between SoGCN and/or overlap with multiple SoGCN's. These numbers also suffer from the limitations of existing information on historical ecosystems as well as our relatively poor understanding of the distribution of SoGCN relative to historical ecosystem conditions. These knowledge gaps have been identified as priorities for future research efforts in South Dakota.

The numbers identified in the habitat-based conservation actions for each species were obtained by cross-walking the conservation goals identified in Figures 6.1 through 6.16 with the individual species distributions identified in Figures 4.1.1.1 through 4.5.4.4. As an example, the Figures below represent a portion of Figures 6.14 and 4.1.1.1.

Figure 6.14 – conservation goals (example)

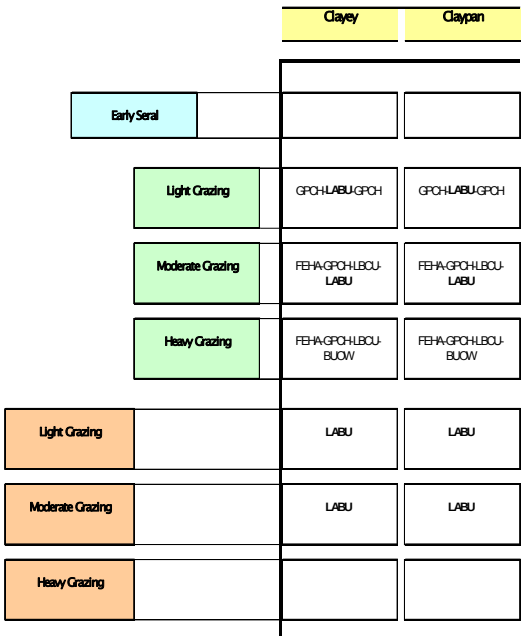


Figure 4.1.1.1 – species distributions (example)

From the above (abbreviated) Tables, we sum the number of acres representing 10% of the historical ecosystems by priority level and that also represent Lark Bunting habitat as:

High priority (red) = 8143 + 8143 + 562 + 562 = 17,410 acres
Medium priority (yellow) = no overlap with Lark Bunting habitat = 0 acres
Low priority (green) = 0 + 0 + 0 + 0 = 0 acres

It is important to note that the distributions of SoGCN relative to historical ecosystems were developed using existing information on key habitat needs. However, very few studies have included ecological sites and historical disturbance regimes to describe a species' habitat requirements. For this reason, the key habitat needs of a species were interpreted and extrapolated to our current understanding of historical ecosystems and may therefore reflect over-estimations or under-estimations of a species distribution. This information gap has been identified as a key research priority for SoGCN and will require re-evaluation as better information becomes available.

The non-habitat conservation actions describe additional steps that can be taken to prevent further declines in species numbers. The non-habitat actions should be conducted in parallel with conservation actions for ecosystem diversity. Additional research priorities have also been identified.

COMMON NAME: AMERICAN WHITE PELICAN (AWPE)

Scientific Name: *Pelecanus erythrorhynchos*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.9, 6.12, and 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the American White Pelican may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Missouri River Ecoregion		
High: 9,191 acres	Medium: 0 acres	Low: 0 acres
Mixedgrass Subregion		
High: 10 acres	Medium: 6 acres	Low: 0 acres
Tallgrass Subregion		
High: 12 acres	Medium: 4 acres	Low: 0 acres

Non-Habitat

- Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels near American White Pelican habitat.
- Develop programs and materials to inform the public on appropriate activities near American White Pelican nesting sites or in some instances, protect nesting sites using fencing, postings, etc.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity
- Determine the incidence of disease in nesting colonies
- Evaluate water quality near nesting colonies
- Determine foraging habitats and impacts on local fisheries
- Investigate seasonal abandonment of nesting colonies
- Investigate the impacts of West Nile Virus

COMMON NAME: TRUMPETER SWAN (TRSW)

Scientific Name: *Cygnus buccinator*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.2, 6.6, 6.9, 6.12, and 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Trumpeter Swan may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion		
High: 6,610 acres	Medium: 322 acres	Low: 0 acres
Black Hills Ecoregion		
High: 1,132 acres	Medium: 0 acres	Low: 0 acres
Missouri River Ecoregion		
High: 5,548 acres	Medium: 0 acres	Low: 0 acres
Mixedgrass Subregion		
High: 25,602 acres	Medium: 2 acres	Low: 0 acres
Tallgrass Subregion		
High: 53,822 acres	Medium: 0 acres	Low: 0 acres

Non-Habitat

- Develop programs and materials to inform the public on appropriate activities near Trumpeter Swan nesting sites.
- Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels near important Trumpeter Swan habitat.
- Develop programs and materials to inform hunters on critical identification features of Trumpeter Swans relative to other similar waterfowl species.
- Develop programs and materials to ensure public awareness of non-toxic shot regulations in Trumpeter Swan habitat, both existing areas and areas identified for future restoration.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity
- Evaluate different levels of human disturbance around nest sites

COMMON NAME: OSPREY (OSPR)

Scientific Name: *Pandion haliaetus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.9) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Osprey may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Missouri River Ecoregion
High: 11,096 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels near Osprey habitat.
- Develop programs and materials to inform the public on appropriate activities near Osprey nesting sites.
- Develop programs and materials to reduce illegal shooting of Osprey.
- Reintroduce the Osprey into unoccupied suitable habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: BALD EAGLE (BAEA)

Scientific Name: *Haliaeetus leucocephalus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.2, 6.6, 6.9, 6.12, and 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Bald Eagle may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 13,214 acres Medium: 650 acres Low: 0 acres
Black Hills Ecoregion
High: 1672 acres Medium: 592 acres Low: 0 acres
Missouri River Ecoregion
High: 11,096 acres Medium: 0 acres Low: 0 acres
Mixedgrass Subregion
High: 44,803 acres Medium: 6,405 acres Low: 0 acres
Tallgrass Subregion
High: 71,762 acres Medium: 4 acres Low: 0 acres

Non-Habitat

- Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels near Bald Eagle habitat.
- Develop programs and materials to inform the public on appropriate activities near Bald Eagle nesting sites.
- Develop programs and materials to reduce illegal shooting of Bald Eagle.
- Participate in cooperative population monitoring following federal delisting.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: NORTHERN GOSHAWK (NOGO)

Scientific Name: *Accipiter gentilis*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.8) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Northern Goshawk may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Black Hills Ecoregion
High: 20,800 acres Medium: 7,840 acres Low: 34,740 acres

Non-Habitat

- Develop programs and materials to inform the public on limiting disturbance near Northern Goshawk nesting sites.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: FERRUGINOUS HAWK (FEHA)

Scientific Name: *Buteo regalis*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.1, 6.5, 6.11and 6.14) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Ferruginous Hawk may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 1,165,971 acres Medium: 444,349 acres Low: 0 acres
Black Hills Ecoregion
High: 2,250 acres Medium: 0 acres Low: 11,030 acres
Mixedgrass Subregion
High: 1,167,432 acres Medium: 11,608 acres Low: 0 acres
Tallgrass Subregion
High: 318,516 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Develop programs and materials to inform the public on limiting disturbance near Ferruginous Hawk nesting sites.
- Develop programs and materials to reduce illegal shooting of Ferruginous Hawks.
- Work with agencies and landowners to reduce the use of poisons to control Ferruginous Hawk prey species in Ferruginous Hawk habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: PEREGRINE FALCON (PEFA)

Scientific Name: *Falco peregrinus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals for ecosystem diversity important for Peregrine Falcon habitat. Peregrine Falcon's require special habitat features of cliffs and rock outcrops near adequate prey sources.

Non-Habitat

- Work with agencies and landowners to reduce pollution and pesticide use in Peregrine Falcon habitat.
- Develop programs and materials to reduce human disturbance near Peregrine Falcon nest sites.
- Reintroduce the Peregrine Falcon into unoccupied suitable habitat.

Common Name: GREATER SAGE GROUSE (SAGR)

Scientific Name: *Centrocercus urophasianus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.1) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Greater Sage-grouse may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 0 acres Medium: 0 acres Low: 149,885 acres

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 or enhance birds of prey with a hunting advantage, within critical sage-grouse habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

Common Name: GREATER PRAIRIE-CHICKEN (GPCH)

Scientific Name: *Tympanuchus cupido*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.11 and 6.14) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Greater Prairie-Chicken may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Mixedgrass Subregion
High: 1,427,795 acres Medium: 11,608 acres Low: 0 acres
Tallgrass Subregion
High: 465,014 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Work with agencies and landowners to reduce insecticide use in Greater Prairie-Chicken habitat.
- Develop programs and materials to inform landowners on the importance of preventing woody plant encroachment in grassland ecosystems.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: WHOOPING CRANE (WHCR)

Scientific Name: *Grus americana*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.2, 6.9, 6.12, and 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Whooping Crane may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion			
	High: 5,662 acres	Medium: 6 acres	Low: 0 acres
Missouri River Ecoregion			
	High: 5,548 acres	Medium: 0 acres	Low: 0 acres
Mixedgrass Subregion			
	High: 16,862 acres	Medium: 2 acres	Low: 0 acres
Tallgrass Subregion			
	High: 29,132 acres	Medium: 0 acres	Low: 0 acres

Non-Habitat

- Develop strategies to reduce the risk of Whooping Crane collisions with utility lines.
- Work with agencies, landowners, and industry to minimize detrimental activities to Whooping Crane habitat.
- Promote existing programs and materials to reduce illegal shooting of Whooping Crane.
- Monitor and protect staging/migrating birds.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity
- Establish population trends.

COMMON NAME: PIPING PLOVER (PIPL)

Scientific Name: *Charadrius melodus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.9) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Piping Plover may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Missouri River Ecoregion			
	High: 5,252 acres	Medium: 0 acres	Low: 0 acres

Non-Habitat

- Develop programs and materials to protect Piping Plover breeding habitat from detrimental human activities.
- Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels near Piping Plover habitat.
- Cage Piping Plover nests to deter predators.
- Perform predator control when necessary.
- Fence off nesting areas to reduce disturbance to Piping Plovers nests.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: WILLET (WILL)

Scientific Name: *Catoptrophorus semipalmatus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.2, 6.9, 6.12, and 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Willet may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion			
	High: 7,236 acres	Medium: 36,078 acres	Low: 0 acres
Missouri River Ecoregion			
	High: 5,548 acres	Medium: 3,036 acres	Low: 0 acres
Mixedgrass Subregion			
	High: 69,699 acres	Medium: 33,143 acres	Low: 0 acres
Tallgrass Subregion			
	High: 66,864 acres	Medium: 14,125 acres	Low: 10,745 acres

Non-Habitat

- Develop programs and materials to inform the public on limiting disturbance near Willet nesting sites.
- Work with agencies, landowners, and industry to reduce pesticide/herbicide use near important Willet habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity
- Establish population trends

COMMON NAME: LONG-BILLED CURLEW (LBCU)

Scientific Name: *Numenius americanus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.2, 6.12, and 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Long-billed Curlew may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion			
	High: 1,173,207 acres	Medium: 479,790 acres	Low: 0 acres
Mixedgrass Subregion			
	High: 142,097 acres	Medium: 33,143 acres	Low: 0 acres
Tallgrass Subregion			
	High: 67,698 acres	Medium: 3,380 acres	Low: 0 acres

Non-Habitat

- Develop programs and materials to protect Long-billed Curlew breeding habitat from detrimental human activities.
- Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels near important Long-billed Curlew habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: MARBLED GODWIT (MAGO)

Scientific Name: *Limosa fedoa*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.9) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Marbled Godwit may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion			
	High: 7,236 acres	Medium: 36,078 acres	Low: 0 acres
Mixedgrass Subregion			
	High: 69,699 acres	Medium: 33,143 acres	Low: 0 acres
Tallgrass Subregion			
	High: 39,256 acres	Medium: 14,125 acres	Low: 0 acres

Non-Habitat

- Develop programs and materials to inform the public about the role historic disturbance regimes played in maintaining Marbled Godwit habitat.
- Protect staging/migration areas from human disturbance
- Control nest and chick predators
- Conduct research on population trends
- Monitor and protect staging/migrating birds.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: WILSON'S PHALAROPE (WIPH)

Scientific Name: *Phalaropus tricolor*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.2, 6.6, 6.9, 6.12, and 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Wilson's Phalarope may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion			
	High: 7,242 acres	Medium: 26,801 acres	Low: 9,271 acres
Black Hills Ecoregion			
	High: 1,184 acres	Medium: 526 acres	Low: 0 acres
Missouri River Ecoregion			
	High: 6,992 acres	Medium: 1,592 acres	Low: 0 acres
Mixedgrass Subregion			
	High: 76,100 acres	Medium: 26,742 acres	Low: 0 acres
Tallgrass Subregion			
	High: 70,244 acres	Medium: 21,490 acres	Low: 0 acres

Non-Habitat

- Reduce cattle-trampling of nests
- Control nest and chick predators
- Develop programs and materials to inform the public on appropriate activities near Wilson's Phalarope nesting sites.
- Develop strategies to reduce the risk of utility line collisions.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity
- Determine current breeding distributions

COMMON NAME: INTERIOR LEAST TERN (LETE)

Scientific Name: *Sterna antillarum athalassos*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.2 and 6.9) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Interior Least Tern may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 5,650 acres Medium: 18 acres Low: 0 acres
Missouri River Ecoregion
High: 5,252 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Develop programs and materials to protect Interior Least Tern breeding habitat from detrimental human activities.
- Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels near Interior Least Tern habitat.
- Perform predator control when necessary.
- Fence off nesting areas to reduce disturbance to Interior Least Tern nests.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: BLACK TERN (BLTE)

Scientific Name: *Chlidonias niger*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.2, 6.9, 6.12, and 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Black Tern may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 7,236 acres Medium: 26,801 acres Low: 9,271 acres
Missouri River Ecoregion
High: 6.992 acres Medium: 1,544 acres Low: 0 acres
Mixedgrass Subregion
High: 76,100 acres Medium: 26,742 acres Low: 0 acres
Tallgrass Subregion
High: 70,244 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Work with agencies, landowners, and industry to maintain water quality by reducing soil erosion and reducing chemical use near Black Tern habitat.
- Maintain stable water levels in nesting colonies during nesting season
- Post signs near nesting colonies to discourage human disturbance
- Develop educational programs and conduct research to protect Black Tern nesting sites from disturbance.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity
- Determine breeding population numbers, trends, and distributions

COMMON NAME: BURROWING OWL (BUOW)

Scientific Name: *Athene cunicularia*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.1, 6.5, 6.11, and 6.14) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Burrowing Owl may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 1,201,476 acres Medium: 444,349 acres Low: 0 acres
Black Hills Ecoregion
High: 2,250 acres Medium: 2,250 acres Low: 5,515 acres
Mixedgrass Subregion
High: 1,191,564 acres Medium: 11,608 acres Low: 0 acres
Tallgrass Subregion
High: 159,258 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Work with agencies and landowners to reduce the use of pesticides and poisons to control burrowing mammals in Burrowing Owl habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: LEWIS'S WOODPECKER (LEWO)

Scientific Name: *Melanerpes lewis*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.8) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Lewis's Woodpecker may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Black Hills Ecoregion
High: 15,258 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Develop programs and materials to inform the public of the role historic disturbance regimes played in maintaining Lewis's Woodpecker habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: AMERICAN THREE-TOED WOODPECKER (ATTW)

Scientific Name: *Picoides dorsalis*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.8) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the American Three-toed Woodpecker may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Black Hills Ecoregion
High: 5,760 acres Medium: 2,880 acres Low: 0 acres

Non-Habitat

- Develop programs and materials to inform the public about the role historic disturbance regimes played in maintaining American Three-Toed Woodpecker habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: BLACK-BACKED WOODPECKER (BBWO)

Scientific Name: *Picoides arcticus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.8) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Black-backed Woodpecker may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Black Hills Ecoregion
High: 13,680 acres Medium: 6,840 acres Low: 0 acres

Non-Habitat

- Develop programs and materials to inform the public about the role historic disturbance regimes played in maintaining Black-backed Woodpecker habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: AMERICAN DIPPER (AMDI)

Scientific Name: *Cinclus mexicanus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.6) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the American Dipper may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Black Hills Ecoregion
High: 1.5 stream miles Medium: 950 riparian acres Low: 0 acres

Non-Habitat

- Work with agencies and landowners to protect riparian areas from erosion and chemical pollution.
- Develop programs and materials to protect American Dipper nest sites from disturbance.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity
- Investigate genetic diversity of the Black Hills American Dipper population

COMMON NAME: SPRAGUE'S PIPIT (SPPI)

Scientific Name: *Anthus spragueii*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.1) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Sprague's Pipit may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 1,775,864 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Develop programs and materials to protect Sprague's Pipit breeding habitat from detrimental human activities.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: LARK BUNTING (LABU)

Scientific Name: *Calamospiza melanocorys*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.1, 6.11, and 6.14) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Lark Bunting may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 1,046,185 acres Medium: 0 acres Low: 188,942 acres
Mixedgrass Subregion
High: 332,761 acres Medium: 0 acres Low: 17,096 acres
Tallgrass Subregion
High: 318,516 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Work with agencies and landowners to reduce pesticide use to control grasshoppers in Lark Bunting habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: BAIRD'S SPARROW (BASP)

Scientific Name: *Ammodramus bairdii*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.1) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Baird's Sparrow may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 1,046,817 acres Medium: 26,479 acres Low: 9,271 acres

Non-Habitat

- Develop programs and materials to inform the public on the importance of preventing woody plant encroachment in grassland ecosystems.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: LE CONTE'S SPARROW (LCSP)

Scientific Name: *Ammodramus leconteii*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.11 and 6.14) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Le Conte's Sparrow may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Mixedgrass Subregion
High: 76,100 acres Medium: 26,747 acres Low: 0 acres
Tallgrass Subregion
High: 70,244 acres Medium: 1,000 acres Low: 0 acres

Non-Habitat

- Develop programs and materials to inform the public about the role historic disturbance regimes played in maintaining Le Conte's Sparrow habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: WHITE-WINGED JUNCO (WWJU)

Scientific Name: *Junco hyemalis aikeni*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.8) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the White-winged Junco may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Black Hills Ecoregion
High: 13,680 acres Medium: 6,840 acres Low: 13,680 acres

Non-Habitat

- None

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: CHESTNUT-COLLARED LONGSPUR (CCLO)

Scientific Name: *Calcarius ornatus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.1 and 6.11) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Chestnut-collard Longspur may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 1,775,227 acres Medium: 0 acres Low: 0 acres

Mixedgrass Subregion
High: 734,644 acres Medium: 5,804 acres Low: 0 acres

Non-Habitat

- Work with agencies and landowners to reduce the use of pesticides and herbicides in Chestnut-collared Longspur habitat.
- Develop programs and materials to inform the public about the role historic disturbance regimes played in maintaining Chestnut-collared Longspur habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: FRINGE-TAILED MYOTIS (FTMY)

Scientific Name: *Myotis thysanodes pahasapensis*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Map and protect caves and mines as a special habitat feature.
- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.8) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the fringe-tailed myotis may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 49,456 acres Medium: 0 acres Low: 6,231 acres
Black Hills Ecoregion
High: 13,960 acres Medium: 0 acres Low: 21,000 acres

Non-Habitat

- Develop programs and materials to reduce human disturbance of fringe-tailed myotis roosting sites and hibernacula.
- Work with agencies and landowners to reduce pesticide use to control important prey species in fringe-tailed myotis habitat.
- Install bat-friendly gates at important cave and abandoned mine sites

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: NORTHERN MYOTIS (NOMY)

Scientific Name: *Myotis septentrionalis*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Map and protect caves and mines as a special habitat feature.
- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.2, 6.6, 6.9, 6.12, and 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the northern myotis may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion			
	High: 3,460 acres	Medium: 47,463 acres	Low: 8,975 acres
Black Hills Ecoregion			
	High: 14,812 acres	Medium: 3,042 acres	Low: 0 acres
Missouri River Ecoregion			
	High: 4,218 acres	Medium: 1,554 acres	Low: 0 acres
Mixedgrass Subregion			
	High: 58,928 acres	Medium: 26,747 acres	Low: 22,375 acres
Tallgrass Subregion			
	High: 47,236 acres	Medium: 23,680 acres	Low: 21,990 acres

Non-Habitat

- Develop programs and materials to reduce human disturbance of northern myotis roosting sites and hibernacula.
- Work with agencies and landowners to reduce the use of pesticides to control important prey species in northern myotis habitat.
- Install bat-friendly gates at important cave and abandoned mine sites

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: TOWNSEND'S BIG-EARED BAT (TBBA)

Scientific Name: *Corynorhinus townsendii*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Map and protect caves and mines as a special habitat feature.
- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.4 and 6.8) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Townsend's big-eared bat may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion			
	High: 0 acres	Medium: 0 acres	Low: 13,306 acres
Black Hills Ecoregion			
	High: 15,258 acres	Medium: 2,008 acres	Low: 0 acres

Non-Habitat

- Develop programs and materials to reduce human disturbance of Townsend's big-eared bat roosting sites and hibernacula.
- Install bat-friendly gates at important cave and abandoned mine sites

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: FRANKLIN'S GROUND SQUIRREL (FGSQ)

Scientific Name: *Spermophilus franklinii*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.11 and 6.14) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Franklin's ground squirrel may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Mixedgrass Subregion
High: 332,761 acres Medium: 0 acres Low: 0 acres
Tallgrass Subregion
High: 134,136 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- None

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: RICHARDSON'S GROUND SQUIRREL (RGSQ)

Scientific Name: *Spermophilus richardsonii*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.11 and 6.14) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Richardson's ground squirrel may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Mixedgrass Subregion
High: 639,737 acres Medium: 0 acres Low: 0 acres
Tallgrass Subregion
High: 137,111 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Develop programs and materials to reduce poisoning, shooting, and trapping of Richardson's ground squirrels.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: NORTHERN FLYING SQUIRREL (NFSQ)

Scientific Name: *Glaucomys sabrinus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.8) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the northern flying squirrel may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Black Hills Ecoregion
High: 15,258 acres Medium: 2,008 acres Low: 0 acres

Non-Habitat

- None

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: BEAR LODGE MEADOW JUMPING MOUSE (BLJM)

Scientific Name: *Zapus hudsonius campestris*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.6) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Bear Lodge meadow jumping mouse may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Black Hills Ecoregion
High: 1,698 acres Medium: 1,476 acres Low: 10 acres

Non-Habitat

- Work with agencies and landowners to reduce disturbance to Bear Lodge meadow jumping mouse habitat from land use and recreational activities

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity
- Conduct a taxonomic investigation of *Z. h. campestris* to assist in determining if it is a valid subspecies

COMMON NAME: KIT OR SWIFT FOX (SWFO)

Scientific Name: *Vulpes velox*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.1, 6.5, 6.11, and 6.14) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the swift fox may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 1,201,476 acres Medium: 444,349 acres Low: 0 acres
Black Hills Ecoregion
High: 2,250 acres Medium: 2,250 acres Low: 11,030 acres
Mixedgrass Subregion
High: 1,191,564 acres Medium: 11,608 acres Low: 0 acres
Tallgrass Subregion
High: 318,516 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Develop programs and materials to reduce poisoning, shooting, and trapping of swift fox.
- Develop strategies to reduce vehicle collisions with swift foxes.
- Vaccinate all swift foxes that are live-trapped and handled for canine distemper.
- Reintroduce into the northern Great Plains where necessary and feasible.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: BLACK-FOOTED FERRET (BFFE)

Scientific Name: *Mustela nigripes*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.1 and 6.11) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the black-footed ferret may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion			
	High: 106,514 acres	Medium: 0 acres	Low: 0 acres
Mixedgrass Subregion			
	High: 72,398 acres	Medium: 0 acres	Low: 0 acres

Non-Habitat

- Work with agencies and landowners to reduce the prevalence of canine distemper in black-footed ferret habitat.
- Develop predator control programs, where appropriate, in black-footed ferret habitat.
- Develop captive breeding and reintroduction programs.
- Develop incentive programs for landowners who manage for black-footed ferret habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: NORTHERN RIVER OTTER (NROT)

Scientific Name: *Lontra canadensis*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.2, 6.6, 6.9, 6.12, and 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the northern river otter may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion			
	High: 11,288 acres	Medium: 11,288 acres	Low: 0 acres
Black Hills Ecoregion			
	High: 2,056 acres	Medium: 2,056 acres	Low: 0 acres
Missouri River Ecoregion			
	High: 10,504 acres	Medium: 0 acres	Low: 0 acres
Mixedgrass Subregion			
	High: 29,498 acres	Medium: 4,214 acres	Low: 0 acres
Tallgrass Subregion			
	High: 58,248 acres	Medium: 0 acres	Low: 0 acres

Non-Habitat

- Develop strategies to reduce northern river otter mortality by lethal beaver traps.
- Work with agencies and landowners to reduce the prevalence of canine distemper and rabies in northern river otter habitat.
- Develop programs and materials to reduce illegal shooting of northern river otter.
- Monitor northern river otter in eastern South Dakota through biannual surveys

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: ELKTOE (ELKT)
Scientific Name: *Alasmidonta marginata*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.16) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the elktoe may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Tallgrass Subregion
High: 1 stream mile Medium: 0 Low: 0 acres

Non-Habitat

- Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels in elktoe habitat.
- Develop programs to reduce or eliminate the threat of exotic aquatic species competing with elktoe.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: ROCK POCKETBOOK (ROPO)
Scientific Name: *Arcidens confragosus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.16) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the rock pocketbook may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Mixedgrass Subregion
High: 0 Medium: 9 stream miles Low: 3 stream miles
Tallgrass Subregion
High: 2 stream miles Medium: 0 Low: 0 acres

Non-Habitat

- Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels in rock pocketbook habitat.
- Develop programs to reduce or eliminate the threat of exotic aquatic species competing with rock pocketbook.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: CREEK HEELSPLITTER (CRHE)
Scientific Name: *Lasmigona compressa*

CONSERVATION ACTIONS

Habitat – based on Ecosystem Diversity

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.14) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the creek heelsplitter may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Tallgrass Subregion
High: 0 stream mile Medium: 20 stream miles Low: 20 stream miles

Non-Habitat

- Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels in creek heelsplitter habitat.
- Develop programs to reduce or eliminate the threat of exotic aquatic species competing with creek heelsplitter.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: HIGGINS EYE (HIEY)
Scientific Name: *Lampsilis higginsii*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.10) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Higgins eye may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Missouri River Ecoregion
High: 68 stream miles Medium: 0 Low: 0

Non-Habitat

- Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels in Higgins eye habitat.
- Develop programs to reduce or eliminate the threat of exotic aquatic species competing with Higgins eye.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: SCALESHELL (SCAL)
Scientific Name: *Leptodea leptodon*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.10) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the scaleshell may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Missouri River Ecoregion
High: 40 stream miles Medium: 18 stream miles Low: 0

Non-Habitat

- Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels in scaleshell habitat.
- Develop programs to reduce or eliminate the threat of exotic aquatic species competing with scaleshell.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: HICKORYNUT (HICK)
Scientific Name: *Obovaria olivaria*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.16) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the hickorynut may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Missouri River Ecoregion
High: 34 stream miles Medium: 0 Low: 0
Mixedgrass Subregion
High: 0 Medium: 3 stream miles Low: 3 stream miles
Tallgrass Subregion
High: 1 stream mile Medium: 0 Low: 0

Non-Habitat

- Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels in hickorynut habitat.
- Develop programs to reduce or eliminate the threat of exotic aquatic species competing with hickorynut.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: MAPLELEAF (MAPL)
Scientific Name: *Quadrula quadrula*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.16) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the mapleleaf may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Missouri River Ecoregion
High: 74 stream miles Medium: 6 stream miles Low: 0
Mixedgrass Subregion
High: 42 stream miles Medium: 23 stream miles Low: 3 stream miles
Tallgrass Subregion
High: 50 stream miles Medium: 0 Low: 0

Non-Habitat

- Work with agencies, landowners, and industry to reduce water pollution and pesticide/herbicide levels in mapleleaf habitat.
- Develop programs to reduce or eliminate the threat of exotic aquatic species competing with mapleleaf.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: DAKOTA VERTIGO (DAVE)
Scientific Name: *Vertigo arthuri*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.8) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Dakota vertigo may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Black Hills Ecoregion
High: 13,680 acres Medium: 1,000 acres Low: 0 acres

Non-Habitat

- Work with agencies and industry to reduce disturbance to Dakota vertigo habitat.
- Work with agencies, landowners, and industry to reduce pesticide/herbicide levels in Dakota vertigo habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: MYSTERY VERTIGO (MYVE)
Scientific Name: *Vertigo paradoxa*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.8) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the mystery vertigo may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Black Hills Ecoregion
High: 13,680 acres Medium: 1,000 acres Low: 0 acres

Non-Habitat

- Work with agencies and industry to reduce disturbance to mystery vertigo habitat.
- Work with agencies and landowners to reduce pesticide/herbicide levels in mystery vertigo habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: FRIGID AMBERSNAIL (FRAM)

Scientific Name: *Catinella gelida*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.8) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the frigid ambersnail may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Black Hills Ecoregion
High: 15,258 acres Medium: 0 acres Low: 15,258 acres

Non-Habitat

- Work with agencies and industry to reduce disturbance to frigid ambersnail habitat.
- Work with agencies, landowners, and industry to reduce pesticide/herbicide levels in frigid ambersnail habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: COOPER'S ROCKY MOUNTAINSNAIL (CRMO)

Scientific Name: *Oreohelix strigosa cooperi*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.8) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Cooper's rocky mountainsnail may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Black Hills Ecoregion
High: 13,680 acres Medium: 1,000 acres Low: 0 acres

Non-Habitat

- Work with agencies and industry to reduce disturbance to Cooper's rocky mountainsnail habitat.
- Work with agencies, landowners, and industry to reduce pesticide/herbicide levels in Cooper's rocky mountainsnail habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: GHOST TIGER BEETLE (GTBE)

Scientific Name: *Cicindela lepida*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.2 and 6.9) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the ghost tiger beetle may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 53,744 acres Medium: 59,182 acres Low: 17,840 acres
Missouri River Ecoregion
High: 5,252 acres Medium: 5,728 acres Low: 0 acres

Non-Habitat

- None

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: GREAT PLAINS TIGER BEETLE (GPTB)

Scientific Name: *Amblycheila cylindriformis*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.1) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Great Plains tiger beetle may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 49,456 acres Medium: 0 acres Low: 6,231 acres

Non-Habitat

- None

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: AMERICAN BURYING BEETLE (AMBE)

Scientific Name: *Nicrophorus americanus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.1, 6.11 and 6.14) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the American burying beetle may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 871,169 acres Medium: 637 acres Low: 127,230 acres
Mixedgrass Subregion
High: 1,161,081 acres Medium: 0 acres Low: 10,802 acres
Tallgrass Subregion
High: 385,218 acres Medium: 125,460 acres Low: 2,946 acres

Non-Habitat

- None

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: POWESHEIK SKIPPERLING (POSK)

Scientific Name: *Oarisma powesheik*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.14) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the powesheik skipperling may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Tallgrass Subregion
High: 159,258 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Work with agencies, landowners, and industry to reduce pesticide/herbicide levels in powesheik skipperling habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: OTTOE SKIPPER (OTSK)

Scientific Name: *Hesperia ottoe*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.1, 6.11 and 6.14) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Ottoe skipper may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 1,046,185 acres Medium: 0 acres Low: 0 acres
Mixedgrass Subregion
High: 332,761 acres Medium: 0 acres Low: 0 acres
Tallgrass Subregion
High: 159,258 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Work with agencies, landowners, and industry to reduce pesticide/herbicide levels in Ottoe skipper habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: DAKOTA SKIPPER (DASK)

Scientific Name: *Hesperia dacotae*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.12 and 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Dakota skipper may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Mixedgrass Subregion
High: 16,856 acres Medium: 22,370 acres Low: 0 acres
Tallgrass Subregion
High: 29,124 acres Medium: 21,490 acres Low: 0 acres

Non-Habitat

- Develop programs to reduce or eliminate exotic weed invasion in Dakota skipper habitat.
- Work with agencies, landowners, and industry to reduce pesticide/herbicide levels in Dakota skipper habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: IOWA SKIPPER (IOSK)

Scientific Name: *Atrytone arogos iowa*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.1, 6.11 and 6.14) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Iowa skipper may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 2,212,156 acres Medium: 444,349 acres Low: 0 acres
Mixedgrass Subregion
High: 1,500,193 acres Medium: 11,608 acres Low: 0 acres
Tallgrass Subregion
High: 557,774 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Develop programs to reduce or eliminate exotic weed invasion in Iowa skipper habitat.
- Work with agencies, landowners, and industry to reduce pesticide/herbicide levels in Iowa skipper habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: REGAL FRITILLARY (REFR)
Scientific Name: *Speyeria idalia*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.1, 6.11 and 6.14) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the regal fritillary may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 1,046,185 acres Medium: 0 acres Low: 0 acres
Mixedgrass Subregion
High: 332,761 acres Medium: 0 acres Low: 0 acres
Tallgrass Subregion
High: 159,258 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- Develop programs to reduce or eliminate exotic weed invasion in regal fritillary habitat.
- Work with agencies, landowners, and industry to reduce pesticide/herbicide levels in regal fritillary habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: BLACK HILLS FRITILLARY (BHFR)
Scientific Name: *Speyeria atlantis pahasapa*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.6) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Black Hills fritillary may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Black Hills Ecoregion
High: 1,184 acres Medium: 90 acres Low: 0 acres

Non-Habitat

- None

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: BANDED KILLIFISH (BAKI)
Scientific Name: *Fundulus diaphanus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.16) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the banded killifish may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Tallgrass Subregion
High: 50 stream miles + 60 wetland acres Medium: 60 wetland acres Low: 4,908 wetland acres

Non-Habitat

- Work with agencies and landowners to reduce pesticide/herbicide runoff into banded killifish habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: BLACKNOSE SHINER (BLSH)

Scientific Name: *Notropis heterolepis*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.13 and 6.16) for diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the blacknose shiner may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

  Mixedgrass Subregion
  High: 42 stream miles Medium: 44 stream miles + 1,878 wetland ac. Low: 10 stream miles + 1,878 wetland ac.
  Tallgrass Subregion
  High: 74 stream miles Medium: 0 Low: 26 stream miles + 4,908 wetland ac.

Non-Habitat

- None

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: CENTRAL MUDMINNOW (CEMU)

Scientific Name: *Umbra limi*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.16) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the central mudminnow may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

  Tallgrass Subregion
  High: 50 stream miles + 60 wetland acres Medium: 60 wetland acres Low: 0

Non-Habitat

- None

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: FINESCALE DACE (FIDA)

Scientific Name: *Phoxinus neogaeus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.3 and 6.7) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the finescale dace may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

  Great Plains Steppe Ecoregion
  High: 282 str. mi. + 706 wetland ac. Medium: 114 str. mi. + 296 wetland ac. Low: 32 str. mi. + 706 wetland ac.
  Black Hills Ecoregion
  High: 3.4 stream miles Medium: 34.2 str. miles + 4 wetland ac. Low: 8 str. miles + 4 wetland ac.

Non-Habitat

- Reintroduction into unoccupied suitable habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: LONGNOSE SUCKER (LOSU)

Scientific Name: *Catostomus catostomus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.3) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the longnose sucker may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 200 stream miles + 706 wetland ac. Medium: 82 stream miles Low: 706 wetland ac.

Non-Habitat

- Work with agencies, industry, and landowners to reduce soil erosion and runoff in longnose sucker habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity
- Investigate the genetic diversity of the Black Hills population of longnose sucker

COMMON NAME: NORTHERN REDBELLY DACE (NRDA)

Scientific Name: *Phoxinus eos*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.3, 6.13 and 6.16) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the northern redbelly dace may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 282 stream miles Medium: 82 stream miles Low: 0
Mixedgrass Subregion
High: 42 stream miles Medium: 44 stream miles Low: 10 stream miles
Tallgrass Subregion
High: 74 stream miles Medium: 0 Low: 26 stream miles

Non-Habitat

- Work with agencies, industry, and landowners to reduce soil erosion and runoff in northern redbelly dace habitat

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: PALLID STURGEON (PAST)

Scientific Name: *Scaphirhynchus albus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.10) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the pallid sturgeon may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Missouri River Ecoregion
High: 34 stream miles Medium: 0 Low: 0

Non-Habitat

- Work with agencies, industry, and landowners to reduce soil erosion and pollution in pallid sturgeon habitat.
- Work with States within pallid sturgeon's range to temporarily place moratorium on commercial fishing of all sturgeon species
- Work with States to develop a policy that will ensure risk assessment prior to introductions of new non-indigenous species to the Missouri and Mississippi Rivers.
- Develop captive breeding and stocking programs.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity
- Investigate impact of pallid sturgeon iridovirus

COMMON NAME: PADDLEFISH (PADD)

Scientific Name: *Polyodon spathula*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.10) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the paddlefish may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Missouri River Ecoregion
High: 34 stream miles Medium: 0 Low: 0

Non-Habitat

- Work with agencies, industry, and landowners to reduce soil erosion and pollution in paddlefish habitat.
- Develop programs and materials to reduce illegal poaching and snagging of paddlefish.
- Develop captive breeding and stocking programs.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: PEARL DACE (PEDA)

Scientific Name: *Margariscus margarita*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.3) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the pearl dace may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 282 stream miles + 706 wetland ac. Medium: 82 stream miles + 296 wetland ac. Low: 706 wetland ac.

Non-Habitat

- Work with agencies, industry, and landowners to reduce soil erosion and pollution in pearl dace habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: SICKLEFIN CHUB (SICH)

Scientific Name: *Macrhybopsis meeki*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.10) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the sicklefin chub may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Missouri River Ecoregion
High: 34 stream miles Medium: 0 Low: 0

Non-Habitat

- Work with agencies, landowners, and industry to reduce soil erosion and water pollution in sicklefin chub habitat.
- Develop programs to reduce or eliminate the threat of non-native fish competing with sicklefin chub.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: STURGEON CHUB (STCH)

Scientific Name: *Macrhybopsis gelida*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.3 and 6.10) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the sturgeon chub may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 0 stream miles Medium: 50 acres Low: 0
Missouri River Ecoregion
High: 34 stream miles Medium: 0 Low: 0

Non-Habitat

- Work with agencies, landowners, and industry to reduce soil erosion and water pollution in sturgeon chub habitat.
- Develop programs to reduce or eliminate the threat of non-native fish competing with sturgeon chub.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: TOPEKA SHINER (TOSH)

Scientific Name: *Notropis topeka*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.13 and 6.16) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Topeka shiner may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Mixedgrass Subregion
High: 42 stream miles Medium: 14 stream miles Low: 0
Tallgrass Subregion
High: 48 stream miles Medium: 0 Low: 0

Non-Habitat

- Work with agencies, landowners, and industry to reduce soil erosion and water pollution in Topeka shiner habitat.
- Review stream mitigation projects and inform government agencies, the public, and landowners about the adverse impacts of stream channelization to watershed health.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity
- Investigate genetic diversity of Topeka shiner in South Dakota.

COMMON NAME: TROUT-PERCH (TRPE)

Scientific Name: *Percopsis omiscomaycus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.16) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the trout-perch may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Tallgrass Subregion
High: 74 stream miles Medium: 0 Low: 26 stream miles + 7,584 ac.

Non-Habitat

- Work with agencies, landowners, and industry to reduce soil erosion and water pollution in trout-perch habitat.
- Develop programs to reduce or eliminate the threat of non-native fish competing with trout-perch.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: LAKE CHUB (LACH)

Scientific Name: *Couesius plumbeus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.3 and 6.7) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the lake chub may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 200 stream miles and 706 wetland ac. Medium: 100 stream miles Low: 706 wetland ac.
Black Hills Ecoregion
High: 3.4 stream miles Medium: 4.4 stream miles Low: 1 stream miles

Non-Habitat

- Work with agencies, landowners, and industry to reduce soil erosion and water pollution in lake chub habitat.
- Develop programs to reduce or eliminate the threat of lake chub predation by non-native fish.
- Develop captive breeding and reintroduction programs for lake chub in South Dakota.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity
- Investigate the genetic diversity of lake chub in the Black Hills Ecoregion

COMMON NAME: MOUNTAIN SUCKER (MOSU)

Scientific Name: *Catostomus platyrhynchus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.7) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the mountain sucker may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Black Hills Ecoregion
High: 3.4 stream miles Medium: 29.8 stream miles Low: 3.6 stream miles

Non-Habitat

- Work with agencies, landowners, and industry to reduce soil erosion and water pollution in mountain sucker habitat.
- Develop programs to reduce or eliminate the threat of mountain sucker predation by non-native fish.
- Develop reintroduction programs for mountain sucker into suitable habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity
- Investigate the genetic diversity of mountain sucker in the Black Hills Ecoregion

COMMON NAME: SOUTHERN REDBELLY DACE (SRDA)

Scientific Name: *Phoxinus erythrogaster*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.16) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the southern redbelly dace may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Tallgrass Subregion
High: 0 Medium: 20 stream miles Low: 20 stream miles

Non-Habitat

- None

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: HORNYHEAD CHUB (HOCH)

Scientific Name: *Nocomis biguttatus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.16) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the hornyhead chub may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Tallgrass Subregion
High: 26 stream miles Medium: 0 Low: 0

Non-Habitat

- Work with agencies, landowners, and industry to reduce soil erosion and water pollution in hornyhead chub habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: ROSYFACE SHINER (ROSH)

Scientific Name: *Notropis rubellus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.16) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the rosyface shiner may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Tallgrass Subregion
High: 26 stream miles Medium: 0 Low: 0

Non-Habitat

- Work with agencies and landowners to reduce soil erosion and water pollution in rosyface shiner habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: LOGPERCH (LOGP)

Scientific Name: *Percina caprodes*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.16) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the logperch may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Tallgrass Subregion
High: 1 stream mile Medium: 0 Low: 4,908 wetland acres

Non-Habitat

- Work with agencies and landowners to reduce soil erosion and water pollution in logperch habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: BLACKSIDE DARTER (BLDA)

Scientific Name: *Percina maculata*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.16) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the blackside darter may be expected to benefit from the following number of stream miles of sustained or enhanced habitat:

Tallgrass Subregion
High: 48 stream miles Medium: 0 Low: 0 acres

Non-Habitat

- Work with agencies and landowners to reduce soil erosion and water pollution in blackside darter habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: BLANDING'S TURTLE (BLTU)

Scientific Name: *Emys blandingii*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Blanding's Turtle may be expected to benefit from the following number of stream miles or wetland acres of sustained or enhanced habitat:

Tallgrass Subregion
High: 50 stream miles + 42,700 wetland acres Medium: 2,338 wetland acres Low: 2,274 wetland acres

Non-Habitat

- This species is on the fringe of its range and will be evaluated for additional actions based on recovery success in areas more central to its source habitat.
- Protect Blanding's Turtle nesting habitat and nests from predation.
- Develop programs and educational materials to reduce road mortality of Blanding's Turtles.
- Work with agencies, landowners, and industry to reduce pesticide/herbicide levels in Blanding's Turtle habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: FALSE MAP TURTLE (FMTU)

Scientific Name: *Graptemys pseudogeographica*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.9) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the False Map Turtle may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Missouri River Ecoregion
High: 11,096 acres Medium: 0 Low: 0 acres

Non-Habitat

- Work with agencies and landowners to reduce water pollution and pesticide/herbicide levels in False Map Turtle habitat.
- Develop programs and materials to reduce False Map Turtle nest disturbance by recreationists.
- Develop programs and materials to reduce illegal shooting of False Map Turtles.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: LINED SNAKE (LISN)

Scientific Name: *Tropidoclonion lineatum*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Lined Snake may be expected to benefit from the following number of acres of sustained or enhanced habitat:

  Tallgrass Subregion
  High: 70,236 acres Medium: 21,490 acres Low: 21,490 acres

Non-Habitat

- This species is on the fringe of its range and will be evaluated for additional actions based on recovery success in areas more central to its source habitat.
- Develop programs and materials to inform the public on appropriate activities near Lined Snake habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity
- Investigate methods to provide or enhance travel corridors in highly-developed areas

COMMON NAME: EASTERN HOGNOSE SNAKE (EHSN)

Scientific Name: *Heterodon platirhinos*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.9, 6.12 and 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Eastern Hognose Snake may be expected to benefit from the following number of acres of sustained or enhanced habitat:

  Missouri River Ecoregion
  High: 10,504 acres Medium: 2,864 acres Low: 0 acres
  Mixedgrass Subregion
  High: 19,207 acres Medium: 2,189 acres Low: 0 acres
  Tallgrass Subregion
  High: 67,086 acres Medium: 32,235 acres Low: 13,691 acres

Non-Habitat

- This species is on the fringe of its range and will be evaluated for additional actions based on recovery success in areas more central to its source habitat.
- Develop programs and materials to inform the public on appropriate activities near Eastern Hognose Snake habitat.
- Work with agencies and landowners to reduce pesticide and herbicide levels near Eastern Hognose Snake habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: BLACK HILLS REDBELLY SNAKE (BHRS)

Scientific Name: *Storeria occipitomaculata pahasapae*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.6) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Black Hills Redbelly Snake may be expected to benefit from the following number of acres of sustained or enhanced habitat:

  Black Hills Ecoregion
  High: 2,547 acres Medium: 3,583 acres Low: 238 acres

Non-Habitat

- Develop programs and educational materials to reduce road mortality of Black Hills Redbelly Snakes during migration periods.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: COPE'S GRAY TREEFROG (CGTR)

Scientific Name: *Hyla chrysoscelis*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Cope's Gray Treefrog may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Tallgrass Subregion
High: 70,244 acres Medium: 22,490 acres Low: 0 acres

Non-Habitat

- This species is on the fringe of its range and will be evaluated for additional actions based on recovery success in areas more central to its source habitat.
- Work with agencies and landowners to reduce levels of pesticides in Cope's Gray Treefrog habitat.
- Develop programs to reduce or eliminate the presence of fish in formerly fishless Cope's Gray Treefrog habitat.
- Develop strategies to limit predation of Northern Cricket Frog by non-native species.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: SMOOTH SOFTSHELL (SMSO)

Scientific Name: *Apalone mutica*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Smooth Softshell may be expected to benefit from the following number of stream miles or wetland acres of sustained or enhanced habitat:

Missouri River Ecoregion
High: 68 stream miles + 10,572 wetland ac. Medium: 0 acres Low: 0 acres
Tallgrass Subregion
High: 2 stream miles + 58,248 wetland ac. Medium: 0 acres Low: 0 acres

Non-Habitat

- Work with agencies and landowners to reduce levels of water pollution in Smooth Softshell habitat.
- Develop programs to inform the public about reducing the impact of recreational activity to Smooth Softshell

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: WESTERN BOX TURTLE (WBTU)

Scientific Name: *Terrapene ornata*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.1) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Western Box Turtle may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 283,225 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- This species is on the fringe of its range and will be evaluated for additional actions based on recovery success in areas more central to its source habitat.
- Develop programs and educational materials to reduce road mortality of Western Box Turtles (e.g., place warning signs in frequently traveled routes and develop culverts to assist Western Box Turtle road crossing).
- Monitor and assess the risk of Western Box Turtle pet trading.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: LESSER EARLESS LIZARD (LELI)

Scientific Name: *Holbrookia maculata*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.1) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Lesser Earless Lizard may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 283,129 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- This species is on the fringe of its range and will be evaluated for additional actions based on recovery success in areas more central to its source habitat.
- Work with agencies and landowners to reduce further degradation of Lesser Earless Lizard habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: NORTHERN CRICKET FROG (NCFR)

Scientific Name: *Acris crepitans*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figures 6.9, 6.12, and 6.15) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Northern Cricket Frog may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Missouri River Ecoregion
High: 11,096 acres Medium: 0 acres Low: 0 acres
Mixedgrass Subregion
High: 44,793 acres Medium: 6,399 acres Low: 0 acres
Tallgrass Subregion
High: 71,752 acres Medium: 0 acres Low: 0 acres

Non-Habitat

- This species is on the fringe of its range and will be evaluated for additional actions based on recovery success in areas more central to its source habitat.
- Develop strategies to limit predation of Northern Cricket Frog by non-native species.
- Work with agencies and landowners to reduce water pollution and levels of pesticides and herbicides in Northern Cricket Frog habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: MANY-LINED SKINK (MLSK)

Scientific Name: *Eumeces multivirgatus*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.1) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Many-lined Skink may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 511,559 acres Medium: 0 acres Low: 39,057 acres

Non-Habitat

- This species is on the fringe of its range and will be evaluated for additional actions based on recovery success in areas more central to its source habitat.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

COMMON NAME: SHORT-HORNED LIZARD (SHLI)
Scientific Name: *Phrynosoma hernandesi*

CONSERVATION ACTIONS

Habitat – based on ecosystem diversity conservation goals

- Develop cooperative programs with agencies, landowners, and private organizations to meet the conservation goals (see Figure 6.1) for ecosystem diversity, as presented at three priority levels (high, medium, and low) for restoration and/or maintenance. Using the example of a conservation goal of maintaining or restoring 10% of the historical ecosystems within each ecoregion, the Short-eared Lizard may be expected to benefit from the following number of acres of sustained or enhanced habitat:

Great Plains Steppe Ecoregion
High: 1,059,458 acres Medium: 444,349 acres Low: 703 acres

Non-Habitat

- Work with agencies, landowners, and industry to reduce recreational use and traffic within Short-horned Lizard habitat.
- Develop programs to reduce the indiscriminant use of insecticides to control insects within Short-horned Lizard habitat.
- Monitor populations of Short-horned Lizard in the Great Plains Steppe Ecoregion.

Research priorities

- Determine distribution and habitat use relative to historical ecosystem diversity

7.0 AGENCY COORDINATION, COOPERATOR INTERACTIONS, AND PUBLIC INVOLVEMENT IN PLAN AND ACTIONS

The section includes information on the following two elements:

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

Element 8: Congress has affirmed through WCRP and SWG, that broad public participation is an essential element of developing and implementing the Comprehensive Wildlife Conservation Plan, the projects that are carried out while the Comprehensive Wildlife Conservation Plan is developed, and the Species of Conservation Priority that Congress has indicated such programs and projects are intended to emphasize.

With the inclusion of these two required elements Congress recognized the value and importance of agency coordination and public involvement that would be needed in the development and implementation of a statewide Comprehensive Wildlife Conservation Plan (CWCP). The South Dakota Game, Fish and Parks Department is the lead agency in this effort. However, the task of developing and successfully implementing a comprehensive plan that addresses the full array of wildlife and wildlife-related issues with a focus on the "species in greatest need of conservation" in South Dakota requires cooperation with a wide range of agencies and support from the general public.

Organizational Structure of South Dakota's Process

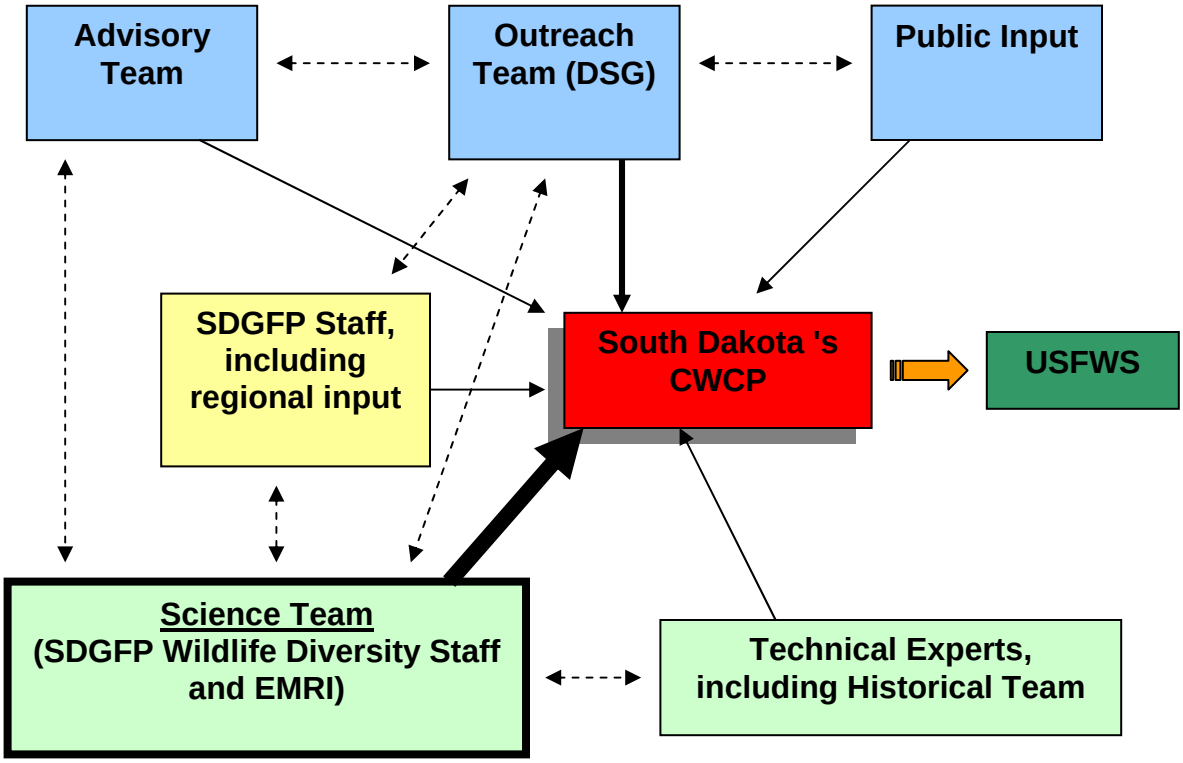


Figure 7.1. Diagram of South Dakota's process for developing their CWCP.

Description of Figure 7.1. Dotted lines represent lines of communication and the solid lines represent input (influence) on the Comprehensive Wildlife Conservation Plan.

Science Team – SDGFP's Wildlife Diversity Team, headed by Eileen Dowd Stukel[1], was responsible for providing overall guidance for developing South Dakota's Comprehensive Wildlife Conservation Plan. SDGFP decided on taking an ecosystem approach for developing the Comprehensive Wildlife Conservation Plan and contracted with Ecosystem Management Research Institute (EMRI), headed by Jon Haufler, Ph.D. for the task of writing the technical aspects for this approach.

Technical Experts (including Historical Team) – Individuals identified by EMRI that could provide specific technical information needed in developing the Comprehensive Wildlife Conservation Plan (such as historical conditions, soil types and vegetative cover, etc.).

Outreach Team – Larry Gigliotti (SDGFP's Planning Coordinator) provided overall guidance for the public involvement component of the Comprehensive Wildlife Conservation Plan. SDGFP hired Dynamic Solutions Group LLC (Bruce Hawkinson, Project Manager) to develop and implement the public involvement component.

Advisory Team – consists of various invited groups that may have an interest in the Comprehensive Wildlife Conservation Plan process (environmental and agricultural groups, agencies, selected SDGFP staff and tribes[2]) plus any interested individual or group could join the advisory group via our Comprehensive Wildlife Conservation Plan web page (advertised at public meetings and news releases) (Appendix H-1). The main purpose of the Advisory Team was to provide a link to the Comprehensive Wildlife Conservation Plan process for interested organizations and individuals (a more detailed function is listed in Appendix H-1).

SDGFP Staff (including regional input) – SDGFP staff was considered as a special "public" group. The goal was for all staff to be informed of South Dakota's process for developing our Comprehensive Wildlife Conservation Plan and provided opportunities for input throughout the process.

Public Involvement and Partnership Process

Advisory Team. An initial meeting, facilitated by Bruce Hawkinson, was held with this group on July 21, 2004 (10:30 a.m. – 3:30 p.m.) at the Governor's Inn in Pierre. The meeting theme was "The Future for Citizens and Wildlife." The purpose of this kick-off meeting of the Advisory Team was to:

[1] Additional members: Dave Ode, Doug Backlund, Alyssa Kiesow, and Jeff Shearer.

[2] All tribes were invited to join the Advisory Team, plus additional effort was made to meet with the tribes to discuss their interest in participating in the CWCP process. Tribal Natural Resource Agency Contacts:

Mr.	Joseph	Shields	Crow Creek Sioux	Natural Resources Director
Mr.	Scott	Anderson	Flandreau Santee Sioux	Natural Resources Director
Ms.	Bonnie	LaDeaux	Rosebud Sioux	Acting Natural Resources Director
Mr.	Jeff	Kelly	Standing Rock Sioux	Natural Resources Director
Mr.	Jimmy	Sam	Oglala Parks and Recreation Authority	Natural Resources Director
Mr.	Mike	Catches Enemy	Oglala Sioux Tribe NR Agency	Natural Resources Director
Mr.	Ben	Janis	Lower Brule Sioux	Natural Resources Director
Mr.	Dennis	Rousseau	Cheyenne River Sioux	Natural Resources Director
Mr.	Alvah	Quinn	Sisseton-Wahpeton Sioux	Natural Resources Director

1. Introduce members and their expectations,
2. Establish clear charge and charter for the Advisory Team,
3. Review the project plan and road map for defining South Dakota's CWCP,
4. Establish how the Advisory Team will function, and
5. Preliminary identification of citizen involvement needs and methods.

E-mail addresses were collected from all participants and all future contact with the Advisory Team was via e-mail and our Comprehensive Wildlife Conservation Plan web page. The Advisory Team members were specifically invited to review the draft plan (July-August 2005).

Town Meetings. Four town meetings were held around the state in mid-September, 2004. The main purpose was to provide information about the Comprehensive Wildlife Conservation Plan process to the general public and to generate a list of questions that South Dakota citizens have concerning the Comprehensive Wildlife Conservation Plan process. The list of questions was used to provide additional information about the Comprehensive Wildlife Conservation Plan process via a list of frequently asked questions with responses posted on our Comprehensive Wildlife Conservation Plan web page. The town meeting dates and locations were:

- September 13, 2004 – Rapid City (29 attendees)[3] – Region 1
- September 14, 2004 – Oacoma (15 attendees) – Region 2
- September 15, 2004 – Watertown (13 attendees) – Region 4
- September 16, 2004 – Sioux Falls (15 attendees) – Region 3

Town meetings were announced via news releases in local newspapers (one TV interview in Rapid City), Advisory Team members were asked to spread the word to their constituents and SDGFP staff were asked to invite interested groups or individuals to a town meeting. Highlights of the town meetings are in Appendix H-2. A total of 33 "frequently asked questions" were identified from the town meetings and other various input with responses provided and posted on our Comprehensive Wildlife Conservation Plan web page (Appendix H-3).

GFP Staff and Commissioners. A special effort was made to keep SDGFP staff and Commissioners informed of the Comprehensive Wildlife Conservation Plan process and encourage their input. A meeting was held in each of the four South Dakota management regions on the afternoon of the public town meetings (dates listed above) for staff information and input. In addition, some SDGFP staff attended the evening public meetings (not included in the count of attendees listed above). An information meeting was held for Pierre staff on February 26, 2004. SDGFP Commissioners were kept informed of the Comprehensive Wildlife Conservation Plan process via information items presented at a couple of Commission meetings.

South Dakota's Comprehensive Wildlife Conservation Plan Web Page. South Dakota's Comprehensive Wildlife Conservation Plan web page was linked to SDGFP's Wildlife Diversity web page and put on-line about mid-June 2004, periodically up-dated with relevant information and maintained throughout the entire process. People could learn about the Comprehensive Wildlife Conservation Plan process and stay informed of progress, join the Comprehensive Wildlife Conservation Plan Advisory Team, and/or provide comments on the Comprehensive Wildlife Conservation Plan (Appendix H-4). Information about the South Dakota's Comprehensive Wildlife Conservation Plan web page was provided via several news releases, announced at all public town meetings, SDGFP staff meetings and all interagency coordination meetings (also included on all handouts at these meetings), and included on printed information about the Comprehensive Wildlife Conservation Plan process. The Comprehensive Wildlife Conservation Plan web page was also a key tool in providing an opportunity for the general public to review the draft plan.

[3] At 2:30 p.m. before the meeting, the television station in Rapid City did an interview with Eileen Dowd Stukel about the CWCP planning process and the Rapid City town meeting being held that evening.

Communication. Press releases were an important tool for providing information about our Comprehensive Wildlife Conservation Plan process to the general public. Press releases were used to provide general information about the Comprehensive Wildlife Conservation Plan process, announce the public town meetings (in general and specifically), and solicit input on the Comprehensive Wildlife Conservation Plan. Three examples of press releases can be found in Appendix H-5. E-mail, after the initial meeting, was the main tool for keeping in touch with the Advisory Team. Two full-length articles were produced for publication in the South Dakota Conservation Digest[4]. Formal and informal meetings were also used to provide information about our Comprehensive Wildlife Conservation Plan process and how to get involved. In addition, as SDGFP staffs become more familiar with the Comprehensive Wildlife Conservation Plan process and especially during implementation of the plan, information will be transferred via the staffs' vast formal and informal communication network.

Coordination with Other Agencies and Tribes

South Dakota has many Federal, State and local agencies that have various levels of management authority or influence over land and water resources in South Dakota. An open list of such agencies was identified and notified by letter of the Comprehensive Wildlife Conservation Plan process in its early phase of development in South Dakota (approximately May 2004). Some of these agencies are members of the Comprehensive Wildlife Conservation Plan Advisory Team.

Tribes were given special consideration since they are large landowners or have influence on more than a million acres in South Dakota. They were specifically, directly, and individually notified of the planning, invited to participate in public meetings, invited to provide technical expertise, invited to the Advisory Team meeting, invited to be involved prior to drafting and again invited to comment on the draft plan. Assistance in communicating with tribes was provided by tribal coordinators in Bureau of Indian Affairs in Aberdeen, South Dakota. Tribal members or representatives participated in public meetings, providing technical input, were briefed by the SDGFP staff, and reviewed the draft documents.

Each agency has its own mission and expectations. As part of this planning effort the agencies were briefed on the process and encouraged to become important partners in this new effort by aligning their conservation actions directed by their missions with that of Comprehensive Wildlife Conservation Plan. SDGFP has met with the following agencies and the details are summarized in Appendix H-6:

June 17, 2004	Universities in eastern South Dakota
June 18, 2004	Natural Resources Conservation Service
July 1, 2004	U.S. Fish and Wildlife Service
August 5, 2004	Forest Service – national grasslands staff from Nebraska National Forest and Dakota Prairie Grasslands
August 6, 2004	Black Hills National Forest
October 4, 2004	Badlands and Wind Cave NPS, and Jewel Cave National Monument, Bureau of Land Management, Bureau of Reclamation, and the Oglala Sioux Tribe
March 31, 2005	Cheyenne River Sioux Tribe

This coordination effort will continue as the plan is implemented.

Review of the Draft Comprehensive Wildlife Conservation Plan

A 30-day comment period was provided, ending on August 19, 2005. The draft Comprehensive Wildlife Conservation Plan was available via the Internet and copies were provided at SDGFP regional offices and upon request. Announcements concerning opportunities to review the draft were made in news

[4] Dowd Stukel, Eileen. 2004. New funding for South Dakota's Fish and Wildlife: Wildlife Conservation and Restoration Program and State Wildlife Grants. South Dakota Conservation Digest. May/June Issue. pp. 8-13.
Hawkinson, Bruce (Dynamic Solutions Group, LLC). 2005. Comprehensive planning: A fresh approach to wildlife management. South Dakota Conservation Digest. May/June Issue. pp. 20-23.

releases and the Advisory Team members and others were specifically contacted by e-mail. In addition, an open-house meeting for the public was requested and provided on August 15 in Rapid City to collect additional comments. Comments were collected and addressed in Appendix H-7.

Understanding South Dakota Citizens – Wildlife Values

In the past decade SDGFP has conducted a number of scientific surveys designed to provide a better understanding of the needs, desires and attitudes of South Dakota residents in relation to wildlife management. Some of the highlights of the results of possible relevance to the Comprehensive Wildlife Conservation Plan are provided here.

A survey of South Dakota residents conducted in 1996 identified "providing opportunities for public participation" as one of SDGFP's weaknesses.[5] The survey also identified that 71% of the respondents were favorable towards SDGFP taking steps to increase public participation efforts such as more meetings, citizen task forces, focus groups, news articles, and public opinion surveys (27% neutral or no opinion and only 2% opposed).[6] Over the past decade SDGFP has taken many steps to increase the amount and quality of public participation opportunities in decisions regarding wildlife management in South Dakota.

A survey of South Dakota residents related to "Teaming With Wildlife" conducted in 1997 concluded that "for a significant majority of South Dakota residents, wildlife represents an important component of their total *quality of life* package."[7] A survey of South Dakota residents conducted in 2002 identified three groups based on their attitudes towards wildlife: strong support for wildlife (68%), medium support for wildlife (12%) and low support for wildlife (20%).[8]

SDGFP participated in a multi-state project entitled "Wildlife Values in the West 2004" conducted by the Human Dimensions in Natural Resources Unit at Colorado State University[9]. This research identified and described four wildlife value orientation types (Figure 7.2). The Utilitarian type believes that wildlife should be used and managed for human benefit. The Mutualist type supports the view that humans and wildlife are meant to co-exist or live in harmony. Pluralists hold both a mutualism and a utilitarian value orientation towards wildlife. The Distanced type is distanced from the issue of wildlife. This research also examined public preferences for species factors and choices within those factors – i.e., origin (native; nonnative), use (game; nongame), and status (extirpated; declining; common) related to making decisions for conservation funding. This research provides clues on how the South Dakota public will react to various wildlife issues that will be useful for implementing the CWCP.

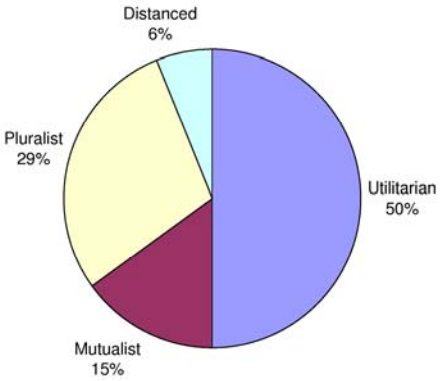


Figure 7.2. Wildlife value orientation types for South Dakota (2004).

[5] Gigliotti, L.M. 1996. Division of Wildlife 1996 public opinion survey: Agency image. Report # HD-2-96.SAM. South Dakota Game, Fish and Parks. Pierre, SD.

[6] Gigliotti, L.M. 1996. Division of Wildlife 1996 public opinion survey: What do our customers want? Report # HD-3-96.SAM. South Dakota Game, Fish and Parks. Pierre, SD.

[7] Gigliotti, L.M. 1998. Environmental and wildlife attitudes of South Dakota residents. Report # HD-6-96.SAM. South Dakota Game, Fish and Parks. Pierre, SD.

[8] Gigliotti, L.M. 2002. Wildlife values and beliefs of South Dakota residents. Report # HD-10-02.AMS. South Dakota Game, Fish and Parks. Pierre, SD.

[9] Teel, T. L., Dayer, A. A., Manfredo, M. J., & Bright, A. D. 2005. Regional results from the research project entitled "**Wildlife Values in the West**." (Project Rep. No. 58). Project Report for the Western Association of Fish and Wildlife Agencies. Fort Collins, CO: Colorado State University, Human Dimensions in Natural Resources Unit.

The Wildlife Values in the West project also included a section of questions specific to South Dakota related to wildlife diversity. The South Dakota section had some general wildlife attitude questions, and some specific questions related to native prairie ecosystems, bat species, the Topeka shiner, and the Missouri River ecosystem. Results from this study will provide a very good understanding of South Dakota residents' wildlife values, which will be very useful in implementing our ecosystem management plan (Comprehensive Wildlife Conservation Plan).

South Dakota Wildlife Action Plan – Agency Coordination, Cooperator Interactions, and Public Involvement

The next step will be to implement the Comprehensive Wildlife Conservation Plan, referred to as the South Dakota Wildlife Action Plan. Information from our publics and research by the International Association of Fish and Wildlife Agencies suggests that the public will be especially interested in the on-the-ground actions that result from implementing this next phase. SDGFP recognizes the critical importance of providing public involvement opportunities and continuing to work with our advisory team and other interested agencies, parties and tribes to the success of this plan.

The South Dakota Game, Fish and Parks (SDGFP) is committed to providing the same level, or more when the situation requires, of coordination with Federal, State, and local agencies and Indian tribes and public involvement in the implementation of South Dakota's Wildlife Action Plan as was demonstrated in the development of this Plan. South Dakota uses a process referred to as "Systematic Development of Informed Consent" developed by Hans and Annemarie Bleiker.[10] On a project-by-project basis this process will identify all potentially affected groups/individuals (including agencies and tribes), what level and type of information they need and how they want to be involved as well as appropriate public involvement strategies that are needed. In addition, a process to keep everyone informed of projects and status is critical to the implementation phase. Two strategies successfully used in the development of this Plan were the Citizen Advisory Team and the Internet. SDGFP will continue working with the Citizen Advisory Team[11] during implementation of the Plan and will maintain a web-site dedicated to providing up-dated information on projects and status. Also, news releases, open-houses and public meetings are frequently used communication and public involvement strategies that will be used when appropriate.

Specifically, when SDGFP commences its Plan revision, we will solicit input using the following techniques:

1. News releases announcing plans to revise South Dakota's Comprehensive Plan;
2. Specific invitation letters to Advisory Team members to participate in Plan revision;
3. Facilitated open houses and meetings for specific groups, upon request;
4. Web site access to keep people informed, gather input, and solicit comments on plan revision;
5. Specific publicized comment period; and
6. Public access to the revised plan.

These techniques apply both to the public and to conservation partners. In addition, SDGFP will meet, upon request, with conservation partners to discuss priorities and projects of mutual interest, in addition to soliciting their input on Plan revisions.

SDGFP will also use various information methods to help the public and our partners understand and relate to the Plan, which is a highly technical document. For example, during the next six months, SDGFP will develop and distribute a synopsis of the Plan's approach. This synopsis will highlight a number of species of greatest conservation need and relate them to the ecosystem approach used in the Plan. We anticipate that this and other information tools will help engage both partners and the public in plan implementation.

[10] see: www.ipmp-bleiker.com or www.consentbuilding.com

[11] The Citizen Advisory Team is ***open***, meaning that interested citizens can join (or leave) this group at anytime in the process.

8.0 MONITORING OF CWCP AND ADAPTIVE MANAGEMENT

Monitoring and inventory is recognized as an important component of the South Dakota CWCP. There is considerable detail that could be developed regarding both monitoring and inventory activities. For the purpose of the CWCP, monitoring and inventory are described strategically, with most specific monitoring and inventory methods and protocols to be determined in implementation phases. However, some high priority inventory and monitoring needs were identified during the development of the plan and are included.

Monitoring and inventory are different but related activities. The purpose of monitoring is to check on the status of specific resources and progress towards stated goals or objectives. Inventory has a more basic purpose of determining the occurrence or abundance of specific resources, not necessarily in regards to stated goals or objectives. Monitoring is a key component of the CWCP 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.

Monitoring Framework

The South Dakota CWCP emphasizes ecosystem diversity as the primary means to address habitat needs for the State's biodiversity, with a secondary focus on non-habitat concerns of species of greatest conservation need. The proposed monitoring follows this same approach. Monitoring of ecosystem diversity addresses objectives at both ecoregion and community levels of biological organization. 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.

Monitoring of Ecosystem Diversity

As discussed in Section 6, the goal of ecosystem diversity is to maintain or increase levels of representation of 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 - Monitoring ecosystem diversity at the ecoregion level involves tracking the amount of existing acres of each specific ecosystem that can contribute to representation of specific desired conditions. Section 6 identifies 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 each ecoregion, additional work is needed to identify the goals for each ecosystem. Section 6 uses a level of 10% of historical amounts for the grass and shrub ecosystems of the Great Plains Steppe and Mixed Grass ecoregions as an example for determining desired levels of representation, but this amount could be either too low or too high for a specific ecosystem. For other ecosystem categories in Section 6, historical references are lacking, and additional efforts at quantifying amounts of each identified ecosystem that occurred under historical disturbance regimes are needed. This is an important research goal for the implementation of the South Dakota CWCP across the full range of ecosystems within the state. An early step in the implementation of the CWCP would be the refinement of these specific representation goals within each ecoregion. Once representation goals are established, monitoring at the ecoregion level involves tracking the number of acres that qualify for representation of each ecosystem identified in the EDM.

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 grasslands or parks, information on amounts of each ecosystem type that meets representation criteria may be directly

available and the acres of representation directly tallied. For Game Production Areas, South Dakota has been evaluating 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 programs such as WHIP or EQIP 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 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 the ecoregion monitoring is to track the amounts of each identified ecosystem from the ecosystem diversity descriptions that are present relative to historical amounts and the stated conservation 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.

For some ecosystems, such as many in the Tallgrass Subregion, representation levels may be very low. In these areas, a goal may be restoration of desired ecosystem conditions. Where sites have been converted, such as to croplands, such restoration may be difficult to achieve and will require a long-term commitment. Farm Bill programs such as CRP that emphasize planting of native species, can provide significant benefits. The ecosystem diversity framework of the CWCP will allow for the specific ecosystem to be targeted and a specific site to be identified. While complete restoration may not be feasible, producing conditions that approximate historical plant communities can provide many of the same benefits. Such acres may be easily tracked through NRCS or FSA monitoring programs (e.g., Natural Resources Inventory). Appropriate sizes, amounts, and distributions can be evaluated through comparisons to the habitat needs of selected species of greatest conservation need, such as prairie chickens. In this way, programs such as CRP may be better targeted to produce benefits to biological diversity.

Monitoring of ecosystem diversity at the landscape level represents a new evaluation process for the state. Developing the specifics of the program as management actions are implemented will be an important operational component.

Ecosystem or Community Level Monitoring - As discussed in Sections 2 and 5, ecosystem representation requires monitoring of the amounts, sizes, and distributions of each ecosystem within the ecoregion, and the determination of whether a specific site meets the requirements for representation. A specific site should have conditions supporting 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% crested wheatgrass, it would not be reasonable to consider it representative of historical plant community composition. An early step in the implementation of the CWCP should be to characterize appropriate levels of representation in terms of the compositions, structures, and functions of each desired ecosystem. This step will identify the criteria for including sites for representation at the ecoregional level. This step will also help to highlight desired ecosystem restoration goals for each type of ecological site.

Monitoring of sites at the ecosystem level will track progress in addressing specific problems such as compositions, structures, functions, or processes. Typically, the plant composition of the ecosystem will be the primary monitoring criterion. Although in aquatic ecosystems the macroinvertebrate community may be the appropriate indicator of representation. 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 sites 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.

As with the ecoregion level monitoring, additional work will be needed to implement an effective monitoring system for the ecosystem or community level. Additional modeling of community dynamics for all ecosystem types can be used to better characterize desired conditions in terms of compositions, structures, and processes at the ecosystem or community level. Once the guidelines are developed and established for this level, they should provide an effective monitoring tool to carry forward into future years.

Adaptive Management for Ecosystem Diversity - Because the dynamics of many ecosystems are poorly 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 CWCP and making the appropriate adjustments.

Monitoring and Inventory Programs for Species

Various monitoring and inventory programs currently exist and will be tracked for the information they provide on the status of species. For example, the Breeding Bird Survey provides standardized, long-term trend information for many species of birds. A summary of these current monitoring programs and any additional pertinent monitoring efforts reported by cooperators or the public are included in the following table.

Table 8.1. Summary of current monitoring programs in South Dakota.

MONITORING/INVENTORY PROGRAM	PRIMARY AGENCY/ORGANIZATION	DESCRIPTION
BIRDS		
North America Breeding Bird Surveys	U.S. Geological Survey	Status and trends of bird populations
Christmas Bird Count	National Audubon Society	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 Project	SD Ornithologists' Union and SD Fish, Game and Parks	Determine the abundance and distribution of breeding birds in South Dakota
Grazing systems bird monitoring	South Dakota Grasslands Coalition and other voluntary cooperators	Bird surveys on different grazing regimes
Bird banding – Farm Island, South Dakota		Species trend data
Colonial Waterbird Inventory and Monitoring Program	Rocky Mountain Bird Observatory and SD Game, Fish and Parks	Census of waterbirds in South Dakota on a 5- 10 year rotational basis

Table 8.1. continued

	MONITORING/INVENTORY PROGRAM	PRIMARY AGENCY/ORGANIZATION	DESCRIPTION
BIRDS continued			
	Monitoring Avian Productivity and Survivorship (MAPS) Program	The Institute for Bird Populations	Monitor population dynamics of over 120 species of land birds (currently one station in Brookings County, South Dakota)
	Bald Eagle Midwinter Survey	SD Game, Fish and Parks, 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	SD Game, Fish and Parks, 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 SD Game, Fish and Parks	Annual surveys of nest colony locations and success
	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
	Sage-Grouse lek surveys	SD Game, Fish and Parks, Forest Service, Bureau of Land Management	Counts of all known leks
	Sharp-tailed Grouse and Greater Prairie-Chicken lek surveys	Forest Service and South Dakota Game, Fish and Parks	Lek counts on Fort Pierre National Grassland
	Raptor Surveys	SD Game, Fish and Parks	Status and trend surveys
MAMMALS			
	Monitoring of Black Hills bats	SD Game, Fish and Parks and Bat Works	Status and trend surveys
	Black-tailed Prairie Dog distribution surveys	SD Game, Fish and Parks	Status and trend surveys
	Sylvatic Plague monitoring	SD Game, Fish and Parks and other cooperators	Monitor distribution and prevalence of sylvatic plague in South Dakota
	River Otter distribution	SD Game, Fish and Parks and South Dakota State University	Monitor species occurrence and evaluate need for reintroduction
	Reintroduced populations of Swift Fox	Badlands National Park, Turner Endangered Species Fund	Monitor success of reintroductions re: establishment of self-sustaining populations
	Reintroduced populations of Black-footed Ferrets	Forest Service, National Park Service, Cheyenne River Sioux Tribe, Rosebud Sioux Tribe	Monitor success of reintroductions re: establishment of self-sustaining populations

Table 8.1. continuted

	MONITORING/INVENTORY PROGRAM	PRIMARY AGENCY/ORGANIZATION	DESCRIPTION
FRESHWATER MUSSELS			
	Mussel surveys – 39 mile and 59 mile Missouri River USCOE Districts	SD Game, Fish and Parks; National Park Service; US Army Corps of Engineers	Status and trend surveys – 5 year recurrence
GASTROPODS			
	Black Hills land snail surveys	Black Hills National Forest	Monitor species occurrence and trends
INSECTS			
	American Burying Beetle population surveys	SD Game, Fish and Parks, U.S. Fish and Wildlife Service, and volunteers	Monitor species occurrence, trends, and state distribution
	Dakota Skipper population surveys	SD Game, Fish and Parks and U.S. Fish and Wildlife Service	Monitor species occurrence, abundance, relationship to management practices, and state distribution
	Aquatic invertebrate survey – Black Hills	SD Game, Fish and Parks	Monitor species occurrence and trends
FISHES			
	Topeka Shiner population monitoring	D Game, Fish and Parks	Monitor species occurrence and trends
	Lake and river fish surveys	SD Game, Fish and Parks	Monitor species occurrence
	Lower Missouri River Fish Surveys	U.S. Army Corps of Engineers, SD Game, Fish and Parks, U.S. Fish and Wildlife Service	Monitor species occurrence and trends, with emphasis on pallid sturgeon re: success of reintroduction efforts
AMPHIBIANS AND REPTILES			
	Wild Turtles Inventory	SD Game, Fish and Parks	Statewide inventory of 9 turtle species
	Reptile and Amphibian surveys	SD Game, Fish, and Parks	Species occurrence

In addition to these surveys, Federal agencies including the U.S. Forest Service and National Park Service have been and plan to continue to conduct various inventories and surveys on their lands. For example, the Grand River National Grassland has been conducting butterfly surveys on the western portion of the grasslands. They have also been conducting sensitive plant surveys, conducting surveys of raptors, native fish inventories, and surveys of sand dune insects. Communicating and sharing the 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 species of greatest conservation need.

Several specific new inventories for species groups or individual species have been identified by South Dakota Game, Fish, and Parks, and should be incorporated into future wildlife diversity programs. Specifically, proposed inventory programs include:

1. Repeat the South Dakota Breeding Bird Atlas, beginning in 2008, which will be 20 years following the first Atlas.

2. Design and conduct a statewide small mammal inventory, with highest priority on unique habitats and species of greatest conservation need.
3. Use results of herpetological inventory to establish a statewide monitoring program.
4. Collect baseline data on furbearer species of undetermined status and/or greatest conservation need.
5. Determine distribution of bullfrogs in South Dakota and investigate the possible impacts on native frog species.
6. Collect additional information on the reproduction, movements and food habits of river otters.
7. Investigate potential cooperative opportunities with Partners in Amphibian and Reptile Conservation (PARC).
8. Investigate the potential to use Biotics software to record monitoring data. Biotics is the software developed by NatureServe for state natural heritage programs to track and monitor species and natural communities. South Dakota is a member of this international network.

Additional specific inventory or monitoring actions have also been identified for various species of greatest conservation need, as identified in Section 5. In addition to these species-specific actions, the Wildlife Diversity Program will develop and circulate a list of high-priority inventory needs. SDGFP will follow the example of the Waterbird Nesting Colony Survey, which includes collection of baseline data and development of a long-term monitoring strategy. This method will better direct State Wildlife Grants funds and other available rare species funding sources to these highest priorities. Wildlife Diversity Program staff will also establish a schedule for developing recovery objectives for state listed species, with a goal of completing this task within 2 years. Although detailed state recovery plans are not anticipated, a threats assessment, recovery goal identification, and specific recovery actions will provide a more coordinated approach by SDGFP and better guidance for cooperating agencies to assist in recovery of these species. These two tools, in addition to the conservation actions identified in the CWCP'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, USFWS, 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.

Adaptive Management for Species Diversity - As with ecosystem diversity, management actions directed towards species, where feasible, should be designed using an adaptive management framework. For many species, information on responses to many management actions remains largely unknown. In many cases, responses by species to management actions are assumed to be occurring, but are seldom monitored. Species responses 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.

Future Research Needs

As indicated in discussions of monitoring and inventory, much information about ecosystem diversity in South Dakota as well as species response to both ecosystem diversity treatments and specific species actions remains unknown. The management actions described in the CWCP will provide excellent opportunities to learn from monitoring of treatment responses, especially when designed in an adaptive management framework with replicates and appropriate controls or comparisons. Research that addresses the most important questions or information gaps will be prioritized on an annual basis.

SDGFP has used State Wildlife Grant funds in the past to fund identified research needs though requests for proposals or for targeted investigations. This practice will be continued in the future with priority research needs identified annually through input from agency personnel and cooperators relative to the strategy outlined and priorities identified in this CWCP. In this way, timely and important research questions can be identified and addressed. While the available budget is small compared to the diversity of research needs, careful selection of projects assures that critical research questions are prioritized.

9.0 REVIEW SCHEDULE

Many of the species included on the list of species of greatest conservation need 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 an organization called NatureServe. The database is a dynamic system of data and maps that is in a nearly constant state of revision and improvement. Based on this influx of new information, the species list will be reviewed biennially to determine any needed changes.

Wildlife Diversity Program staff will develop annual lists of project priorities for State Wildlife Grants and other rare species funding sources. This list will be circulated to potential contractors and other cooperators to encourage a more coordinated approach to rare species and habitat conservation and recovery. Because the majority of the projects are multi-year efforts, SDGFP will conduct a biennial review of progress in completing these high-priority projects and will summarize the results of this review biennially. These results will be shared with cooperators, with a request for input on additional project priorities. SDGFP will also make annual contacts with neighboring states to encourage better coordination on species and habitat projects of mutual interest.

SDGFP will complete a review and revision of the CWCP at 5-year intervals, with specific attention to whether the highest priorities have been addressed, and if they have not been addressed, to attempt to determine the reasons they have not. SDGFP will also conduct a public attitude survey 5 years following approval of South Dakota's CWCP to determine the public's awareness and level of support for this effort.

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Plummer, M.V. 1977. Activity, habitat, and population structure in the turtle, Trionyx muticus. Copeia 1977:431-440.

Western Box Turtle

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Lesser Earless Lizard

Behler, J. L., and F. W. King. 1979. The Audubon Society field guide to North American reptiles and amphibians. Alfred A. Knopf, New York, NY.

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Jones, S. M., and D. L. Droge. 1980. Home range size and spatial distributions of two sympatric lizard species (Sceloporus undulatus, Holbrookia maculata) in the Sand Hills of Nebraska. Herpetologica 36:127-132.

Northern Cricket Frog

Hammerson, G. A., and L. J. Livo. 1999. Conservation status of the northern cricket frog (Acris crepitans) in Colorado and adjacent areas at the northwestern extent of the range. Herpetological Review 30:78-80.

Harding, J. H. 1997. Amphibians and reptiles of the Great Lakes region. University of Michigan, Ann Arbor.

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Many-lined Skink

Hammerson, G. A. 1982. Amphibians and reptiles in Colorado. Colorado Division of Wildlife, Denver.

Stebbins, R. C. 1985. A field guide to western reptiles and amphibians. Second edition. Houghton Mifflin, Boston, MA.

Greater Short-horned Lizard

Hammerson, G. A. 1982. Amphibians and reptiles in Colorado. Colorado Division of Wildlife, Denver.

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APPENDIX A: Background on the SIMPPLLE Model and Model Assumptions.

SIMPPLLE (SIMulating Patterns and Processes at Landscape scaLEs) is a spatially explicit landscape model that we used to simulate vegetation dynamics in grass/shrub ecosystems of the Great Plains Steppe Ecoregion and Mixedgrass Subregion in South Dakota. Created by the USDA Forest Service, SIMPPLLE provided us with the ability to simulate plant community dynamics as a result of historic disturbance events (e.g., fire, bison grazing, and prairie dog activity), climate, and landscape elements (e.g., ecological site, proximity to water, and elevation). SIMPPLLE uses stochastic probabilities and disturbance response parameters we specified to annually assign climate disturbance patterns discussed below. Although SIMPPLLE has a variety of potential applications, we specifically used SIMPPLLE to derive the historical range of variability for each grass/shrub ecosystem. We represent the historical range of variability as the minimum and maximum number of acres that each grass shrub ecosystem occupied in our simulations. Below is a description of the model parameters and model assumptions we used in our SIMPPLLE simulations of the Great Plains Steppe Ecoregion and Mixedgrass Subregion.

Model Landscapes

SIMPPLLE is designed to model vegetation dynamics on specific landscapes rather than artificial landscapes. This spatially explicit landscape feature of SIMPPLLE provided us the ability to select representative areas within the Great Plains Steppe and the Mixedgrass to simulate the unique features of those landscapes. Therefore, within each Ecoregion we selected 8 representative areas to model. These 8 areas represented a total area of 1,968,337 acres modeled in the Great Plains Steppe Ecoregion and 2,590,375 acres modeled in the Mixedgrass Subregion. Each modeled area was broken into 10 acre vegetation units by Ecological Site and each unit was further classified by ecosystem based on vegetation composition. Other landscape features that were static components in each simulated area included aquatic areas, riparian areas, and prairie dog colonies.

Plant Dynamics

Annually within each 10 acre unit, the response of key plant species to climate (i.e., precipitation and temperature) and disturbance (i.e., fire and grazing) were followed and subsequently each 10 acre unit was given an ecosystem classification within each Ecological Site (see Figure 3.4 and Fig 3.18 for ecosystem classification for each Ecological Site within the Great Plains Steppe and Mixedgrass respectively). We performed 75 year simulations in each area and summarized the historic range of variability for each grass/shrub ecosystem in the Great Plains Steppe (Figure 3.4) and Mixedgrass (Figure 3.18). We based the plant species response parameters to climate and disturbance on expert opinion from a team of rangeland ecologists and scientific literature.

Fire

We adjusted the probability of fire occurring in the simulated areas within the Great Plains Steppe Ecoregion and Mixedgrass Subregion to meet our assumption that the historic fire return interval was 15 years in the Great Plains Steppe Ecoregion and the historic average fire return interval was 10 years in Mixedgrass Subregion. The probability of fire occurrence is also influenced by the climate in a given year and the grazing history on individual units (e.g., a heavily grazed 10-acre unit in a given year will have a low probability of burning the following year, whereas a lightly grazed 10-acre unit will have a high probability of burning the following year). Fire spread probabilities were also influenced by fixed landscape features, such as prairie dog colonies and aquatic/riparian areas that may provide natural fire breaks.

Grazing

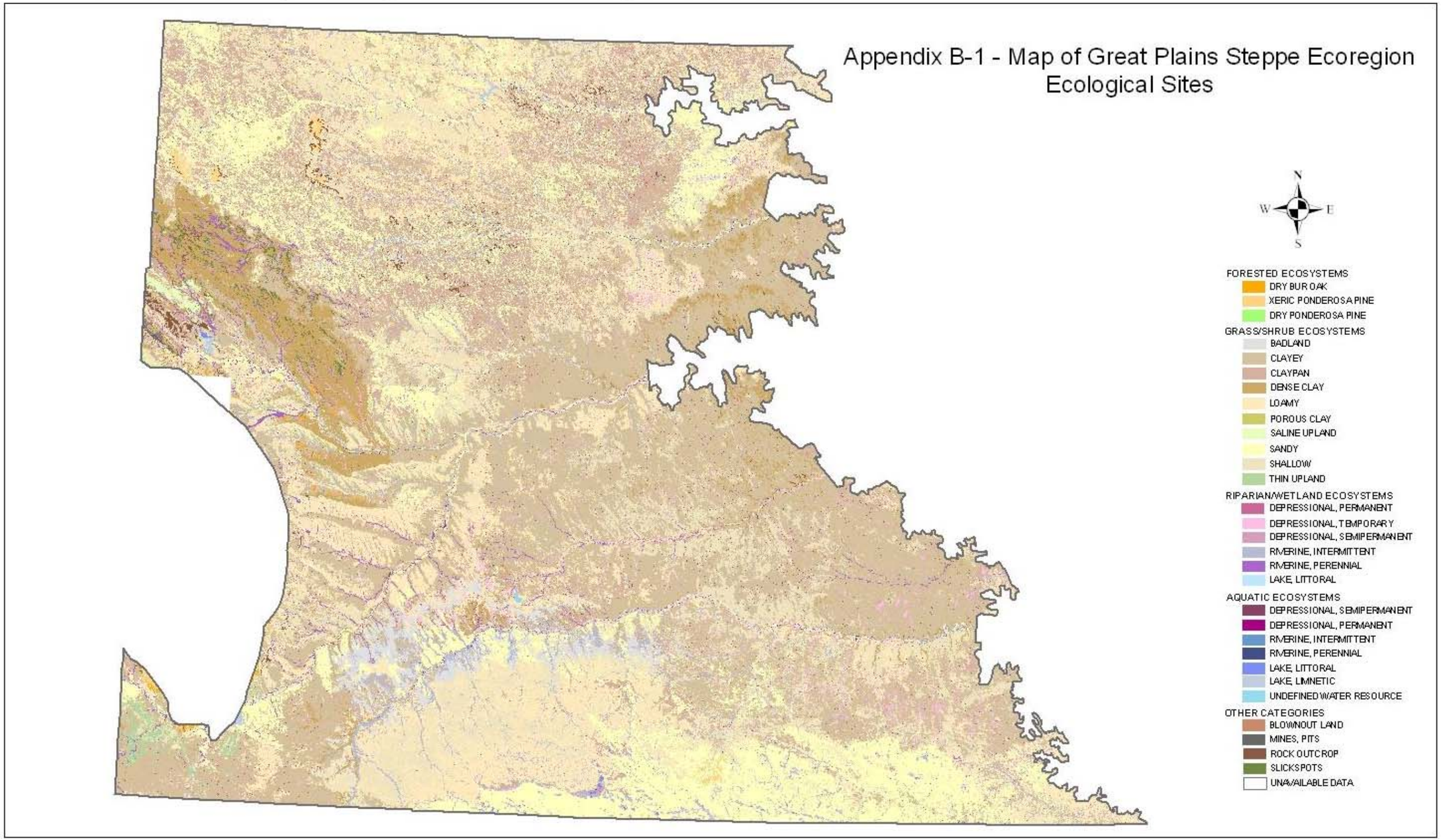
Bison grazing intensity was dependent on the proximity of the 10-acre vegetation units to water and the fire history of the vegetation units within the areas we simulated. For instance, based on our knowledge of bison grazing behavior we assumed that closer the 10-acre vegetation units are to water and the more

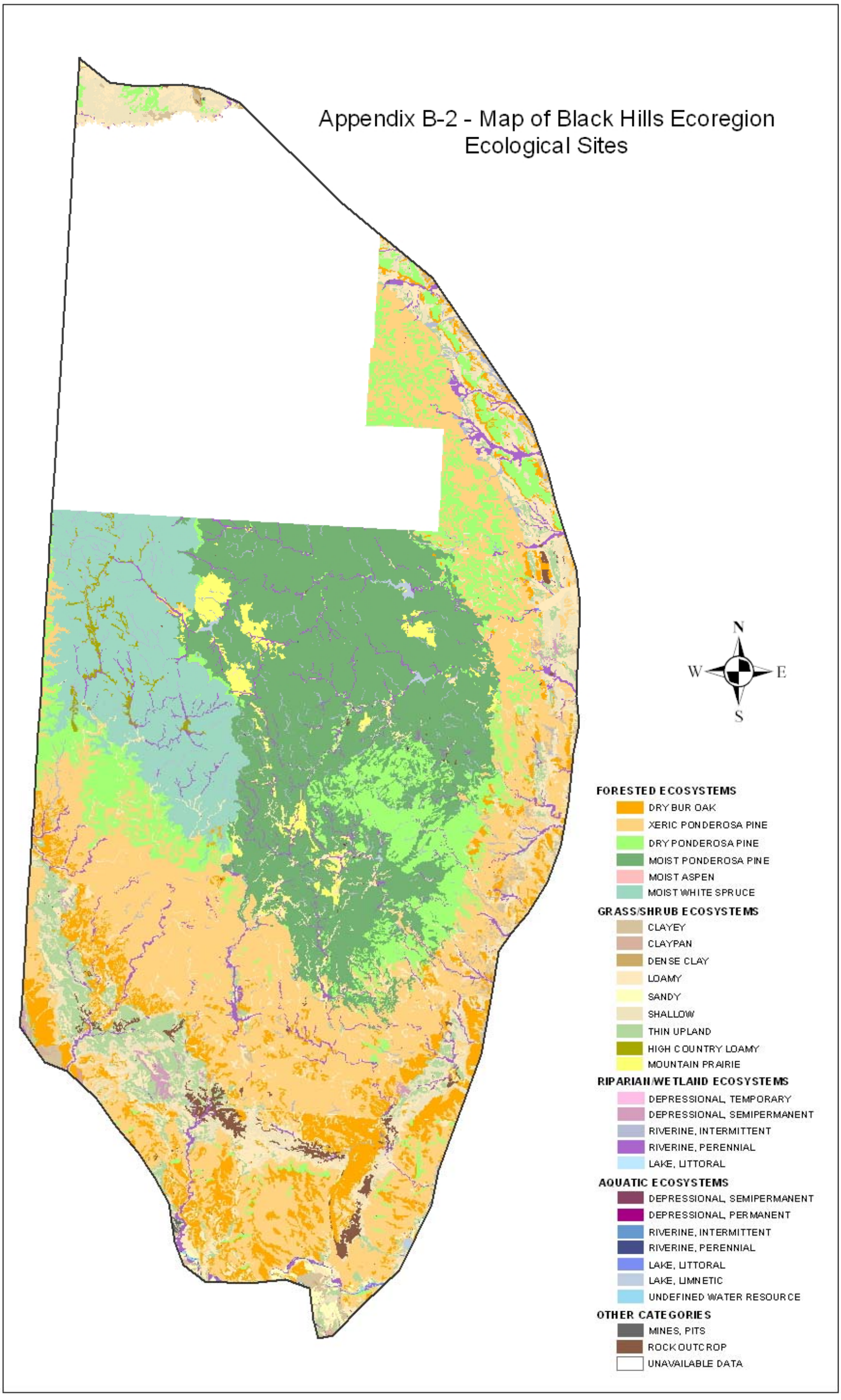
recently burned the vegetation units are, the heavier bison would graze. Vegetation units located between 0 to 10,560 feet away from water had a higher probability of receiving heavy bison grazing, whereas vegetation unit located between 10,561 to 25,000 and 25,001 to ∞ feet away from water had a higher probability of receiving moderate or light grazing, respectively. Likewise, the probability of heavy grazing on 10-acre vegetation units 1 to 3 years after a fire is high, whereas 4 to 7 years and 8 to ∞ years after fire the vegetation units have a higher probability of moderate and light grazing respectively.

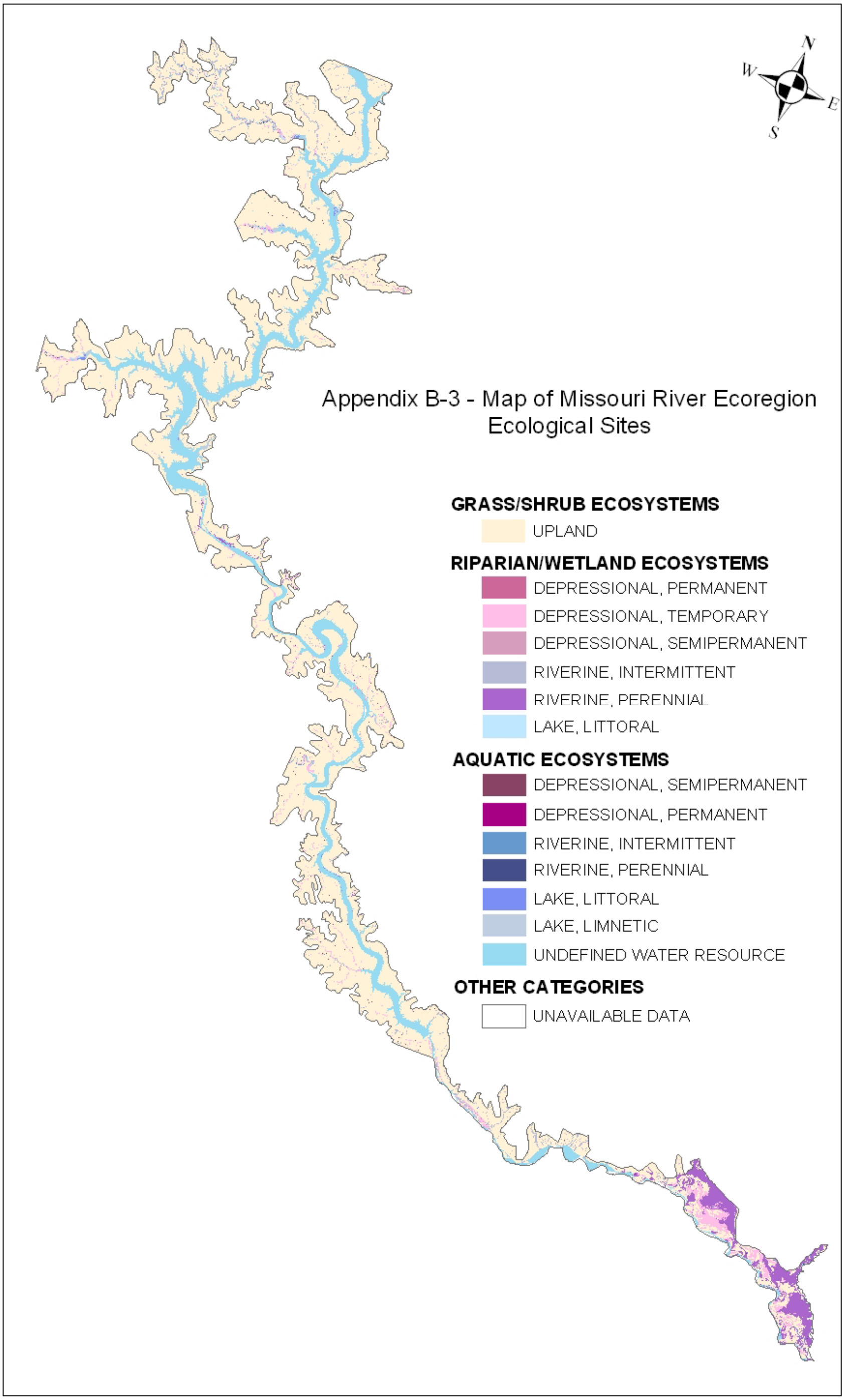
Results

The results of the SIMPPLLE modeling effort should be viewed as preliminary and developed for this effort to primarily demonstrate the best process for developing conservation goals for ecosystem diversity. Priorities for future conservation actions will include objectives for further refining this model and applying it to the entire landscape and all ecoregions within South Dakota.

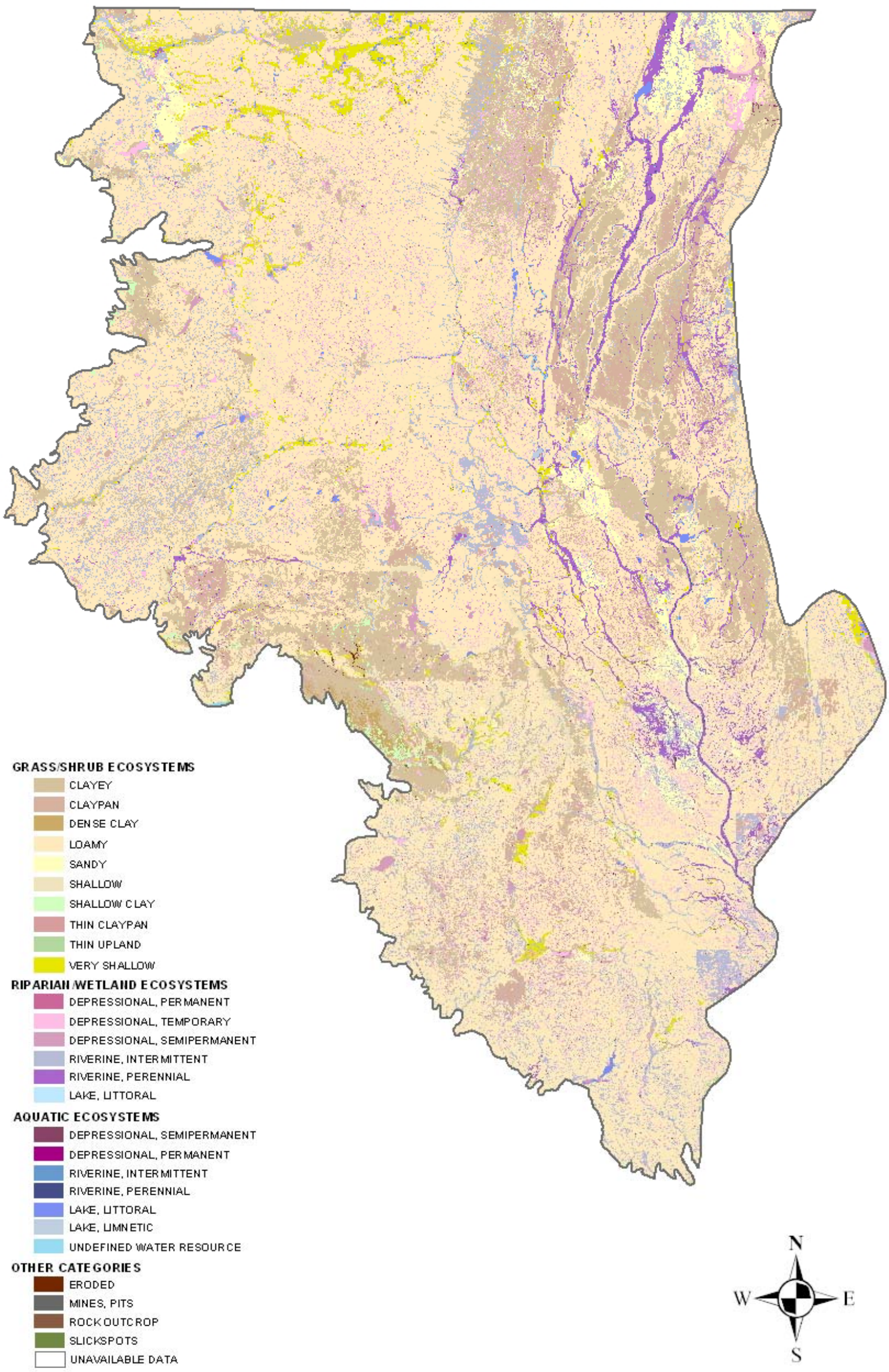
APPENDIX B: Map of ecological sites for all ecoregions of South Dakota

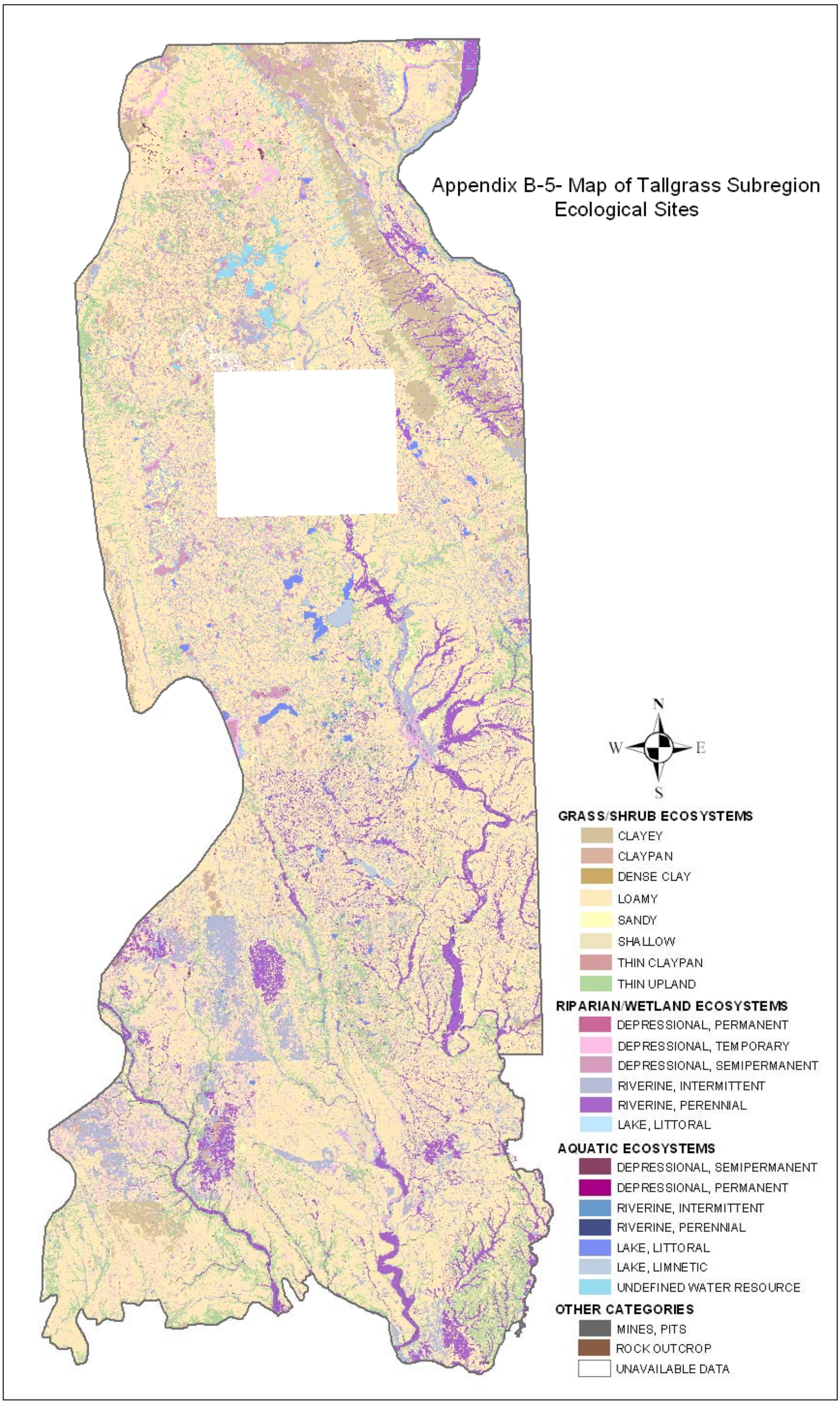



Appendix B-2 - Map of Black Hills Ecoregion
Ecological Sites
N
W
E
S
FORESTED ECOSYSTEMS
DRY BUR OAK
XERIC PONDEROSA PINE
DRY PONDEROSA PINE
MOIST PONDEROSA PINE
MOIST ASPEN
MOIST WHITE SPRUCE
GRASS/SHRUB ECOSYSTEMS
CLAYEY
CLAYPAN
DENSE CLAY
LOAMY
SANDY
SHALLOW
THIN UPLAND
HIGH COUNTRY LOAMY
MOUNTAIN PRAIRIE
RIPARIAN/WETLAND ECOSYSTEMS
DEPRESSIONAL, TEMPORARY
DEPRESSIONAL, SEMIPERMANENT
RIVERINE, INTERMITTENT
RIVERINE, PERENNIAL
LAKE, LITTORAL
AQUATIC ECOSYSTEMS
DEPRESSIONAL, SEMIPERMANENT
DEPRESSIONAL, PERMANENT
RIVERINE, INTERMITTENT
RIVERINE, PERENNIAL
LAKE, LITTORAL
LAKE, LIMNETIC
UNDEFINED WATER RESOURCE
OTHER CATEGORIES
MINES, PITS
ROCK OUTCROP
UNAVAILABLE DATA


N
W
E
S
Appendix B-3 - Map of Missouri River Ecoregion
Ecological Sites
GRASS/SHRUB ECOSYSTEMS
UPLAND
RIPARIAN/WETLAND ECOSYSTEMS
DEPRESSIONAL, PERMANENT
DEPRESSIONAL, TEMPORARY
DEPRESSIONAL, SEMIPERMANENT
RIVERINE, INTERMITTENT
RIVERINE, PERENNIAL
LAKE, LITTORAL
AQUATIC ECOSYSTEMS
DEPRESSIONAL, SEMIPERMANENT
DEPRESSIONAL, PERMANENT
RIVERINE, INTERMITTENT
RIVERINE, PERENNIAL
LAKE, LITTORAL
LAKE, LIMNETIC
UNDEFINED WATER RESOURCE
OTHER CATEGORIES
UNAVAILABLE DATA

Appendix B-4 -Map of Mixedgrass Subregion Ecological Sites




Appendix B-5- Map of Tallgrass Subregion
Ecological Sites
N
W
E
S
GRASS/SHRUB ECOSYSTEMS
CLAYEY
CLAYPAN
DENSE CLAY
LOAMY
SANDY
SHALLOW
THIN CLAYPAN
THIN UPLAND
RIPARIAN/WETLAND ECOSYSTEMS
DEPRESSIONAL, PERMANENT
DEPRESSIONAL, TEMPORARY
DEPRESSIONAL, SEMIPERMANENT
RIVERINE, INTERMITTENT
RIVERINE, PERENNIAL
LAKE, LITTORAL
AQUATIC ECOSYSTEMS
DEPRESSIONAL, SEMIPERMANENT
DEPRESSIONAL, PERMANENT
RIVERINE, INTERMITTENT
RIVERINE, PERENNIAL
LAKE, LITTORAL
LAKE, LIMNETIC
UNDEFINED WATER RESOURCE
OTHER CATEGORIES
MINES, PITS
ROCK OUTCROP
UNAVAILABLE DATA

APPENDIX C: Summary of GIS methodology used in the CWCP assessment

Grass/shrub and forested ecosystems – mapping ecological site and estimating historical amounts

Source GIS and tabular data:

1) U.S. Department of Agriculture Natural Resources Conservation Service. Soil survey geographic (SSURGO) database for all available counties in South Dakota. Fort Worth, TX. Online Linkage: URL:<http://SoilDataMart.nrcs.usda.gov/>

Methodology for developing the GIS layers for mapping the ecological site (EDMs) riparian/wetland and aquatic classifications for the South Dakota CWCP.

1) Reorganize SSURGO data by CWCP ecoregions; use "Ecosite UPLAND" relate table to populate new layer with EMRI_UPLAND variable (based on groupings of NRCS ecological sites); relate on MUSYM variable.
2) Forest ecological sites were developed from NRCS SSURGO associated plant species composition data.
3) Historical amounts were estimated from summing each ecological site based on the EDM classification.

Grass/shrub and forested ecosystems – land use impacts

Source GIS and tabular data:

1) U.S. Department of Agriculture Natural Resources Conservation Service. Soil survey geographic (SSURGO) database for all available counties in South Dakota. Fort Worth, TX. Online Linkage: URL:<http://SoilDataMart.nrcs.usda.gov/>
2) South Dakota Cooperative Fish and Wildlife Unit. South Dakota GAP Analysis Project – land use attributes.

Estimated amounts of land use impacts were obtained by unioning SD GAP land use data with the results of the ecological site mapping.

Riparian/Wetland and Aquatic - Ecological Site Mapping

Source GIS and tabular data:

1) U.S. Department of Agriculture Natural Resources Conservation Service. Soil survey geographic (SSURGO) database for all available counties in South Dakota. Fort Worth, TX. Online Linkage: URL:<http://SoilDataMart.nrcs.usda.gov/>
2) U.S. Fish and Wildlife Service, National Wetlands Inventory. South Dakota data sets. Online link: http://www.wetlands.fws.gov
3) Federal Emergency Management Agency. 100 year floodplain spatial data – Q3 Flood Data Product.

Methodology for developing the GIS layers for mapping the ecological site (EDMs) riparian/wetland and aquatic classifications for the South Dakota CWCP.

1) Reorganize SSURGO data by CWCP ecoregions; use "Ecosite WETLAND" relate table to populate new layer with EMRI_wetland variable; relate on MUSYM variable.
2) Union SSURGO/Ecoregion layer with FEMA 100 year floodplain layer and populate new variable "floodplain"; those polygons within floodplain =Y and those polygons outside floodplain = N

3) Union SSURGO/Ecoregion/FEMA layer with NWI (National Wetland Inventory Data); replace all EMRI_WETLAND with NWI "attribute" variable, where it occurs.

4) Reclassify results using EDM classification for riparian/wetland and aquatic ecosystems.

Riparian/Wetland and Aquatic Ecosystems - historical and existing amounts

Source GIS and tabular data:

1) U.S. Department of Agriculture Natural Resources Conservation Service. Soil survey geographic (SSURGO) database for all available counties in South Dakota. Fort Worth, TX. Online Linkage: URL:<http://SoilDataMart.nrcs.usda.gov/>

2) U.S. Fish and Wildlife Service, National Wetlands Inventory. South Dakota data sets. Online link: http://www.wetlands.fws.gov

3) Federal Emergency Management Agency. 100 year floodplain spatial data – Q3 Flood Data Product.

4) South Dakota Cooperative Fish and Wildlife Unit. South Dakota GAP Analysis Project – river reach attributes.

The results of the methodology described for ecological sites was summed and used to derive estimates of existing amounts for riparian/wetlands and aquatic ecosystems

Estimates of historical amounts for aquatic ecosystems, riverine systems, were calculated using the SD GAP – river reach attributes and the following methodology.

1) Reorganize Aquatic GAP data (river reach attributes) by CWCP ecoregions.
2) Reclassify data based on FLOW variable for perennial vs. intermittent and STREAMSIZE 5 variable for large, small, creek, and headwater.
3) Calculate percent slope using MAXIMUM ELEVATION minus MINIMUM ELEVATION divided by SEGMENT LENTH X 100.
4) Assign classification based on ecological site for aquatic ecosystems of each ecoregion.

Riparian/Wetland and Aquatic Ecosystems – land use impacts

Source GIS and tabular data:

1) U.S. Department of Agriculture Natural Resources Conservation Service. Soil survey geographic (SSURGO) database for all available counties in South Dakota. Fort Worth, TX. Online Linkage: URL:<http://SoilDataMart.nrcs.usda.gov/>
2) U.S. Fish and Wildlife Service, National Wetlands Inventory. South Dakota data sets. Online link: http://www.wetlands.fws.gov
3) Federal Emergency Management Agency. 100 year floodplain spatial data – Q3 Flood Data Product.
4) South Dakota Cooperative Fish and Wildlife Unit. South Dakota GAP Analysis Project – land use attributes.

Estimates of amounts of land use impacts in riparian/wetland and aquatic ecosystems were obtained by unioning the results of the ecological site analysis with the SD GAP analysis of land use.

APPENDIX D: Key to the codes used to indicate the protection status of each species in the South Dakota Comprehensive Wildlife Conservation Plan (http://www.sdgfp.info/Wildlife/Diversity/RareAnimal.htm#KEY).

Codes	Code Definition
Federal Status	
LE	Listed endangered
LT	Listed threatened
C	Candidate for federal listing, information indicates that listing is justified
State Status	
SE	State endangered
ST	State threatened
Global (G) & State (S) Rank	
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
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
B	Breeding season
N	Non-breeding season

APPENDIX E: Species codes used in the South Dakota Comprehensive Wildlife Conservation Plan.

Scientific name	Common name	Species Code
BIRDS		
Pelecanus erythrorhynchos	American White Pelican	AWPE
Cygnus buccinator	Trumpeter Swan	TRSW
Pandion haliaetus	Osprey	OSPR
Haliaeetus leucocephalus	Bald Eagle	BAEA
Accipiter gentilis	Northern Goshawk	NOGO
Buteo regalis	Ferruginous Hawk	FEHA
Falco peregrinus	Peregrine Falcon	PEFA
Centrocercus urophasianus	Greater Sage-Grouse	SAGR
Tympanuchus cupido	Greater Prairie-Chicken	GPCH
Grus americana	Whooping Crane	WHCR
Charadrius melodus	Piping Plover	PIPL
Catoptrophorus semipalmatus	Willet	WILL
Numenius americanus	Long-billed Curlew	LBCU
Limosa fedoa	Marbled Godwit	MAGO
Phalaropus tricolor	Wilson's Phalarope	WIPH
Sterna antillarum athalassos	Interior Least Tern	LETE
Chlidonias niger	Black Tern	BLTE
Athene cunicularia	Burrowing Owl	BUOW
Melanerpes lewis	Lewis's Woodpecker	LEWO
Picoides dorsalis	American Three-toed Woodpecker	ATTW
Picoides arcticus	Black-backed Woodpecker	BBWO
Cinclus mexicanus	American dipper	AMDI
Anthus spragueii	Sprague's Pipit	SPPI
Calamospiza melanocorys	Lark Bunting	LABU
Ammodramus bairdii	Baird's Sparrow	BASP
Ammodramus leconteii	Le Conte's Sparrow	LCSP
Junco hyemalis aikeni	White-winged Junco	WWJU
Calcarius ornatus	Chestnut-collared Longspur	CCLO
MAMMALS		
Myotis thysanodes pahasapensis	fringe-tailed myotis	FTMY
Myotis septentrionalis	northern myotis	NOMY
Corynorhinus townsendii	Townsend's big-eared bat	TBBA
Spermophilus franklinii	Franklin's ground squirrel	FGSQ
Spermophilus richardsonii	Richardson's ground squirrel	RGSQ
Glaucomys sabrinus	northern flying squirrel	NFSQ
Zapus hudsonius campestris	Bear Lodge meadow jumping mouse	BLJM
Vulpes velox	kit or swift fox	SWFO
Mustela nigripes	black-footed ferret	BFFE
Lontra canadensis	northern river otter	NROT
FRESHWATER MUSSELS		
Alasmidonta marginata	elktoe	ELKT
Arcidens confragosus	rock pocketbook	ROPO
Lasmigona compressa	creek heelsplitter	CRHE
Lampsilis higginsii	Higgins eye	HIEY
Leptodea leptodon	scaleshell	SCAL
Obovaria olivaria	hickorynut	HICK
Quadrula quadrula	mapleleaf	MAPL
GASTROPODS		

Vertigo arthuri	Dakota vertigo	DAVE
Vertigo paradoxa	mystery vertigo	MYVE
Catinella gelida	Frigid ambersnail	FRAM
Oreohelix strigosa cooperi	Cooper's rocky mountainsnail	CRMO
INSECTS		
Cicindela lepida	ghost tiger beetle	GTBE
Amblycheila cylindriformis	Great Plains tiger beetle	GPTB
Nicrophorus americanus	American burying beetle	AMBE
Oarisma powesheik	Powesheik skipperling	POSK
Hesperia ottoe	Ottoe skipper	OTSK
Hesperia dacotae	Dakota skipper	DASK
Atrytone arogos iowa	Iowa skipper	IOSK
Speyeria idalia	regal fritillary	REFR
Speyeria atlantis pahasapa	Black Hills fritillary	BHFR
FISHES		
Fundulus diaphanus	Banded killifish	BAKI
Notropis heterolepis	Blacknose shiner	BLSH
Umbra limi	Central mudminnow	CEMU
Phoxinus neogaeus	Finescale dace	FIDA
Catostomus catostomus	Longnose sucker	LOSA
Phoxinus eos	Northern redbelly dace	NRDA
Scaphirhynchus albus	Pallid sturgeon	PAST
Polyodon spathula	Paddlefish	PADD
Margariscus margarita	Pearl dace	PEDA
Macrhybopsis meeki	Sicklefin chub	SICH
Macrhybopsis gelida	Sturgeon chub	STCH
Notropis topeka	Topeka shiner	TOSH
Percopsis omiscomaycus	Trout-perch	TRPE
Couesius plumbeus	Lake chub	LACH
Catostomus platyrhynchus	Mountain sucker	MOSU
Phoxinus erythrogaster	Southern redbelly dace	SRDA
Nocomis biguttatus	Hornyhead chub	HOCH
Notropis rubellus	Rosyface shiner	ROSH
Percina caprodes	Logperch	LOGP
Percina maculata	Blackside darter	BLDA
REPTILES AND AMPHIBIANS		
Emys blandingii	Blanding's Turtle	BLTU
Graptemys pseudogeographica	False Map Turtle	FMTU
Tropidoclonion lineatum	Lined Snake	LISN
Heterodon platirhinos	Eastern Hognose Snake	EHSN
Storeria occipitomaculata pahasapae	Black Hills Redbelly Snake	BHRS
Hyla chrysoscelis	Cope's Gray Treefrog	CGTR
Apalone mutica	Smooth Softshell	SMSO
Terrapene ornata	Western Box Turtle	WBTU
Holbrookia maculata	Lesser Earless Lizard	LELI
Acris crepitans	Northern Cricket Frog	NCFR
Eumeces multivirgatus	Many-lined Skink	MLSK
Phrynosoma hernandesi	Short-horned Lizard	SHLI

APPENDIX F: Common or increasing non-native plant species occurring in South Dakota.

Source: United States Department of Agriculture, Natural Resources Conservation Service. 2004. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA, USA.

Grass/Shrub and Forested Ecosystems

Canada Thistle (state listed noxious weed)
A perennial weed that grows in cultivated crops, pasture, rangeland, woodlands and wetlands. Canada thistle is found extensively throughout South Dakota. 2004 statewide noxious weed estimates found that 1,722,972 acres were infested with Canada thistle.

Leafy Spurge (state listed noxious)
A perennial forb of rangelands, found throughout South Dakota. 2004 statewide noxious weed estimates found that 315,835 acres were infested with leafy spurge.

Yellow and Dalmatian Toadflax (local noxious weed)
Perennial forbs of rangeland, pasture and roadsides. Yellow and Dalmatian toadflax are most prevalent in the Black Hills Ecoregion and northwestern mixed grass subregion but it is also found in the Great Plains Steppe Ecoregion.

Russian Knapweed (state listed noxious weed)
A perennial forb of rangelands found throughout South Dakota

Spotted Knapweed (local noxious weed)
A perennial weed of rangeland and roadsides. Highest densities of spotted knapweed are found in the Black Hills Ecoregion, however, scattered populations are also found in the Great Plains Steppe Ecoregion and the Eastern Plains Ecoregion.

Absinth Wormwood (local noxious weed)
A perennial forb of pastures and rangeland found primarily throughout the Eastern Plains Ecoregion.

Riparian/Wetland and Aquatic Ecosystems

Eurasian watermilfoil (not positive about its designation)
A submersed perennial that is found in lakes, ponds, shallow reservoirs, and slow moving rivers and streams. In South Dakota Eurasian watermilfoil is of greatest concern in the southern Missouri River ecoregion.

Curly leaf pondweed (not positive about its designation)
A submersed perennial that grows in contained waters or slow moving streams and rivers. (not sure where it is considered a problem)

Salt cedar (state listed noxious)
A recent invader of South Dakota's riparian corridors. Salt cedar is most prevalent in the western and central portions of South Dakota, however it is currently found in every ecoregion.

Purple loosestrife (state listed noxious weed)
A long-lived perennial that is <u>not</u> currently widely established in South Dakota, however, it is located in wetlands, marshes and along streams throughout South Dakota.

*For more information about non-native invasive plants visit www.natureserve.org/getdata/plantdata.jsp

APPENDIX G: 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)

***Wildlife Habitat Incentives Program (WHIP)* -** A voluntary program for people who want to develop and improve wildlife habitat primarily on private land. The NRCS provides both technical assistance and up to 75 percent cost-share assistance to establish and improve fish and wildlife habitat. WHIP agreements between NRCS and the participant generally last from 5 to 10 years from the date the agreement is signed.

***Wetlands Reserve Program (WRP)* -** A voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. The NRCS provides technical and financial assistance to eligible landowners. Landowners have the opportunity of enrolling eligible lands through permanent easements, 30-year easements, or restoration cost-share agreements. 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.

***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.

Grassland Reserve Program (GRP) - A voluntary program offering landowners the opportunity to protect, restore, and enhance grasslands on their property. Section 2401 of the Farm Security and Rural Investment Act of 2002 (Pub. L. 107-171) amended the Food Security Act of 1985 to authorize this program. The Natural Resources Conservation Service, Farm Service Agency and Forest Service are coordinating implementation of GRP, which helps landowners restore and

protect grassland, rangeland, pastureland, shrubland, and certain other lands and provides assistance for rehabilitating grasslands. The program will conserve vulnerable grasslands from conversion to cropland or other uses and conserve valuable grasslands by helping maintain viable ranching operations

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 restoration of wetlands and other fish and wildlife habitats on private land through public-private partnerships. Projects are designed to restore native habitat to as near a natural state as possible. A common thread through every South Dakota Partners project is the ability to be flexible and responsive enough to accommodate the site-specific needs and concerns of landowners. Since 1991, this approach has resulted in over 3,600 South Dakota landowners becoming valued Partners for Fish and Wildlife partners, 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 brood-rearing cover ground-nesting birds, and provide grassland habitat for various wildlife species.

U.S. Department of Agriculture, Forest Service (programs administered through the State)

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

Wetland/Grassland Habitat Program – The objective of this program is to implement conservation practices with voluntary landowners that will benefit breeding waterfowl and other wetland/grassland dependent species. These practices not only restore or enhance wildlife habitat, but can also provide improvements to the operations of cooperating landowners on working lands. Cost sharing is available up to 100 percent.

Coordinated Soil & Water 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.

319 Nonpoint Source Pollution (NPS) Project Grant - The 319 grant funds may be used for watershed implementation and assessment/planning, ground water, and information and education projects that control or prevent NPS pollution.

PRIVATE PROGRAMS AND SOURCES

Ducks Unlimited **-** Provides a cost-share programs directed towards wetland/grassland restoration and grassland enhancement. 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.

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 H: Public comments on the draft South Dakota Comprehensive Wildlife Conservation Plan July 18 – August 19, 2005.

Appendix H-1 – South Dakota Advisory Team and Charter

Mr.	Doug	Albertson	National Park Service	Badlands National Park
Ms.	Madonna	Archambeau	Chairwoman	Yankton Sioux Tribe
Mr.	Pete	Bauman	Organization	The Nature Conservency
Mr.	Chuck	Berry	SDSU/USGS	SD Coop. Wildlife and Fisheries Research Unit
Ms.	Jodi	Biers	Organization	Wildlife Experiences, Inc
Mr.	Duane	Big Eagle	Chairman	Crow Creek Tribal Office
Mr.	Gary	Brundige	Wildlife and Habitat Research	South Dakota Game, Fish and Parks
Mr.	Eddie	Childers	National Park Service	Badlands National Park
Mr.	Charles	Colombe	Chairman	Rosebud Sioux Tribe
Mr.	Paul	Coughlin	Land Management	South Dakota Game, Fish and Parks
Mr.	James	Crawford	Chairman	Sisseton-Wahpeton Sioux Tribe
Mr.	Tony	DeToy	USDA-FS	Fort Pierre National Grassland
Mr.	Mark	DeVries	Agency	Jackson Co.-Land and Natural Resources
Ms.	Eileen	Dowd-Stukel	State agency	South Dakota Game, Fish and Parks
Ms.	Rosemary	Draeger	Member	South Dakota Ornithologists' Union
Mr.	Leonard	Eller	President	Flandreau Santee Sioux Tribe
Mr.	Jack	Erickson	State Agency	South Dakota Game, Fish and Parks
Ms.	Roxy	Everson	Governor's Staff	South Dakota Governor's Office
Ms.	Jenna	Finn	Agency	Haakon County Conservation District
Ms.	Brenda	Forman	AG Unity	SD Association of Cooperatives
Mr.	Harold	Frazier	Chairman	Cheyenne River Sioux Tribe
Mr.	Andy	Gabbert	Resource Biologist	South Dakota Game, Fish and Parks
Ms.	Michele	Ganshow	State agency	South Dakota Office of Tourism
Mr.	Larry	Gigliotti	State agency	South Dakota Game, Fish and Parks
Mr.	Pete	Gober	SD Ecological Services	USFWS-ES
Mr.	Jeff	Grendler	Conservation Officer	South Dakota Game, Fish and Parks
Mr.	Doug	Hansen	State agency	South Dakota Game, Fish and Parks
Mr.	Lee	Harstad	State agency	South Dakota Office of Tourism
Mr.	Jon	Haufler	Organization	Ecosystem Management Research Institute
Mr.	Chris	Hesla	Organization	SD Wildlife Federation
Mr.	Dan	Hubbard	Dept of Wildlife and Fisheries Science	South Dakota State University

Ms.	Laura	Hubers	Waubay NWR	USFWS
Mr.	Mike	Jandreau	Chairman	Lower Brule Tribal Office
Mr.	Mike	Lees	Federal Aid Coordinator	South Dakota Game, Fish and Parks
Mr.	Jim	Margadant	West River Office	Sierra Club
Mr.	Lowell	Mesman	Organization	SD Farm Bureau
Mr.	Will	Morlock	Regional Wildlife Management	South Dakota Game, Fish and Parks
Mr.	Charlie	Murphy	Chairman	Standing Rock Sioux Tribe
Ms.	Joanna	Murray	Tribe Game, Fish and Parks Department	Cheyenne River Sioux Tribe
Mr.	Bob	Paulson	Black Hills Program	The Nature Conservency
Mr.	Jonathan	Proctor	Organization	Predator Conservation Alliance
Mr.	Don	Rathert	Education Chairman	Black Hills Coalition
Mr.	Ron	Schauer	Regional Wildlife Management	South Dakota Game, Fish and Parks
Mr.	Chuck	Schlueter	State agency	South Dakota Game, Fish and Parks
Mr.	Dave	Swanson	University/SD Ornithologists' Union	University of South Dakota
Mr.	Tom	Troxel	Organization	Black Hills Multiple Use Coalition
Mr.	Chad	Tussing	Education Services	South Dakota Game, Fish and Parks
Mr.	Spencer	Vaa	Waterfowl Management	South Dakota Game, Fish and Parks
Ms.	Connie	Vicuna	SD State Wildlife Biologist	USDA-NRCS
Mr.	Mike	Williams	Organization	Izaak Walton League
Mr.	Stephen	Wilson	Agency	National Park Service
Mr.	John	Yellow Bird Steele	President	Oglala Sioux Tribe

CHARTER for the
South Dakota Comprehensive Wildlife Conservation Plan
Advisory Team

1) Purpose of the Advisory Team:

(a) To serve as an idea generator related to the steps in the Citizen involvement process for the CWCP;
(b) To communicate back to their organization or group, keeping those members in the loop, and to bring their members' ideas forward;
(c) To help publicize this effort, including notifying their members and others about events such as the public meetings;
(d) To serve as a sounding board or "reality check" on elements of the conservation strategies; and
(e) To serve as reviewers of interim steps and products; and
(f) To provide information and identify information sources.

This is an "advisory" team only; the SD Game, Fish and Parks retains final decisions on process, plan content and course of action for public involvement.

The Advisory Team can identify ways of reaching various communities of the public, determine the right messages, and find appropriate ways to communicate with them. We already have good

working relationships in many of these communities but want to make sure we are covering and listening to all of them. Misinformation is the greatest threat to this planning.

2) Time Frame:
The Advisory Committee will not continue beyond the end of preparation of the Comprehensive Wildlife Conservation Plan (CWCP). The CWCP is required to be delivered to the U.S. Fish and Wildlife Service (the granting agency) by October 2005.

3) Advisory Team Roles and Responsibilities:
As an Advisory Team Member I will:

(a) Respond promptly to requests from SDGFP for information or for input,
(b) Be open and honest with their ideas and perspectives,
(c) Be responsive to guidance from facilitators hired by SDGFP,
(d) Be open minded and respectful of the people involved in sharing differing opinions that are bound to arise,
(e) Plan to meet in person only once; additional work be done by email and/or over the phone,
(f) Be invited to be involved in assisting with a statewide round of public meetings and a review of the draft plan,
(g) Look for creative ways to assist in the advertising and communications about the CWCP, and
(h) Work as a team member to address the responsibilities of the committee.

4) Contractor and SDGFP's Planning Team Support:

Dynamic Solutions Group LLC (DSG) has been contracted by the SDGFP as facilitators and process coaches to assist with citizen involvement of the CWCP. DSG members and several SDGFP employees make up the planning team for preparation of the CWCP. The planning team is expected to help the Advisory Committee achieve its outcomes by:

(a) Helping plan, run, and report the results of the initial Advisory Team meeting,
(b) Serving as an impartial "process specialist" for future communications,
(c) Assessing the Advisory Team's progress in meeting its responsibilities and making suggestions as needed,
(d) Working with SDGFP and the Advisory Team to develop approaches to meeting the committee's responsibilities,
(e) Establishing a clear context and structured framework for deliberations,
(f) Helping create and maintain an environment where all parties are as comfortable as possible,
(g) Developing and maintaining trust and respect within the committee so that all individuals can provide their opinions,
(h) Evoking and encouraging the creativity of all members of the committee, and
(i) Asking appropriate questions as necessary to stimulate understanding among committee members.

5) SDGFP Roles and Responsibilities:

The SDGFP will be responsible for the following:

(a) Identifying individuals from a broad range of interests in conservation to be members of the Advisory Committee,
(b) Bringing those members together for an initial meeting,
(c) Explaining the charge to the Advisory Team,
(d) Providing media resources as needed to the Advisory Team, including, but not limited to (i) website, (ii) news releases, (iii) video, (iv) magazine articles, etc.
(e) Providing advice and counsel to the Advisory Team,
(f) Notifying the Advisory Team of changing circumstances, new information, etc. about CWCP preparation, and

(g) Making clear and timely decisions regarding items and matters related to preparation of the CWCP, and
(h) Providing feedback to the Advisory Team.

6) Ecosystem Management Research Institute's roles and Responsibilities:

EMRI has the responsibility to keep DSG and SDGFP informed of the progress of the plan and to provide lead-time when public involvement components are necessary.

Appendix H-2 – Highlights of the September Town Meetings: Citizen Input into the South Dakota Comprehensive Wildlife Conservation Plan

The town meetings were facilitated by Bruce Hawkinson, Dynamic Solutions Group. These highlights were also posted on our CWCP web page (www. dynamicsolutionsgroup.com/SD).

Rapid City – September 13, 2004 (29 attendees)

The meeting brought out issues about the state and private citizen's right to manage wildlife without Federal interference and issues about impacts on customs, culture, and economies, include property rights and property owner's responsibility. In addition, we heard that the state should carefully make decisions about accepting Federal money for this planning.

Animal and habitat issues were centered on development, urban sprawl, overgrazing, and drought. Species like sage grouse, prairie dogs and mountain lions were on attendee's minds. Habitat concerns like Black Hills meadows, woody draws, good livestock management enhances habitat for wildlife, prairie restoration, mixed grass prairie, and water availability.

Attendee's advice was to: focus on specific or critical habitat and wildlife species relationships, build and enforce long term housing development plans to protect habitat and environment, to make agriculture a priority, and to control wildlife at a manageable level (overpopulation can be a huge problem).

Oacoma – September 14, 2004 (15 attendees)

There was great interest in the Missouri River and frustration with the states' inability to influence the management of the Missouri River reservoirs. Issues like mountain lion populations, cedar encroachment, pesticide use, the few acres owned by SDGFP and the need for GFP to change from enforcement to management were raised, along with issue of plovers over people.

Species and habitat thoughts included native birds, mountain lions, meadowlarks, hummingbirds and prairie chickens. Habitat concerns were for the management of succession on wildlife management areas, Missouri River habitat, tall and mid grass prairies, sagebrush, wetland complexes and native prairie habitat.

The attendee's thought that best management practices for grazing needed to be used more and that crop rotation were good for wildlife populations. There is a need to focus the department toward biology rather than enforcement, to pay attention to tribal lands and their management, to change from traditional wildlife biology to holistic grazing management, to make the plan truly comprehensive; and protect, manage, conserve habitats, i.e. Missouri river lake levels in the spring for walleye spawning. GFP or some other public entity needs to purchase more land.

Watertown – September 15, 2004 (13 attendees)

This meeting was very habitat orientated. Attendees thought that the diversity of prairies, wetlands and uplands needed attention during this comprehensive planning process. Fire and controlled burns were thought to be important. In addition, the planning needs more publicity and attention.

Species and habitat concerns were focused on song birds and their migration, jack rabbits, Dakota Skipper butterflies, mussels and clams, and all wildlife dependent on grasslands, wetlands, riparian lands and sage brush. There was the greatest interest in the Tallgrass Prairie's loss of forbs, wetlands and water quality, woody draws, stream and riparian areas, native grass management of existing grass, grasslands primarily in the Missouri Coteau and Prairie Coteau.

The attendees of this meeting thought that this planning needed to take into account the following: use partnerships to protect and manage large blocks of land, educate the public about why species and habitats are important, and the need for economic incentives to keep and protect habitat. They thought this plan needs multi-agency cooperation, and the single most productive management would be to make friendly conservation provisions in the next farm bill, example-more land accepted into CRP, green belts along riparian areas (buffer strips). In addition, GFP needs to work with private landowners, and not to alienate landowners. This plan needs to have no negative impacts and it needs to take a holistic approach to conservation.

Sioux Falls – September 16, 2004 (15 attendees)

At this meeting attendees were very interested in public education, involving and informing people about this planning and the plan itself. Also issues like off road vehicles, the need to have more wardens, and the need to pay attention to habitat.

Species and habitat issues in Sioux Falls revolved around nongame, watchable wildlife, sharp-tail grouse, prairie chickens and mountain lions. Habitat issues included: grasslands, lakes, streams, tallgrass prairie. The single most highlighted issue was to have comprehensive, coordinated land and water practices in SD.

Ideas and advice from this meeting were to reach out to many groups during this planning like the stock growers and don't rely on just town meetings. In addition, hold night meetings, weekend meetings, and go to the people. Don't expect everyone to come to meetings. The people in attendance were very positive about the outdoor campus' education and the need for more campuses throughout SD.

Overall Summary-72 people attended these meetings

We heard that people think this is a valuable planning process and they have great hope for its completion and funding. But we also heard that the town meetings were not enough input into this important planning process and that GFP has to reach out to many groups. We heard that people are concerned about the "Takings Issue" and that private property rights need to be considered. And there was a general concern about how this important information was collected at these meeting and that it will get used in the planning.

Appendix H-3 – Frequently Asked Questions Generated by the Public at the Town Meetings

1. **Has the decision been made to accept the Federal money associated with the State Wildlife Grants and the plan?**

The SD Game, Fish and Parks Department has taken advantage of State Wildlife Grants funding, which helps to make our license dollars go further. John Cooper, in a letter to the U.S. Fish and Wildlife Service, made a commitment to use State Wildlife Grants funds appropriately and to deliver a plan that emphasized "species of greatest conservation need" in South Dakota by October 2005. These funds were set aside specifically to help state wildlife agencies accomplish more for species and habitats that either did not have an existing funding source or their needs were low priorities within state agencies.

2. **What strings are attached to the money?**

Although many types of wildlife projects are eligible, State Wildlife Grants funding is intended mainly for projects dealing with species and habitats that have not received the same attention that game species have traditionally enjoyed. SWG projects are like any other that SDGFP conducts with federal match dollars. Objectives are described and justified, the project is conducted and summarized, and a portion of the costs are reimbursed from federal funds. SDGFP voluntarily submits projects for consideration and submits only those activities that it is willing and able to accomplish.

3. **Why not give the money back and get the Federal Government out of South Dakota?**

SDGFP has been trying for many years to find funding for species that haven't received help from traditional sources. State Wildlife Grants funding has allowed SDGFP to conduct many projects that it would not have otherwise been able to do. The agency has a mandate to manage for the needs of all fish and wildlife resources in the state, and SWG funding has allowed SDGFP to better fulfill that responsibility with less impact on limited license dollars. SWG projects are voluntary on the state's part, and once the project is completed, there are no further obligations to the federal government.

4. **How will the economic impacts on customs, culture, communities and property rights be addressed in the plan?**

We have had a series of public input meetings to get an initial feeling from the public about the species in need, habitat needs and threats to wildlife, and ways that the department needs to implement management for rare species. In addition, the Plan's web site will bring in many comments during the entire planning period. Additional public input will be sought after the first draft of the plan is written to gauge the public's reaction to the plan's direction and content. In addition, a group of dedicated stakeholders from across the spectrum of interests serves as a valuable sounding board during this planning effort.

5. **How will property rights be protected when this money is used?**

This plan is a guidance document that does not change South Dakota laws. All laws dealing with land and property will be honored.

6. **Why do we need more wildlife?**

The goal of this program is not necessarily more wildlife. SD's CWCP emphasizes identifying and wisely managing habitats that support the vast array of fish and wildlife in South Dakota. A variety of habitat trends and land uses affect wildlife habitats. By addressing habitat and population levels from a strategic and long-range view, South Dakota hopes to identify vulnerable habitats and species before they decline to the point that they become regional or national concerns.

7. **Will SD lose control of these species and money?**

The funding that is helping SDGFP prepare the Comprehensive Plan and complete new projects is an annual allocation from the U.S. Congress. SDGFP applies for funding for specific projects and hopes to continue to use these funds as long as they are available. Although South Dakota's list of species of conservation need contains some federal endangered or threatened species, the list is mainly a "watch list" of species that may need further study and possible intervention at the habitat level if we hope to avoid endangered species listing.

8. **Is the plan already written so the town meeting input is already too late?**

The plan is currently being drafted for submission to the U.S. Fish and Wildlife Service by October 1, 2005. SDGFP asked specific questions at the open houses that are of great interest to the agency. All public input will be reviewed, and the plan will document all comments received so this input can be shared with people who were unable to attend their regional open house.

9. **How do we know that the information from the town meetings is really being used?**

As in any public involvement process, all public testimony and input are considered as part of decision making. However, not all input may be used. Some public input may actually contradict input from other citizens. Some public input may add unnecessarily to costs or may go against established state and federal laws. All these things must be considered. The open house format and website comment form allow us to hear the range of opinions on topics relating to wildlife, and all input will be considered before the Comprehensive Plan is finalized.

10. Will the existing land in state wildlife areas be used for nongame wildlife purposes?

Yes, it is now and will be in the future. SDGFP has always tried to make the best use possible of its lands to accommodate traditional uses, such as game production, hunting, and fishing, while also providing for other wildlife habitats and user needs.

11. Will "land acquisition" be used to conserve wildlife species of greatest conservation need?

SDGFP does not anticipate that land acquisition will be necessary for the species of greatest conservation need, except possibly for federal endangered species. In that situation, the U.S. Fish and Wildlife Service would be most likely to explore that option. Acquiring land to protect a specific wildlife species is extremely rare in the U.S.

12. There is great need for many species so that the cost of implementation could cost much more than the funding coming from Congress for this program; how will that be dealt with in the conservation plan?

South Dakota's Plan uses a habitat approach rather than separate plans for each rare species. By understanding which habitats have declined since settlement, SDGFP and other entities can better meet the needs of the majority of fish and wildlife species. Some species may still need individual plans, but a broader habitat approach will make much more efficient use of limited resources.

13. How will GFP (Game, Fish and Parks) work with private landowners on plan implementation?

South Dakota has a long history of working cooperatively with interested landowners on wildlife and habitat enhancements. This will only increase with new funding and a better understanding of which habitats are limited in the state.

14. How will the FS, BLM, FWS, EPA, NRCS, NPS, Department of Defense and tribes be brought into the implementation of this plan?

SDGFP already has good working relationships with federal agencies and has specifically met with many of them about the Comprehensive Plan. Most federal agencies have received guidance from their national directors to allow and encourage them to participate in the states' Comprehensive Plans or Strategies. Relationships with tribes are more challenging, but SDGFP is always interested in cooperating on projects of mutual interest.

15. What is the likelihood of this funding continuing?

State Wildlife Grants are awarded on a year-to-year basis, so there is no guarantee that the funding will continue. For that reason, legislative efforts continue to focus on identifying a longer-term solution. With sufficient resources, states could develop more complete programs to monitor species and habitats proactively, rather than to react to crises or to endangered species listing actions by the federal government. If state plans are well received in Congress, the likelihood is good that funding will continue and potentially increase.

16. How will the short-term funding be used?

A list and short summaries of the projects can be found at the following website: http://www.sdgfp.info/Wildlife/Diversity/swgarticle.pdf (please cut and paste this web address into your web browser). The Wildlife Diversity Program within SDGFP has concentrated on projects that help fill information gaps for wildlife that is rare or that has not been studied before. Another focus has been on wildlife species that have not been eligible for other federal funding sources, such as amphibian and reptiles and invertebrate animals that are not federally listed. Because other funds are available, SDGFP

has not spent a significant amount of State Wildlife Grants funds on federal endangered species or on game species.

17. If congress provides long-term funding in the future, how will that be used?

The Comprehensive Plan will provide a framework or roadmap for South Dakota to follow to provide for the needs of wildlife and associated habitats. Long-term funding will be used to accomplish monitoring and habitat enhancement needs identified in the Plan. SDGFP has worked with many other agencies in the state during the Plan's preparation, and they expressed strong support for the habitat focus. Hopefully these agencies will also help fulfill the needs identified in the Plan to benefit wildlife and habitats.

18. How can the influence of politics be managed?

Politics is everywhere - in small communities and at state and national levels. Our hope is that providing many opportunities for input will encourage people to express opinions or concerns that might otherwise become political issues.

19. Why won't this planning just be another exercise with no implementation?

At a minimum, the Plan will provide a strategic framework for SDGFP's current activities related to rare habitats and species. Assuming some level of enhanced funding continues, efforts will expand to allow an increasingly proactive stance rather than reacting to "brushfires" with endangered species listings. Ideally, the collection of Plans and Strategies from all states and territories will make an undeniable case that state wildlife agencies are ready to accept their full responsibility to manage fish and wildlife species and their associated habitats, and sufficient funding for implementation will be available.

20. How can a plan of this magnitude be completed in a year?

SDGFP has long been involved in strategic planning to address the needs of wildlife and their habitats, so planning is not a new concept for the agency. To assure that the plan is completed on time, SDGFP has sought assistance for two specific areas of expertise. Ecosystem Management Research Institute, headed by Dr. Jon Haufler, has experience with large-scale ecosystem planning. EMRI's staff is working closely with SDGFP in fulfilling the biological requirements of the Plan. Dynamic Solutions Group is a firm with public involvement expertise, and Bruce Hawkinson's involvement will help SDGFP gather meaningful input and provide feedback for information needs identified in open houses and on the Plan's website. No plan is perfect. South Dakota's Plan will be the best we can produce under existing time constraints and information gaps. The Plan will be a dynamic document that is revised regularly.

21. The Missouri River is a separate management region, how can the Corps of Engineers become a partner in this process?

Despite areas of disagreement about how Missouri River flows are managed, SDGFP works well with the Corps of Engineers on many issues, including monitoring and recovery of least terns, piping plovers, and bald eagles. Missouri River management will always be controversial because of conflicting resource issues, but SDGFP remains willing to work with the Corps where possible.

22. GFP does a lot of enforcement; will this money be used for monitoring populations and managing habitat instead of enforcement?

SDGFP will continue to enforce laws and regulations to protect wildlife resources, including game, nongame, and endangered species. The Plan won't change SDGFP's activities to protect and manage habitats and wildlife species, which include monitoring of species and habitats, habitat enhancement, sharing of information, public contacts, and enforcement. Enhanced funding will allow SDGFP to place a greater emphasis on inventories, life history investigations, and other needs related to nongame species.

23. Will the plan be truly comprehensive; it appears that walleye, deer and pheasants are not going to be part of this plan?

Most of South Dakota's game species already have management plans with associated population goals, monitoring strategies, and funding. The Plan's focus is on those species that have not received the same level of attention as game species or endangered species. The Plan's habitat focus will address the needs of most of South Dakota's fish and wildlife species, regardless of whether they are game or nongame.

24. Are plovers more important to SD than people?

Sometimes it seems that endangered species take priority over people. The State of South Dakota has worked very hard to lessen the impact of federal endangered species listings on South Dakotans. The efforts of SDGFP and the SD Department of Agriculture contributed greatly to the removal of the black-tailed prairie dog from the federal candidate list. SDGFP led a successful effort to exempt South Dakota from critical habitat designation for the Topeka shiner. These successes required a large commitment of time and resources that are simply not available for every species. In addition, recovering species already listed requires much time and money. Instead of waiting for future listings of endangered species, SDGFP hopes that the proactive habitat-based approach in the Comprehensive Plan will be a better use of limited resources.

25. Can you show me the list of species of greatest need?

Yes, this is on the website at: http://www.dynamicsolutionsgroup.com/SD/html/SDgreatestNeed.pdf (please cut and paste this web address into your web browser)

26. Will the county commissions be involved in determining the species of greatest conservation need and plan implementation?

The species of greatest conservation need list is determined on a statewide basis, not at a county level. County commissions, like all interested parties, are encouraged to provide input on the planning process.

27. How will endangered species laws be addressed in this plan?

The Plan does not override existing laws or create new laws. SDGFP will continue to participate in endangered species issues. In some cases, the agency may oppose future federal listings that it does not believe are warranted. In other cases, the agency will assist with recovery efforts to justify removal from the federal list of threatened or endangered species. The Comprehensive Plan will refer to existing recovery plans for endangered species and will not develop new recovery goals.

28. How will highly visible species like mountain lion, prairie dog and plover be considered in this plan?

Visibility is not a consideration in how the Plan is developed. These three examples already have their own management plans. The list of species of greatest conservation need is determined by biological factors, not by whether a species is highly visible. Completion of the Comprehensive Plan won't change the fact that SDGFP will always be involved in contentious issues.

29. Who approves the introduction of species into SD and how are the impacts addressed?

This is a complicated question, since the answer depends on whether the species is a wildlife or plant species, whether it is being reintroduced to the state or introduced for the first time, whether it is a federal endangered species, whether it is being introduced on tribal lands only, etc. The Comprehensive Plan in itself does not change existing laws or regulations.

30. How can we make wildlife accessible to youth?

In addition to many education efforts already performed by SDGFP, education will certainly be a byproduct of this plan. It is important that education programs reach out to young people and include information about biodiversity and ecosystem management and why these things are so important to each and every citizen. As young people become more aware that wildlife has a purpose in their lives, they will want to pursue more knowledge, which will make all wildlife species more accessible to them.

31. Will public involvement and education be part of this plan?

The Plan is required to address public involvement, and it will be an important facet of SDGFP's planning effort. Although education is not specifically required, SDGFP already has a strong focus on environmental education, and that will be reflected in the Plan.

32. Will urban wildlife conflicts be addressed in this plan?

Specific issues, such as urban deer conflicts or mountain lion presence near Black Hills communities, will not be discussed, but the broader issues of urbanization and loss of wildlife habitats will likely be identified as conservation threats in the Plan.

33. How will the conservation impacts of drought, salt cedar, noxious weeds, coal bed waste water, house development on fragile soils, water quality, lakes and rivers, prairie diversity, lack of fire, loss of wetlands, tree planting on the prairie, CRP, land conversion, drainage, and urban sprawl be built into this conservation plan?

Each of these threats is impacting South Dakota's wildlife habitats, and they will be discussed in the threats assessment portion of the Plan. Many of these issues are beyond the authority of SDGFP or the State of South Dakota, which increases the importance of getting buy-in from other entities, both governmental and private, for better land and resource stewardship in South Dakota.

34. Who makes the decisions on this plan's completion and its implementation?

The completed plan is the responsibility of SDGFP, which operates under the authority of the Department Secretary and the SDGFP Commission. SDGFP will implement as much of the Plan as staff and funding allow, but the Plan is intended as a guidance document for the State of South Dakota, not just for SDGFP. If coordination efforts are successful, other agencies, private organizations and individuals, and tribes will also help to implement portions of the Plan that are relevant to them.

35. How can the public be better informed on issue for all wildlife?

To be better informed watch the newspaper, listen to the news, and visit the SDGFP website for wildlife diversity and Comprehensive Plan updates. To learn more about national efforts on this topic, visit the Teaming with Wildlife website: http://teaming.com/ (please cut and paste this web address into your web browser)

36. How can my friend, who couldn't be at the meetings, provide input?

Anyone can provide input or stay updated on the Plan by visiting this website: http://www.dynamicsolutionsgroup.com/SD/html/index.php (please cut and paste this web address into your web browser)

Appendix H-4 – South Dakota's CWCP web page for comments and to get involved (including joining the Advisory Team)

Comments Page...

First and Last Name, Please

Affiliation, Group, or Organization

Address

City

State

Zip Code

Email Address

10 digit phone number

Planning Comments:

How would you like to continue to be involved in this comprehensive wildlife planning? (advisory team, plan review, e-mail updates...)

Submit

Town Meeting Highlights
New Funding

Plan Elements

Plan Timelines

South Dakota Projects

Wildlife Diversity Homepage

Species of Greatest Conservation Need List

Comments and Get Involved!

Frequently Ask Questions

Appendix H-5 – Three examples of press releases used for providing information about South Dakota's CWCP

8-11-2004 GFP LOOKING TOWARD THE FUTURE

PIERRE, SD – The Department of Game, Fish and Parks is involved in an important process that will help shape the future of fish and wildlife for South Dakota.

The agency is working in cooperation with wildlife enthusiasts to create a Comprehensive Wildlife Conservation Plan for the future. The plan will address the needs of fish and wildlife species in the state based on habitat. The plan will also identify the needs of South Dakota's rarest species.

All 50 states are creating similar plans. When fit together, they will show the current state of America's wildlife and will identify critical conservation actions needed to keep fish and wildlife populations healthy.

"This plan will allow South Dakota to be proactive in identifying voluntary conservation actions and identify partnership roles for citizens and groups," said Doug Hansen, director of the Division of Wildlife. "Full funding for all wildlife has been a critical need for us. Hunters and anglers have traditionally provided generous funding for species that are hunted and fished, but this new congressional funding will address the hundreds of species in South Dakota that fall outside traditional funding sources. Many conservation interests have been working for 20 years to identify stable funding for all species. Our planning for the new State Wildlife Grants Program is the core of a state and national program for keeping America's wildlife healthy."

Eileen Dowd Stukel, Wildlife Diversity Coordinator for GFP added that, "At this point State Wildlife Grants funding is not permanent, but it gives us an exciting opportunity to identify strategic conservation needs and to justify long-term funding across South Dakota and across the country."

GFP will seek assistance from citizens and organizations as it develops this plan for South Dakota. "We're going to need everyone's input, including sportsmen and women, bird watchers, conservationists, tribes, farmers, ranchers and other agriculture producers," said John Cooper, Secretary of the Department.

Public meetings will be held across the state during September. This will be South Dakotan's opportunity to voice their conservation concerns and help shape the Comprehensive Plan.

Details about the meetings, including dates and locations, will be made available soon. For more information on the process and meetings, access the web site at www.dynamicsolutionsgroup.com/SD.

8-25-2004 South Dakotans for Wildlife Legacy

PIERRE, SD – South Dakota residents will have an opportunity to shape the future of this state's wildlife resources at a series of regional meetings to be held Sept. 13-16.

The Department of Game, Fish and Parks is hosting the meetings to allow citizens the chance to voice their opinion on issues and ideas that will shape the future of South Dakota's fish and wildlife legacy.

GF&P is spearheading an ambitious effort called the South Dakota Comprehensive Wildlife Conservation Plan. A variety of wildlife community members, including government agencies, agricultural interests, conservation and sportsmen's groups, and other South Dakotans committed to wildlife conservation are designing the comprehensive plan.

The result will address the needs of all fish and wildlife using a habitat approach. Special attention will be given to South Dakota's rarest species.

Collecting public input is considered one of the most important parts of this planning process.

"This is an incredible opportunity for South Dakota to make great strides in fish and wildlife management and to keep species from becoming endangered. We can use this program proactively to assure that our children and grandchildren enjoy all the great things South Dakota has to offer to hunters, anglers, birdwatchers, or simply people who enjoy being outdoors," says Doug Hansen, Wildlife Division Director for SD Game, Fish and Park.

Open houses will be held in Rapid City, Oacoma, Sioux Falls and Watertown during the week of September 13-16, 2004. Anyone with an interest in wildlife is invited to attend and participate. The meeting schedule is:

- September 13, 2004-Rapid City 6:30-8:30 p.m. at the Peace Officer's Association Building.
- September 14, 2004-Oacoma 6:30-8:30 p.m. at the Oacoma Community Center at I-90 and exit 260.

- September 15, 2004-Watertown 6:30-8:30 p.m. at the Ramkota Hotel off of I-29.
- September 16, 2004-Sioux Falls 6:30-8:30 p.m. at the Radisson Hotel, I-29 and 41st street, exit 77.

All 50 states are creating similar comprehensive wildlife plans. When fit together they will show the current state of America's wildlife and identify actions needed to keep fish and wildlife populations healthy.

You can also express your thoughts and ideas about the planning process on-line at *http://dynamicsolutionsgroup.com/SD/public_webform.htm*.

More information about the wildlife diversity program can be found online at: *http://www.sdgfp.info/Wildlife/Diversity/index.htm*, and more information about these meetings can be found at *www.dynamicsolutionsgroup.com/SD/meetings.*

11-8-2004 GFP Takes Comments On Planning Effort

PIERRE, S.D. – The Department of Game, Fish and Parks held a series of four open house events at various locations across the state during the month of September.

The agency invited the public to hear about a planning effort called the South Dakota Comprehensive Wildlife Conservation Plan, which takes a broad view of landscapes from a fish and wildlife perspective. The plan considers:

- What are South Dakota's essential habitats, and where are they?
- What habitats have changed since South Dakota was settled?
- Which animals need special attention to ensure their long-term survival?
- How can this state be more proactive in wildlife and habitat management?

The meetings were facilitated by Bruce Hawkinson of Dynamic Solutions Group, a firm that specializes in gathering public input.

"South Dakotans have a tremendous amount of interest in wildlife, and many see the state's natural attributes as an important reason people visit and live in the state," Hawkinson said. "But there is some skepticism that ideas shared with Game, Fish and Parks will be taken seriously."

Hawkinson said that it was apparent from the meetings that South Dakotans have a good understanding of what some of the threats are to wildlife. "Without fire, prairies revert to forests. Tilled prairies are less drought resistant. Drained wetlands make the landscape more fragile and more affected by drought. The Missouri River is impounded and no longer functions as a free-flowing river. Many of the threats in South Dakota are similar to those in other states, but at a smaller scale."

The Department of Game, Fish and Parks is working with federal agencies and interested tribes, organizations and individuals to identify conservation threats to wildlife, conservation actions needed to alleviate those threats, management goals, and partnerships to improve resource management in South Dakota.

"The state's economy depends on the wise use of natural resources and the sustainability of those resources for our children and grandchildren," Hawkinson said.

Game, Fish and Parks is seeking the assistance of all South Dakotans to be part of the Comprehensive Wildlife Conservation Plan. The plan is part of a process that is bringing new funding for fish and wildlife management into the state.

South Dakota's approach will help in the effort to avoid future endangered species issues, and offers the potential to energize diverse groups into partnerships that will help with land and resource stewardship to benefit fish and wildlife.

To help with this important effort, citizens can find more information and volunteer by going to the GFP website at www.sdgfp.info. Once there, visitors should hold their cursor over the subheading "Wildlife, Hunting, and Fishing," click on the link to "Wildlife Diversity," then click on the link "South Dakota Comprehensive Wildlife Conservation Plan."

Appendix H-6 – Summary of the coordination effort with other agencies, colleges and tribes

June 17, 2004 – Interagency meeting with universities in eastern South Dakota
Representatives of universities in eastern South Dakota (South Dakota State University, University of South Dakota, Dakota State University, Northern State University, University of Sioux Falls, and Dakota Wesleyan University) were invited to an informational meeting about the South Dakota Comprehensive Wildlife Conservation Plan on June 17, 2004. Highlights of the meeting were as follows:

- A number of potential information sources were mentioned that might be of use during Comp. Plan preparation, such as the North American Fisheries Action Plan (habitat focus, pallid sturgeon, freshwater mussels), benthic research conducted by Chuck Berry, results of the EMAP project, SDGFP lake data, river fish inventories (700 sites visited), and small impoundments' research data collected by graduate students Stukel and Wilson.
- Drew Ricketts shared background about work being conducted by the Missouri River Institute in Vermillion, SD, which will be fully operational by August 2005. Drew also mentioned herp surveys being done by Karen Gaines in the Missouri and James rivers.
- Other potential data sources are a P-R completion report by Ray Linder concerning the Missouri River, based on photos taken prior to dam construction; a GIS database housed at the Missouri River Institute; SD Geology Survey data, housed at the Geography Department at USD; DENR lakes data and the STORET database; and eastriver and westriver wetlands data, which should be accessible through SDGFP GIS.
- K.C. Jensen recommended that some of the major national bird conservation planning efforts (Shorebird Conservation Plan, Partners in Flight plans) might be of use, such as in supporting selection of certain species of concern.

Attendees:
Jon Haufler, EMRI
Eileen Dowd Stukel, SDGFP
Larry Gigliott, SDGFP
Dave Willis, SDSU, phone 605-688-4784, email David.Willis@sdstate.edu
K.C. Jensen, SDSU, phone 605-688-4781, email Kent.Jensen@sdstate.edu
Michael Kjellsen, SDSU, phone 605-688-5894, email Michael.Kjellsen@sdstate.edu
Rex Johnson, USFWS, phone 218-736-0606, email Rex_Johnson@fws.gov
Michael Brown, SDSU
Drew Ricketts, USD, representing Karen Gaines and Jim Novak, phone 605-677-6567, 414 E. Clark, Vermillion, SD 57069, email kfgaines@usd.edu
Dan Hubbard, Department of Wildlife and Fisheries Sciences, SDSU Box 2140B, Brookings, SD 57007-1696, phone 605-688-4780, email Daniel.Hubbard@sdstate.edu
Chuck Berry, USGS SDCFWRU, SDSU Box 2140B, Brookings, SD 57007-1696, phone 605-688-6121, email Charles.Berry@sdstate.edu

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June 18, 2004 – Interagency meeting with Natural Resources Conservation Service
NRCS staff were invited to meet with SDGFP staff and contractor Jon Haufler regarding the South Dakota Comprehensive Wildlife Conservation Plan on June 18, 2004. Ten individuals participated in the meeting. Their names and contact information are included at the end of this memo. The agenda was as follows:

- Introduction to the Comp. Plan - Eileen Dowd Stukel, SDGFP
- South Dakota's approach to the public involvement requirements - Larry Gigliotti, SDGFP
- South Dakota's planned ecosystem approach - Jon Haufler, EMRI
- Discussion of NRCS' potential data sources

- Feedback on NRCS' potential involvement in the progress of SD's Comp. Plan
- Open discussion

Following the background sharing portion of the meeting, the remaining discussion focussed on the status of NRCS' ecological site classification and the useability of other NRCS data sources in the Comp. Plan. Various limitations were discussed and acknowledged, and NRCS' two assistant state conservationists expressed a willingness to allow their personnel to participate as time and other commitments allow. Dave Schmidt will serve as the primary initial contact, with Connie Vicuna as a second contact when the focus shifts to the fish and wildlife aspects of the planning process. Dave will work in close cooperation with Dan Shurtliff and others as needed. Jon Haufler will follow up with another meeting with Dave and Dan to gather input on the ecosystem diversity matrices by ecoregion and on existing vegetation conditions.

Attendees:
Jon Haufler, EMRI
Dave Ode, SDGFP
Eileen Dowd Stukel, SDGFP
Larry Gigliotti, SDGFP
Ron Nadwornick, NRCS, phone 605-352-5648, email Ronald.Nadwornick@sd.usda.gov
Denise Grawer, NRCS, phone 605-352-1203, email denise.grawer@sd.usda.gov
Connie Vicuna, NRCS, phone 605-352-1235, email connie.vicuna@sd.usda.gov
Mike Kuck, NRCS, phone 605-352-1206, email michael.kuck@sd.usda.gov
Dave Schmidt, NRCS, phone 605-352-1236, email david.schmidt@sd.usda.gov
Dan Shurtliff, NRCS, phone 605-352-1254, email daniel.shurtliff@sd.usda.gov

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July 1, 2004 – Interagency meeting with U.S. Fish and Wildlife Service

At the request of the U.S. Fish and Wildlife Service Region 6, we participated in a meeting on July 1, 2004 with the primary purpose of updating their personnel on our Comp. Plan progress. Paul Gertler, Assistant Region Director for Migratory Birds and State Programs and Amelia Orton-Palmer, Federal Assistance and state liaison for Comp. Plans/Strategies, joined SDGFP staff and SD USFWS Ecological Services staff.

A handout was shared that included specific accomplishments to date, a description of the process for identifying state species of conservation need, a draft plan outline and map of South Dakota management units provided by EMRI, and a description of future plans for coordination.

Several specific questions were asked or addressed, including the relevance of NEPA compliance to the Comp. Plan, the process for identifying state species of concern, methods of linking processes across state lines, whether the Plan should include specific projects and budgets, and any initial concerns about South Dakota's approach. No concerns were expressed by USFWS personnel. The NAT has developed a principles document related to the 8 essential elements. This will be shared with states shortly.

Attendees:

USFWS:
Paul Gertler
Amelia Orton-Palmer
Pete Gober
Sara Reindl

SDGFP:
John Cooper
Emmett Keyser
Jeff Shearer
Alyssa Kiesow
John Kirk
Doug Backlund
Wayne Winter
Doug Hansen
Eileen Dowd Stukel

August 5, 2004 – Interagency meeting with Forest Service national grasslands staff
Forest Service national grasslands staff from Nebraska National Forest and Dakota Prairie Grassland were invited to meet with SDGFP staff and contractor Jon Haufler regarding the South Dakota Comprehensive Wildlife Conservation Plan on August 5, 2004 in Pierre. Ten individuals participated in the meeting. Their names and contact information are included at the end of this memo. The agenda was as follows:

- **Introduction to the Comp. Plan – Eileen Dowd Stukel, SDGFP**
- South Dakota's ecosystem approach – Jon Haufler, EMRI
- Discussion of potential data sources within the national grasslands
- Feedback on national grassland staff's potential involvement in the progress of SD's Comp. Plan
- Open discussion

This meeting proceeded as other interagency meetings have, with discussion of relevance of Forest Service planning documents, both at the grassland and regional levels, and data sources that might be useful in characterizing historical conditions in South Dakota and in describing current ecological conditions. Greg Schenbeck will be sharing several documents of potential interest with Jon Haufler. All Forest Service personnel expressed a willingness to be contacted for future input or information needs. Jon invited anyone with a specific interest to attend his historical committee meeting in early October in Hot Springs.

Attendees:
Eileen Dowd Stukel, SDGFP
Dave Ode, SDGFP
Jon Haufler, EMRI
Sara Reindl, USFWS, phone 605-224-8693, sara_reindl@fws.gov
Scott Larson, USFWS, phone 605-224-8693 x 32, scott_larson@fws.gov
Glenn Moravek, USFS, phone 605-5517, gmoravek@fs.fed.us
Greg Schenbeck, USFS, phone 308-432-0313, gschenbeck@fs.fed.us
Dan Svingen, USFS, phone 701-250-4443, dsvingen@fs.fed.us
Jack Isaacs, USFS, 605-374-3592, jisaacs@fs.fed.us
Jim Wickel, USFS, 701-250-4463 x 109, jwickel@fs.fed.us

August 6, 2004 – Interagency meeting with Black Hills National Forest
Black Hills National Forest staff met with SDGFP staff and contractor Jon Haufler regarding the South Dakota Comprehensive Wildlife Conservation Plan on August 6, 2004 in Custer. Nine individuals participated in the meeting. Their names and contact information are included at the end of this memo. The agenda was as follows:

- **Introduction to the Comp. Plan – Eileen Dowd Stukel, SDGFP**
- South Dakota's ecosystem approach – Jon Haufler, EMRI
- Discussion of potential data sources within the national grasslands
- Feedback on BHNF staff's potential involvement in the progress of SD's Comp. Plan
- Open discussion

This meeting proceeded as other interagency meetings have, with discussion of relevance of Forest Service planning documents and data sources that might be useful in characterizing historical conditions in South Dakota and in describing current conditions. Forest Service employees remarked on the similarity between the forest planning process and the ecosystem process that SDGFP/EMRI is using for

the Comp. Plan. Approximately 60 wildlife species were identified in BHNF's planning effort. Relevant lists are the local interest species, management indicator species, and sensitive species. They will complete their draft amendment in one month.

Several resources/experts were mentioned, including Jack Butler, Skip Smith and Wayne Shepherd, a Black Hills hydrology study conducted by the SD School of Mines, and a BHNF forest vegetative data inventory (emphasis on overstory). A regional riparian/wetland assessment is being done for Region 2. A suggestion was made that the Comp. Plan use existing classification systems and focus attention on threats and needs. Kerry Burns was designated as BHNF's contact for the Comp. Plan. Deanna is willing to provide input on historical conditions. Copies of the following document were shared with SDGFP/EMRI staff:

"A Century of Change in Black Hills Forest and Riparian Ecosystems"
B 722, February 1996
Authors: J. Barry Parrish, Daryl J. Herman, and Deanna J. Reyher, U.S. Forest Service, Agriculture Experiment Station, U.S. Department of Agriculture, South Dakota State University

Attendees:
Eileen Dowd Stukel, SDGFP
Dave Ode, SDGFP
Jon Haufler, EMRI
Dave Thom, USFS, Nat. Resources Staff Officer, 605-673-9206, dthom@fs.fed.us
Kerry Burns, USFS, Forest Wildlife Biologist, 605-673-9232, kburns@fs.fed.us
Steve Hirtzel, USFS, Fisheries Biologist, 605-673-9214, shirtzel@fs.fed.us
Cara Staab, USFS, Asst. Forest Wildlife Biologist, 605-673-9347, cstaab@fs.fed.us
Deanna Reyher, USFS, Interdisciplinary – Ecologist/Soil Sci./Botanist, 605-673-9348, dreyher@fs.fed.us
Brad Exton, USFS, Acting Forest Supervisor, 605-673-9202, bexton@fs.fed.us

October 4, 2004 – Interagency meeting with Badlands National Park, Wind Cave National Park, Jewel Cave National Monument, Bureau of Land Management, Bureau of Reclamation, and the Oglala Sioux Tribe (BNP, WCNP, BLM, BOR and OST; respectively)
The following entities were invited to meet with SDGFP staff and contractor Jon Haufler regarding the SD Comprehensive Wildlife Conservation Plan on October 4, 2004 at Badlands National Park: Badlands National Park, Wind Cave National Park, Jewel Cave National Monument, Bureau of Land Management, Bureau of Reclamation, and the Oglala Sioux Tribe. No reply was received from JCNM, but all other agencies were represented. Nine individuals participated in the meeting. Their names and affiliations are included at the end of this memo. The agenda was as follows:

- Introduction to the Comp. Plan – Eileen Dowd Stukel, SDGFP
- South Dakota's planning approach – Jon Haufler, EMRI
- Discussion of potential data sources
- Feedback on staff's potential involvement in the progress of SD's Comp. Plan

Following presentation of background information and handouts, the group discussed a number of suggestions for improving the presentation and content of the SD Comp. Plan, including:

- need overall goal statement for the plan that is easy for the public to understand and relate to; this should include a vision statement that serves to engage agencies and individuals in a shared vision for South Dakota's wildlife species and habitats
- concern was expressed about the importance of acknowledging jurisdictional boundaries within the state; this can be handled under an introductory section that includes guiding principles

- a suggestion was made that human impacts to wildlife be discussed from a broader perspective, with the possibility that such an approach might justify zoning restrictions
- NPS fire management plans are a potential data source
- Cheyenne River ST prairie management plan should be reviewed and cited
- a suggestion was made that the Plan have a progress reporting system, including follow-up to involved agencies
- agencies would like to be informed that a draft Plan is available for review, in addition to general news release information
- BNP is interested in pursuing potential SWG projects of mutual interest with SDGFP
- several individuals were mentioned as additional sources of information or as potential Advisory Team members: Dan Licht, NPS; Amy Symstad, Mount Rushmore; Cody Wenk and Marie Curtain, WCNP

Attendees:
Eileen Dowd Stukel, SDGFP
Dave Ode, SDGFP
Doug Backlund, SDGFP
Jon Haufler, EMRI
Dan Foster, WCNP
Chuck Berdan, BLM
Faye Streier, BOR
Brian Kenner, BNP
Bill Supernaugh, BNP
Jimmy Sam, OST

Faye Streier Bureau of Reclamation 515 9th Street Room 101 Rapid City, SD 57701	Chuck Berdan Bureau of Land Management 310 Roundup Street Belle Fourche, SD 57717
Dan Foster Wind Cave National Park RR 1, Box 190 Hot Springs, SD 57757-9430	William Supernaugh Badlands National Park PO Box 6 Interior, SD 57750
Jimmy Sam Oglala Sioux Tribe Parks and Recreation Authority PO Box 570 Kyle, SD 57752	Michael Catches Oglala Sioux Tribe Dept. of Natural Resources PO Box 320 Pine Ridge, SD 57770

March 31, 2005 – Interagency meeting with Cheyenne River Sioux Tribe
Bruce Hawkinson of Dynamic Solutions Group has attempted to engage South Dakota tribes in the Comprehensive Wildlife Conservation Plan process by offering briefings to interested tribes. Bruce received favorable responses from the Oglala, Rosebud, Cheyenne River and Sisseton-Wahpeton tribes. Eileen Dowd Stukel followed up with these 4 tribes to set up specific meetings during late March, when Jon Haufler was available to travel to South Dakota for this set of meetings. Two tribes responded to the follow-up request – Cheyenne River and Sisseton-Wahpeton. Sisseton-Wahpeton personnel subsequently had an unexpected meeting conflict and were unable to attend a meeting at the Cheyenne River Sioux Tribe's Game, Fish and Parks Department office in Eagle Butte on March 30, 2005. Six individuals participated in the meeting. Their names and affiliations are included at the end of this memo. The agenda was as follows:

- Introduction to the Comp. Plan (handout)– Eileen Dowd Stukel, SDGFP
- Review of public involvement process to date and plans for public review of draft plan – Larry Gigliotti, SDGFP
- South Dakota's planning approach (PowerPoint presentation) – Jon Haufler, EMRI
- Discussion of potential data sources, pertinent publications or plans, and opportunities for future cooperative projects - All

The meeting proceeded as other interagency meetings have, with discussion of relevance of tribal planning documents and data sources that might be useful in the preparation of the Plan. Two planning documents were recommended for inclusion – the Prairie Management Plan and the Title VI land management plan prepared by CRST. Much of the discussion dealt with projects and programs run by CRST that are of an ecological nature, much as the SD Comp. Plan is being designed. The group also discussed the potential that this collection of plans/strategies may influence federal funding priorities in the future. CRST and other tribes will be notified when the draft plan is available for comment.

Attendees:
Eileen Dowd Stukel, SDGFP
Dave Ode, SDGFP
Larry Gigliotti, SDGFP
Jon Haufler, EMRI
Joanna Murray, CRST GFP
Dennis Rousseau, CRST GFP

Appendix H-7 – Table 1. List of people/groups providing comments.

ID #[1]	Comments provided by…	Contact information (if provided)…
1	Jackson County Land Use Committee	PO Box 280, Kadoka, SD 57543
2	Joe Logue	HCR 46 Box A1, Oelrichs, SD 57763
3	Don Rathert	2701 Mystic Mt. Rd., SD 57702-7061
4	Mary Miller	35333 115th St., Leola 57456
5	Greg Schenbeck Wildlife Management Biologist	Nebraska National Forest, 125 North Main Street, Chadron, NE 69337 (308) 432 - 0313, fax 0309
6	Stan Boltz (NRCS) State Range Management Specialist	*no contact information provided*
7	Dan Shurtliff (NRCS) Assistant State Soil Scientist	*no contact information provided*
8	Connie Vicuña (NRCS) Biologist	200 Fourth Street SW, Huron, SD 57350 (605) 352-1235
9	Badlands National Park	PO Box 6, Interior, SD 57750
10	Dr. Tom Huhnerkoch	Lead, SD 57754 (605) 584-1958
11	Carrie Longwood South Dakota Stockgrowers Association (Ken Knuppe, President)	426 St. Joseph Rapid City, SD 57701
12	Nancy Drilling Rocky Mountain Bird Observatory www.rmbo.org	SD Colonial Waterbird Monitoring Project 230 Cherry St. Fort Collins, CO 80521 tel: (970) 482-1707 cell: (970) 222-5884 nancy.drilling@rmbo.org
13	Mountain Lion Foundation	PO Box 1896, Sacramento, CA 95812
14	Jeff Lerner, Defenders of Wildlife Director, Conservation Planning	202-772-0291 jlerner@defenders.org
15	Nancy Hilding Prairie Hills Audubon Society	6300 W. Elm St. Black Hawk, SD 57718
16	Jack Cole Spearfish Canyon Preservation Trust	P.O. Box 882 Spearfish, SD 57783
17	Dale Peters	712 W. Addie St., Lead, SD 57754

[1]This ID # is used to identify the origin of comments provided in the Appendix 7.7 – Table 2.

Appendix H-7 – Table 2. General comments and specific comments (by chapter) on the DRAFT South Dakota Comprehensive Wildlife Conservation Plan (July 18 – August 19, 2005).[1]

General Comments	
(ID #)[2] Comment	**Response** NOTE: Some comments were statements of fact or opinion that did not lend themselves to specific responses or changes to the plan. In those cases, no response is indicated.
(1) The Jackson County Land Use Committee was created by the Jackson County Board of Commissioners in May of 2003. The Jackson County Land Use Committee is charged with coordinating its efforts with federal and state land management agencies in the development and implementation of land use plans and management actions which are compatible with the best interests of Jackson County and its citizens. The Jackson County Land Use Committee requests any plan or action that places or encourages land-use restrictions on lands within Jackson County or in any other way reduces the economic production of Jackson County be amended in order to eliminate these concerns.	This plan is a voluntary guidance document and does not place land-use restrictions on any land nor provides any specific encouragement for any specific land-use action.
(1) The Jackson County Land Use Committee does not believe that an accurate measurement of the health of an ecosystem can be obtained when only species that are in various and questionable stages of decline are used as indicator species. Jackson County is very proud of the numerous species and the abundant wildlife that is present today in the county. The Jackson County Land Use Committee respectfully requests that while this plan will not manage for game species and other species that already are under some form of management plan, that they be included when "ecosystem health" is discussed.	All wildlife, especially including game species, will be considered when evaluating ecosystem health. Just because a species was not included in the list of Species of Greatest Conservation Need does not mean a species is not important.
(2) Lewis & Clark used no less than 9 times in section 3 as historical reference-is applicable only to Missouri River eco-region, as they stayed on or near the river. Limited value as historical facts due to limited scope and timing of their observations.	Reference to “time of Lewis & Clark” was used to provide a time reference for the reader, not as a reference for species distributions.
(2) I fail to find acknowledgement of scientific fact that species “naturally” become extinct.	Natural extinction is a commonly accepted fact. Extinction is a natural process, however human activities in the past 100+ years have increased the rate of extinction many fold. Neither a statement that it is a natural process nor a discussion of human alteration of extinction rates were included in the document, as both are generally acknowledged and accepted facts.[3]
(3) References are made in all Ecoregions to Lewis and Clark observations. They only traveled along the Missouri River so they could not comment on plants and animals in the eastern or western parts of the state. And the plants and animals of eastern SD are different from those in the Black Hills region.	Reference to “time of Lewis & Clark” was used to provide a time reference for the reader, not as a reference for species distributions.
(3) The method of dealing with plants and creatures of concern are all the same and that will not work.	unsure of comment's meaning – The overall ecosystem approach should address the needs

	to most species.
(4) Identify information gaps for each species and a plan of action to work with partners/Universities to obtain the needed information	Operational suggestion - this level of detail would not be included in a strategic plan.
(4) Develop a more specific action steps to take in order to link this plan with other states and provide cross boundary implementation. At the very least the plan should define ways that states will share information and discuss their progress.	Operational suggestion - this level of detail would not be included in a strategic plan.
(4) Prioritization is needed in this plan. If a priority were given for each threat for each species, this plan would be more useful to partners, and would help to illustrate where limited time and resources should be spent to get the biggest bang for the buck. For some species this may be a "best guess" at which threat is the biggest cause for concern. A more detailed plan of action and implementation process should be identified for at least the highest threats (i.e. habitat conversion effects the most species according to the table 5.7 but this plan does little to address ways of preventing further habitat conversion.)	Operational suggestion - this level of detail would not be included in a strategic plan. This strategic plan is "comprehensive" from the standpoint of viewing South Dakota as a whole, not in providing separate detailed species recovery plans for every species in South Dakota.
(4) More biological data could be provided for each species such as area relationships (if known), current/desired population size, relationships to grazing practices, etc. References for specific information should be cited in order to help practitioners/partners find where the data came from if they want to gain a more detailed understanding of the problem. For example vehicle collisions is stated as a cause of concern for burrowing owls. A citation should be given for this to justify why it is listed and to provide a source of further information for practitioners. If possible further information such as the extent of mortality due to collisions should also be given to help prioritize this threat with the others that are listed.	Operational suggestion - this level of detail would not be included in a strategic plan. A decision was made early in the planning process to use non-technical style of writing, with only limited use of citations.
(6) This comment relates to the comment on flood events. It seems that your conclusion is that most if not all of the riverine/riparian areas were herbaceous dominated. However, according to a Rocky Mountain Research Station paper (Research Paper RMRS-RP-8, Native Woodlands and Birds of South Dakota: Past and Present) "Historic evidence indicates that native woodlands were part of the presettlement prairie landscape." They are referring to cottonwood, ash, hackberry & boxelder trees that apparently occurred along rivers and other more minor streams/riparian areas. The publication shows pictures of mature trees taken in various locations between 1902 and 1909. Also historical accounts are included by people attempting to traverse the area. So my comment basically is that in terms of woodlands, you may want to consider adding a deciduous element, which would include species as mentioned above. If you want some information that we have developed in MLRA 64 (Loamy Overflow ecological site, woody draws), I can send that to you.	Riparian/wetland areas were not assumed to be herbaceous dominated. This is evidenced by the fact that all riparian/wetland EDMs include emergent, shrub, and forested categories. The goal of future research will be to characterize each of the riparian/wetland EDM's with descriptions of plant communities by ecological site and historical disturbance regimes. This will include descriptions of woodland/deciduous types. Further, NRCS ecological sites (riparian/wetland systems such as loamy overflow) were used, in addition to NWI data, to delineate riparian/wetland sites for mapping purposes.
(6) On several of the species of concern, under the causes of concern you have listed loss of nesting and	*see preceding statement;* as information is developed on plant communities relative to

roosting trees near water bodies, but I don't see where this type of community is described in a matrix.	ecological sites and historical disturbance, habitat variables important to wildlife species will also become available
(6) On tables showing number of species in each habitat descriptor, it would be helpful to somehow list the species with codes.	A list of species has been included in each figure.
(6) In looking at the conservation goals in acres matrices, it appears that the model is heavily influenced by the fire return intervals. Yet only ¼ (23 of 90) of the species of greatest conservation need are shown being impacted by modified/suppressed fire regimes. It seems either the model or the matrices are overemphasizing the impact of fire.	Maintaining or restoring ecosystem diversity is a separate concern from the issue of SoGCN; historically, fire was an important disturbance element in South Dakota; if we evaluated all wildlife species (not just SoGCN) in South Dakota we would likely find more species dependent on the fire maintained ecosystems than on "fire-free" ecosystems throughout SD. In addition, 23 out of 90 is a pretty significant number of species to be impacted by a particular factor.
(9) The plan is a good idea but doesn't seem to have any real teeth. Overall, the plan is overwhelming and difficult to understand.	By definition a plan identifies "a course of action". We believe the SD CWCP thoroughly describes the philosophy behind the course of action, the course of action, and steps to evaluate the course of action. The plan does not incorporate the operational details to achieve the objectives of the plan.
(12) Re: classify ecological sites using soil types (as explained in Section 3, p. 10) All of this seems to be an exercise in classifying the vegetation of South Dakota. However, this is a Wildlife plan and you do not convincingly make the link between the ecological sites defined by soil types and wildlife diversity. It isn't clear that if you preserve 10% of a certain classification, what that means for wildlife. What justification do you have for dividing for example, grass/shrubs ecosystem, by soil type? Is the faunal community different between soil types? Are there certain soil-types that produce the exact same wildlife community? Are animals responding to the landscape in this manner? You don't address any of this. This doesn't seem to be a 'wildlife-centric' classification (i.e., classifying the landscape from wildlife's point of view) which I expected for a Wildlife Plan.	All wildlife species are dependent on physical characteristics of vegetation or other non-vegetation features for their "habitat". Classification systems help delineate similar conditions on the landscape and aid in understanding distributions and habitat needs of wildlife species. Soils, combined with other variables, are a well-known determinant of plant species distributions, as well as plant assemblages/communities. Since many wildlife species are dependent on certain types of plant assemblages/communities, a classification of soils can help us predict both plant and animal occurrences.
(12) Re: classification of aquatic systems (line 20, p 12, section 3) and riparian/wetland systems (line 36, p. 11, section 3). Curiously, you define your grassland systems abiotically (soil type), which is doesn't seem to have a direct relationship to different types of wildlife communities, but you refuse to define riparian, wetland, or aquatic systems with abiotic factors, preferring a 'functional' approach. But, while terrestrial organisms are responding to vegetation structure which is based on abiotic factors, aquatic organisms are responding directly to abiotic factors (temperature, water flow, water depth, etc.). The fauna of a shallow semi-permanent depression with submergent vegetation is radically different from the fauna of a deep lake. If you protect X% based on your classification scheme, will you really	Abiotic factors were used in the development of the riparian/wetland and aquatic EDM's; this includes the interaction of topographic position and hydrological influences on the riparian/wetland and aquatic ecosystem (i.e., lake, depressional, riverine); functional simply refers to how the riparian/wetland and aquatic ecosystems remove/store water in the landscape. We agree that the fauna of a shallow, semi-perm depression is different than the fauna of a deep lake – that is why the classification includes both of these ecosystems. We have also suggested that the aquatic macro-invertebrate community may be appropriate to

protect all types of aquatic diversity? Is there some way to define your aquatic and wetland systems by faunal communities or by some way in which the resulting categories are different species assemblages?	characterize the differences in aquatic ecosystems.
(12) Re: protecting X% of each category as a means of preserving wildlife diversity. As much research over the past 10-20 years has shown, the size, shape, and landscape matrix of preserved plots are just as important to wildlife as the percentage of land preserved. In general, the larger the plots, and the closer together and more connected the plots are to one another, the more likely you are to maintain viable wildlife populations. The size and relative positions of the protected plots should be strategically chosen and monitored to maximize wildlife diversity.	In general, we agree with this statement as presented in Section 6, page 3, and paragraph 1. However, we cannot scientifically support the statement that land must be in a "preserved" condition to function as better habitat for a species.
(11) The document does state that the authors of the plan are not necessarily attempting to return the land to its original state. That is good because there is no such thing as the original state, except when the earth was formed. Obviously it would be impossible to accomplish that. Just as with everything, the landscape, water ways and species numbers are constantly changing. That is a fact of life. There is no way to maintain any of those variables for an extended period of time.	
(11) The Stockgrowers believe that a cost – benefit analysis should be published to assure the public that the funding that the state will receive will be worth the expense and time of preparing this document. Additionally, the Stockgrowers believe the public should be made aware of the actual plan for the use of the federal funds that are promised. This should be very specific. Additionally, the Stockgrowers disagree with the underlying philosophy of this plan, which seems to be that more funding will allow for more wildlife conservation. That is simply not true and has been proven. Conata Basin is a perfect example. Millions of taxpayer dollars have been spent to create a wasteland of devastation, not conducive to wildlife or forage production.	1st point: cost-benefit analysis not consistent with strategic plan approach; 2nd point: Final plan will be on SDGFP website.
(10) any plan of any kind although you mention that big game is covered elsewhere, must contain specifically here in sd the large predators, puma, bobcat, wolf and possibly the black bear. this plan does not and clearly shows more lip service than substance. you push rentlessly for puma hunting, exploit the bobcat, as evidenced by annual increases of offtake yet you have no concrete population density values. even though you do list the swift fox and the prairie dog, you went out of your way to poison the dogs and frankly risk destruction of the very slim repopulation of black footed ferret in the conata area just to appease less than 60 ranchers. the lion hunt is driven by the same bias and personal adgendas. any plan that does not include in its guidence and conservation the large predators falls short of the agencies mission. finally to say in print that you will do almost anything to "prevent any action that will keep a	This comment is mainly due to the recent decision to have a mountain lion season in South Dakota. The mountain lion and bobcat populations in South Dakota are well studied and determined to be healthy, and SDGFP has a comprehensive mountain lion plan for South Dakota. As for wolves and black bear we do not have confirmed viable populations and only one recently confirmed black bear sighting near the Wyoming boarder. However, using an ecosystem approach the needs of these species are still considered. In addition, the black bear is protected as a state threatened species, and the gray wolf is protected as a federal threatened species.

species frombeing listed as endangered" flies in the face of the future of said species. why must your department continue to push animals to the brink only then to run publicly to their rescue? please retool your plan to include the large cats and canines all so necessary to a truly balance environment... your plan falls short when not addressing the puma and other large predators...they surly fall into the group of "wildlife species of greatest conservation need"...how can the puma outnumbered over 5000 humans to one puma be even considered to be delisted from threatened..those are overbearing odds against its future existence..i find it amusing that such a plan could even print the name aldo leopold when the actions of the agency run counter to so many of his teachings...i pray for the large cats nightly..if only you would do the same.....	
(16) Provided a packet of information to the Department of Game, Fish and Parks that describes the "national disgrace" caused by neglect of the Black Hills and state's water resources; lists specific legal and biological solutions	Information provided more relevant to implementation of actions, i.e., operational suggestions.
(16) pay more attention to dipper losses in Spearfish Canyon	The American Dipper is a state threatened species that is included in this plan.
(17) why is "fool hen" subspecies of ruffed grouse not on species list	The term fool hen typically refers to spruce grouse, which are not found in South Dakota.
(13) Provided a detailed letter -- included below	These letters were reviewed and where possible were addressed in the plan, however, many points were either opinion statements or operational issues.
(15) Provided a detailed letter -- general comments included below	
(14) Provided a detailed letter -- included below	
In addition to the comments provided above, the World Wildlife Fund provided a CD copy of the Northern Plains Conservation Network document *Oceans of Grass: A Conservation Assessment of the Northern Great Plains* as comment on the draft SD Comprehensive Wildlife Conservation Plan.[4]	

Comments to Specific Sections of the Plan	
(ID #)[2] [page / line #][5] Comment	**Response**
Section 1	
(1) [p. 1 / lines 12-17] The Jackson County Land Use Committee takes exception to the statements made in this paragraph. It contains generalizations that we do not believe to be historically accurate and do not take into account numerous factors that contributed to the decline, and in some instances, the extinction of some species.	
(11) [p. 1 / lines 12-50, 1-3] This portion of the plan insinuates that the concept of wildlife conservation didn't exist until some hunters in the early 1900's decided to implement wildlife conservation strategies. How can the authors of this plan be confident that earlier inhabitants were incapable and/or unwilling to carry out conservation practices? It is only logical to think that the very first settlers to South Dakota would have had a keen interest in conserving game and other species. Some depended on wildlife to put food on their tables. This section also infers that additional federal funds will be needed to improve wildlife management. Experience has proven, in a number of cases (both wildlife related, and otherwise) that federal management and subsidization does little or nothing to improve the situation on state, federal or private property.	
(8) [p. 4 / lines 10 & 12] How does one obtain copies of these documents? Is there more reference information available?	The South Dakota Game, Fish and Parks, Wildlife Division Strategic Plan can be obtained from the Pierre office and see footnote #4 for a reference for the other document. In addition, the final document will have a more detailed reference list.
(6) [p. 5 / lines 18-19] ***Replace with the following:*** Developed by USDA/NRCS, it is a system of dividing the landscape into units for the purposes of inventory, evaluation, management and study. An ecological site, as defined for rangeland, is a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation.	Suggested changes were made in the document.
Section 2	
(8) [p. 2 / lines 1 & 2] Is there a reference or a web site to review this information?	Will be included in citations.
(8) [p. 2 / lines 16-18] Is there really a conflict in habitat demands between sage grouse and prairie dogs? Is this an appropriate example?	Example removed.

Section 3	
(8) [Figure 3.19] No seasonal depressional wetlands **(8) [Figure 3.23 & Table 3.24]** Nothing on seasonal depressional systems **(8) [Figure 3.24]** – No temporary and seasonal systems in the aquatic ecosystems? **8) [p. 17 / Table 3.3]** The depressional systems addressed in riparian and wetland ecosystems do not include Seasonal water regimes. Seasonal wetlands are a very important wetland water regime across South Dakota. **8) [p. 29 / Table 3.19]** No seasonal depressional systems are included.	The framework for the riparian/wetland classification is not based on Cowardin but Brinson, instead. Seasonal wetlands, as defined by Cowardin, ARE included in the Temporary wetland category of the EDM classification. As with most landscape classifications, there are always lumpers and splitters. We believe the EDM framework provides more detail than is usually encountered in landscape classifications but we still try to consolidate whenever possible to reduce the complexity of the classification.
(8) [p. 10 / line 47] Should ground squirrels or other burrowing animals be included as well as disturbance factors, especially in the eastern portion of the state?	This addition could be considered for future updates of the Plan.
(8) [p. 10 / lines 55-56] The fire intervals discussed by Naugle, Higgins and Bakker (2000) would seem to suggest shorter intervals in the Tall grass region and maybe longer intervals in portions of the Great Plains Steppe. (Naugle, D. E., K. F. Higgins and K. K. Bakker. 2000. A synthesis of the effects of upland management practices on waterfowl and other birds in the Northern Great Plains of the U.S. and Canada, College of Natural Resources, University of Wisconsin-Stevens Point, WI. Wildlife Technical Report 1. 28pp.)	This statement does not conflict with the discussion of fire regimes contained in the Plan.
(7) [p. 13 / line 23] Add: well drained and moderately well drained …	Suggested changes were made in the document
(7) [p. 13 / line 26] Add: Soils are deep to shallow with dominantly fine textures over most of the Ecoregion. The soils in the Southern part of the ecoregion are deep to shallow, with dominantly medium and coarse textures.	Suggested changes were made in the document
(3) [p. 13 / line 35] 160 day growing season is a rare exception	This number was taken from the MLRA descriptions developed by NRCS.
(6) [p. 13 / lines 38-39] Name of MLRA 54 is Rolling Soft Shale Plain (delete the word Montana)	Suggested changes were made in the document
(6) [p. 13 / line 39] Name of MLRA 58D is Northern Rolling High Plains, ***Eastern Part***	Suggested changes were made in the document
(8) [p. 13 / lines 43-54] Sagebrush steppe and the Sand Hills should be addressed in this section as important variants within this ecoregion	Suggested changes were made in the document
(6) [Figure 3.4] On the matrix for the Great Plains Steppe Ecoregion, for the Claypan group, I would do the same as you did for the Badlands group in terms of sagebrush, and put ***silver/big sagebrush*** instead of just Wyoming big sagebrush.	Suggested changes were made in the document

(6) [Figure 3.4] Again on the matrix, I would be tempted to put the Sandy Claypan ecological site in the Sandy group instead of the Porous Clay group.	Suggested changes were made in the document
(8) [p. 19 / line 51] Since Lewis and Clark did not go to the Black Hills, reference to "the time of Lewis and Clark" may not be appropriate.	Reference to "time of Lewis & Clark" was used to provide a time reference for the reader, not as a reference for species distributions.
(6) [p. 2 / line 14] classification with a classification of successional stages ***and/or alternative states*** (also referred to as state and transitional…	Suggested changes were made in the document
(6) [p. 2 / line 17] classification with a classification of succesional stages ***and/or alternative states***. Further, the EDM can be linked to a GIS and…	Suggested changes were made in the document
(3) [p. 23 / line 39] There were many vegetated sand bars in the Missouri River	Suggested changes were made in the document
(8) [p. 24 / line 2] Is there a common name for *Quadrula fragosa*	Changed to winged mapleleaf
(8) [p. 27 / lines 22 & 28] Prairie wolf or plains wolf	replaced with wolf
(6) [Figure 3.18] On the matrix, it should be ***broom snakeweed***, not snake broomweed.	Suggested changes were made in the document
(6) [Figure 3.18] On the matrix, I noticed that you have western snowberry on several groups in the long fire interval part. It seems that people might question a sprouter not being shown on the short fire interval part, but listed on the long fire interval part. The fire effects information from the Forest Service says the following: "Western snowberry sprouts vigorously from the root crown and rhizomes following fire; stands are usually denser in burned than in adjacent unburned areas. Spring and fall fires induce western snowberry sprouting, but frequent fires may reduce cover." So I suppose if the frequency was high enough under the short interval part, the snowberry might be removed, but it would have to be very frequent. In some studies out of Nebraska, they had to remove the snowberry every year for three to four years to get any success on taking it out. If it were me, I'd probably put snowberry on the Loamy group at the Moderate Grazing level under short interval fire (take out sideoats grama), and leave it on the Light Grazing level under the long fire interval part on the Loamy group. Then I would consider taking it off all the other groups. From my experience, snowberry is a good species to tell if you're on a Loamy versus a Clayey (i.e., snowberry typically doesn't do great on Clayey sites).	changed to eastern red cedar
(6) [Figure 3.18] On the matrix, should include Loamy Overflow as a site in the Loamy group.	Loamy overflow is included in the mapping of riparian/wetland ecosystems rather than grass/shrub ecosystems.
(3) [p. 3 / lines 39-40] Why are ND statistics in a SD plan	This was the best available information on lightning strikes that could reasonably be extrapolated to South Dakota.
(3) [p. 30 / lines 17-18] There is no area in eastern SD that is 1200 feet above the James River	Suggested changes were made in the document
(8) [p. 30 / lines 33-35] Small area in the NE corner of SD drains into Hudson Bay	Suggested changes were made in the document
(7) [p. 30 / lines 33-35] Many of the Streams in this	Clarified in the document text

region are "closed basin" (especially on the Coteau) and drain into the lake areas.	
(7) [p. 30 / line 40] Red River Valley MLRA number is 56, not 260; MLRA 107 in South Dakota has been recorrelated to MLRA 102C (Loess Hills)	Corrections were made in the document
(8) [p. 31 / lines 5-22] There are some important wooded habitats on the east side of the Prairie Coteau, such as Sica Hollow, that should be included in the descriptions	Suggested changes were made in the document
(6) [p. 4 / lines 32-44] Perhaps you address this in the next paragraph, but even at a 4 to 1 ratio, if my math is correct, that would still leave 7.5 million buffalo in scattered herds that did not migrate a lot. It would seem to me that the conditions you discuss in the next paragraph would have also been fairly prevalent (mosaics of vegetative structures due to repeated use patterns in relation to water sources). Certainly this must have been the case near Great Falls, Montana, where apparently Lewis & Clark described (in my words) "fields of cactus" when they portaged their boats.	If the concern is that we have not stated that heavy grazing occurred, we would suggest that the statement "Grazing is often intense in the path of a herd" does imply heavy grazing. In addition, the grass/shrub EDM's do identify heavy grazing as a normal disturbance event.
(8) [p. 4] Do you somewhere talk about the number of cattle that now graze the prairies and grasslands and compare the impacts on plant communities?	The current ecosystem conditions in SD are the product of over 100 years of different land use practices, not just what is occurring today. Evaluating current land use practices does not necessarily solve the problem. We prefer to identify a strategy to achieve the conditions required to maintain or restore ecosystem diversity, and as part of this strategy develop the information and tools to meet this objective.
(8) [p. 6 / line 36] Suggest that you replace the word "disturbance" with "influence"	We have consistently maintained throughout the document that beaver were an important disturbance element on the landscape; as "disturbance" is generally used to describe important ecological processes.
(8) [p. 6 / lines 39-40] Locations for beaver dams here seems somewhat inconsistent with the quote from Lewis and Clark in lines 17-23.	We agree that a major river like the Missouri River would not typically have beaver ponds stretched from bank to bank, however, backwater areas, sloughs, or slow water areas may have been appropriate beaver dam sites along the Missouri River.
(6) [p. 7] Maybe you cover this somewhere else, but it seems like in a discussion of flood events, it would be a nice place to discuss the importance of these events in the make-up & maintenance of riparian woody habitats. In other words, it seems that flooding is a necessary part in the establishment and later recruitment opportunities of the stream and lower woody draw trees. One "problem" that occurs is after downcutting and a reduction of flood flows, we often end up with trees on lower terraces that are getting old, and no recruitment is occurring.	This problem was discussed in Section 5, particularly in the Missouri River, riparian/wetland discussion
(3) [p. 9 / line 54] Northeastern SD has several thousand acres of forest	While evaluating the predominant historical ecosystems in SD, we determined that much of the current forest conditions in eastern SD are riparian/wetland forest with expansion into the

	surrounding uplands due to fire exclusion. Our definition of "riparian forest" extends upslope from the more narrowly restricted floodplain, thus would include forest acreage often considered "upland forest." Much of what is now bur oak forest was historically bur oak savanna.
Section 4	
(4) It would be more useful to have a detailed plan of action for each species addressing the main threats to that species. It would also help to have more information on where these species are now (population size) and what the goal should be for each. For monitoring purposes this information will be very important in order to assess success of programs that may be implemented as a result of this plan. This will also bring forth information gaps that should be address for each species.	Operational suggestion - this level of detail would not be included in a strategic plan.
(1) The Jackson County Land Use Committee does not find "conversion of habitat for agriculture or other purposes" a valid threat to the bird species that are found in Jackson County for the following reasons; 1. Most tillable soils in Jackson County have already been tilled. 2. An increasing percentage of tilled lands are being planted back to native grasses and forage.	
(1) [pages 12 & 21] The Jackson County Land Use Committee opposes the reduction of prairie dog control in Jackson County.	
(5) [p. 12] (Greater Prairie Chicken) Under "Key Habitat", I recommend adding "lightly grazed native grasslands and native grasslands that receive periodic annual rest from livestock grazing". Under "Causes of Concern" and "Habitat Loss/Degradation", I recommend adding "livestock grazing practices that result in monotypic grassland structure and inadequate spring nesting cover".	1st point: We find using the term "native" to be problematic as it would require us to add it to all 90 species; we have added the statement "as based on historical ecosystem conditions" to the definition of Key Habitat at the beginning of Section 4; we have also not used the term "livestock" as this would imply that key habitat is based on current conditions 2nd point: Suggested changes made in document.
(2) [pages 16 86] I fail to see how activities about or referring to genesis of man (anthropogenic) are detrimental to curlew or red belly snake habitat!!	Changed to *human*
(3) [p. 36] The Richardson Ground Squirrel is plentiful in northeastern SD	
(2) [p. 38] BLJM shouldn't be included if validity of sub-species hasn't been determined. The plan list is for species—not sub-species.	One of the action items is to investigate the taxonomic status to determine if this is a valid subspecies. The Plan is not restricted to species – other subspecies are included, such as the interior least tern and the white-winged junco.
(1) [p. 39] The Jackson County Land Use Committee has strong reservations to any Swift Fox reintroductions within the County for the following reasons; 1. The Jackson County Land Use Committee has	

determined that private landowners within the county do not have adequate liability protection for "incidental take" of a species on the South Dakota Threatened and Endangered Species list. 2. The Jackson County Land Use Committee is opposed to any action or plan that includes an increase in acres occupied by prairie dogs and/or would reduce the prairie dog control activities conducted within the County.	
(1) [p. 40] The Jackson County Land Use Committee requests that the planners stop focusing on increasing the number of prairie dog colonies and the size of the colonies, and instead focus on improving the "ecosystem health" of current prairie dog colonies. Jackson County is significantly impacted by the soil erosion, the water pollution, the noxious weeds, and the loss of AUM's to citizens of the county due to the current Black Footed Ferret management plan. The plans and actions for the Black Footed Ferret are currently being conducted by other government agencies and Non-Governmental Organizations. The Jackson County Land Use Committee does not believe that the State should focus it's energy on duplicating the work of federal agencies.	
(5) [p. 40] (Black-footed Ferret) Under "Causes of Concern", you may want to now consider listing "plague".	Suggested changes were made in the document
(2) [p. 55] RE: Causes of concern: Speculation of threats is in no way scientific.	Clarified in text.
(3) [p. 6] Civilization is not a deterrent to osprey nesting (personal observation)	
(3) [p. 8] The goshawk nests on power poles	
(1) [p. 9] The Jackson County Land Use Committee has two concerns with this section. First, the Jackson County Land Use Committee strongly objects to restricting the use of land that may be considered "habitat." State Government should not encourage other agencies to restrict the use of the land upon which our citizenry depends to maintain economically viable business operations. Second, the Jackson County Land Use Committee has been actively involved in getting legislation passed that will increase the amount of control activity conducted on prairie dogs colonies within the county and oppose any plans or actions that would reduce the control activity in Jackson County.	1st point: →changed to *reduce impacts*
(1) The Jackson County Land Use Committee does not find "conversion of habitat for agriculture or other purposes" a valid threat to the bird species that are found in Jackson County for the following reasons; 1. Most tillable soils in Jackson County have already been tilled. 2. An increasing percentage of tilled lands are being planted back to native grasses and forage.	
(11) [all Figures] These graphs are very difficult to interpret. They mention so few species of insects or	Very little research/inventory has been conducted on invertebrates, therefore, a

other species, it is difficult to believe that a thorough investigation was actually completed.	habitat approach is even more strongly justified.
(11) [Figure 4.4.1.5] This graph depicts an increased instance of need for wildlife conservation on active prairie dog towns than inactive ones. This confirms the very position that the Stockgrowers have always held – that prairie dogs deteriorate, rather than improve wildlife in any given area. This is especially true of overpopulated towns.	This concern was clarified in the document. Have also made the point that little research has been conducted that will conclusively delineate a species habitat by the disturbance categories identified in the EDM's, consequently, we may be over or underestimating a species distribution due to extrapolation of research based on current vegetation conditions
Section 5	
(8) [Figures 5.1.1, etc.] Naming the species of conservation need for each of the categories would be very helpful	Previously addressed under general comments.
(8) [Figures] Address seasonal depressional systems	Previously addressed in Section 4.
(9) [Table 5.7] For swift fox: I recommend that an "X" be added to the columns "Modified grazing regimes", "Ecosystem alteration / habitat degradation", and "Grazing / agricultural practices". From what we have seen so far with our fox recovery efforts, the surviving fox are selecting for low vegetation height associated with prairie dog towns and ultimately grazing. Grazing also causes prairie dog colonies to expand, thus producing more habitat for fox, ferrets and owls. Although it is a troublesome topic, expansion of prairie dogs through grazing practices benefits many species. For these reasons, I think that grazing should be addressed in the plan. This table was the only place that I could find any reference to it. Likewise for ferrets in Table 5.7: I recommend that an "X" be added to the columns "Modified grazing regimes", "Ecosystem / habitat conversion or loss", and "Grazing / agricultural practices". Once again, prairie dog habitat is the key and grazing practices have a tremendous effect upon colonies.	Suggested changes were made in the document.
(8) [Tables 5.1, 5.2, etc.] It might be helpful to the reader to have a column with totals on the right hand side.	Suggested changes were made in the document
(8) [p. 1 / line 28] Dams and ponds for water supply could also be included here	Suggested changes were made in the document
(8) [p. 10 / line 14] Definition of conversion needs explanation. The term "converted" should be further explained. Is it used in the context of a land use change or in the context of hydrologic modifications? **(8) [p. 8 / line 30]** The term "converted" should be further explained. Is it used in the context of a land use change or in the context of hydrologic modifications?	The manner in which the term conversion is used in Sect 5 is defined on page 1, paragraph 5; the term conversion/converted covers both land use and hydrological modifications in this context – where human-caused.
(8) [p. 10 / line 22] Add "or livestock water" after irrigation	Suggested changes were made in the document
(3) [p. 10 / line 24] If we have lost thousands of acres of prairie dog colonies, there would not have been grazing, historically, for all those bison!	
(3) [p. 10 / line 24] The water table in northeastern SD	

is the highest it has been in over seventy five years	
(8) [p. 10 / line 30] Add "provide livestock water before "control flooding"	Suggested changes were made in the document
(3) [p. 10 / line 36] Most ranchers use rotation grazing	
(9) [p. 10 / line 42] A map inserted here that includes each sub-region would allow the reader to see what areas of SD you are referring to. Figures 5.1.1 – 5.5.4 are really matrix tables and don't permit the reader to see the areas of SD being considered in this analysis.	Some clarification was added to the document to help address this suggestion.
(8) [p. 12] Add windbreak/shelterbelt plantings to the Land/water management practices	Suggested changes were made in the document
(6) [p. 12 / lines 15-16] Again, can you cite specific documented cases of this, or are you assuming that cattle blindly step on everything in their path. From my experience cattle are much more careful about where they step than a person would think. Certainly nesting may be affected by removal of cover, but if that's a concern, then say it.	Buss, I.O. and A.S. Hawkins. 1939. The upland plover at Faville Grove, Wisconsin. Wilson Bulletin: 51(4):202-220. Pavel, V. 2004. The impacts of grazing animals on nesting success of grassland passerines in farmland and natural habitats: a field experiment. Folia Zool.:53(2):171-178.
(6) [p. 12 / line 17] I would suggest striking "stock ponds" from this statement. I believe that animal entrapment in stock ponds is a rare occurrence.	Suggested changes were made in the document
(6) [p. 12 / line 24] Direct disturbance by what? What do you mean exactly by "Forest Management"	Clarified by adding "by logging equipment and related activities"
(6) [p. 12 / line 25] Soil erosion caused by what?	Clarified by adding "surface soil disturbance caused by logging equipment and road construction"
(6) [p. 12 / line 26] Why is this here? Are shrubs only controlled in forest situations? And what exactly are you suggesting is being impacted (i.e., obligate species or fire regimes)?	Addressed in Document – statement removed.
(6) [p. 12 / lines 6-7] Can you cite specific documented cases of this, especially in relation to pesticides and even more so, herbicides. If not, then you are making a presumption.	Comment questions well-documented impacts of pesticides. An obvious example of a pesticide that impacts a species directly is zinc phosphide, which impacts a prey species (black-tailed prairie dog) of the black-footed ferret. EPA pesticide labels commonly include restrictions that prohibit use in or near water because of negative impacts to aquatic life. Other labels restrict use of a certain compound to specific animals, such as below-ground rodents, because of the known negative impacts to nontarget species that live aboveground. A number of years ago, illegal dumping of Thimet near Pierre resulted in injury to several U.S. Fish and Wildlife Service agents, an occurrence that has happened more than once in South Dakota.
(6) [p. 12 / lines 8-10] Are there studies to support impacts on species in South Dakota due to fragmentation?	Bakker, K.K. 2000. Avian occurrence in woodlands and grasslands on public areas throughout eastern South Dakota. PhD Dissertation, South Dakota State University, Brookings.

	DeJong, J.R. 2001. Landscape fragmentation and grassland patch size effects on non-game grassland birds in xeric mixed-grass prairies of western South Dakota. M.S. Thesis, South Dakota State University, Brookings.
(11) [p. 2 / lines 29-37] This section discusses the assumption that free range bison heavily grazed burned areas and that this practice no longer occurs. This may or may not be true, regardless, just because that practice occurred, doesn't mean that it was the most healthy or most sustainable activity on the land.	The coarse filter strategy does not apply "value judgements" to the appropriateness of providing representation of all historical ecosystem conditions.
(8) [p. 3 / line 24] beaver dam removal (add the word "beaver" to the sentence)	Suggested changes were made in the document
(9) [p. 4 / line 14] Several large fires have occurred in the Black Hills recently (e.g. Jasper Fire) and should be mentioned in this section as a possible historical and future disturbance process for large areas in this area. Sometimes weather conditions do not allow immediate fire suppression.	Suggested changes were made in the document
(8) [p. 4 / lines 28-29] It might be helpful to provide some further explanation of what is meant by "less heterogeneous grazing practices"	Added "i.e., uniformly applied grazing levels across all pastures"
(8) [p. 4 / line 32] How prevalent were prairie dogs in the Black Hills?	Suggested changes were made in the document
(7) [p. 4 / line 32] I question that reduction in Prairie dog communities in the Black Hills ecoregion as a major factor. They may have had some impact in the foothills, but not in the Black Hills proper. I would remove this reference.	Suggested changes were made in the document
(9) [p. 4 / Table 5.3] I would expect urban/rural development to be greater than the total acres reported in this table –were these figures determined just like the previous GIS/GAP/SSURGO analysis?	Suggested changes were made in the document
(9) [p. 6 / line 7] Should add a sentence that addresses the dense un-harvested timber stands and decreasing forest health associated with increased insect infestation by the pine bark beetle.	First point was already addressed in the document; second point was added to the document.
(6) [p. 8 / lines 13-14] Saying that modern practices produce a homogenous landscape is at a minimum being too general. I would argue that on a landscape scale, you have probably just as much heterogeneity. With grazing systems that have more intensity of management, plant diversity is probably as high as it's ever been. And there are still those areas where poor management is being practiced, producing lower seral stages. In addition, there are areas of either CRP or other isolated areas where no grazing is taking place. So it seems to me that on a landscape scale, you have heterogeneity of both plant diversity and plant structure.	Recent research does not support this view; results indicate that the landscape is becoming more homogeneous under current land management practices (ie., Brennan et al., Fuhlendorf, etc)
(11) [p. 8 / line 17] This segment claims that the loss of thousands of acres of prairie dog habitat has further impacted many wildlife species. This claim contradicts the graph as discussed above. Additionally, it has not	

been proven that prairie dogs were more abundant at any time in history than they are at present. Plus, it is illogical to choose a certain time period in history to try and replicate. There may have been times in history that prairie dogs were more numerous. There have also been times in history that they were far fewer than they are today. How can an individual or an agency be given the authority to choose the particular segment of history that they feel is the model to be followed? The benefits and costs of increasing and/or decreasing prairie dog numbers are subject to the perspective of the individual dealing with them.	
(8) [p. 8 / line 35] I question whether ditching is more common in the Mixedgrass Subregion as compared to the Tallgrass subregion.	Addressed in document by ending sentence after *Tallgrass Subregion*.
(8) [p. 8 / line 8] Add timing to the list of changes in burning	Suggested changes were made in the document
(8) [p. 9 / line 1] Suggest that you add "livestock water and recreation" after irrigation	Suggested changes were made in the document
(12) [Table 5.7] American white pelican: – include diseases (extremely high densities during nesting)	Suggested changes were made in the document
(12) [Table 5.7] Black tern: include ecosystem, habitat degradation (especially from cattle trampling, feedlots, ag runoff into foraging sites, unstable water levels)	Suggested changes were made in the document
Section 6	
(1) [p. 6 / line 6] Prairie Dog Acreage goals in this plan should be consistent with the acreage goals of the Black-Tailed Praire Dog Management Plan approved by the 2005 Legislature and on file with the Secretary of State. The Jackson County Land Use Committee opposes any plan or action that would call for more than 160,000 acres of prairie dog colonies on non-tribal land and 30,000 acres on tribal lands.	The following was added to Section 6: "Conservation goals for black-tailed prairie dog colonies have been previously identified in Cooper (2004), South Dakota Black-tailed Prairie Dog Conservation and Management Plan. However, the distribution of black-tailed prairie dog colonies should be viewed relative to appropriate ecological sites and their amounts within each ecoregion."
(1) [p. 6 / line 6] The Jackson County Land Use Committee finds that grassland fires are a threat to the public safety and private property. Land ownership patterns within the county are not conducive to prescribed burning. Grassland fires will be extinguished as quickly as possible in Jackson County.	The CWCP does not identify management tools to achieve or maintain historical ecosystems; however, fire may be viewed as an appropriate tool but its use will need to be evaluated on a site-by-site basis.
(1) [p. 6 / line 7] The Jackson County Land Use Committee finds that land ownership patterns within the county are not compatible with free ranging bison.	The CWCP does not identify management tools to achieve or maintain historical ecosystems; however, bison grazing may be viewed as an appropriate tool but its use will need to be evaluated on a site-by-site basis and relative to the landowners objectives.
(1) [p. 6 / line 8] Considerable resources (human and financial) are expended by State government annually in the control of beavers. The Jackson County Land Use Committee finds that the goal of this plan to increase riparian areas affected by beaver to be in direct conflict with the operations of State Trappers and the Animal Damage Control program.	The CWCP does not identify management tools to achieve or maintain historical ecosystems; however, allowing beaver activities may be viewed as an appropriate tool but their occurrence will need to be evaluated on a site-by-site basis.

(11) [p. 1 / line 20] The authors admit that "our understanding of many ecological relationships still remains relatively poor and therefore problematic." The Stockgrowers appreciate this admission and strongly encourage you to take into serious condition the thoughts and suggestions of ranchers and farmers who do have a grasp and a practical understanding of the ecological relationships that exist on the numerous different landscapes. It is imperative that the plan authors maintain this attitude, and realize that mother nature is the ultimate authority and try as we might, humans will never control the ecologic systems on earth.	
(4) [p. 2 / lines 37-38] The overall goal of "maintaining or restoring 10% of the historical occurrence for all ecosystems in each of SD five ecoregions." Should be defined more specifically. What will be considered "restored" or "maintained"? Invasive species needs to be addressed more specifically. What percent of the ecosystem can be composed of invasive species and still be acceptable for adequate representation of the historical occurrence ? How will achieving the goal of X% of the historical occurrence effect each species listed as a species of concern? Should the needs of these species dictate the ultimate goal for adequate habitat?	We have indicated in multiple places in the document that in order to qualify as an historical ecosystem it must substantially resemble the historical condition; defining this more specifically will require additional research that has been recommended in the conservation actions for ecosystem diversity.
(6) [p. 3 / lines 1-13] By using the maximum of the HRV for each habitat descriptor, you end up with a total of 13.3% representation overall (97,217 + 366,774 + 123,731 = 587,722; 587,722 / 4,418,962 = 13.3%). If you had used the average of the HRV, you would have actually ended up with a 10% representation. **6) [p. 4 / lines 1-15]** Since you are using a model to arrive at the HRV, and since the model results in a range, it seems prudent to use the average instead of the maximum for this evaluation	We are aware of this and consider this a more prudent method that provides a greater level of representation in ecosystems with a wider range of variability in conditions.
(4) [p. 3 / line 12] The number of acres listed as the goal for representation for "light" "moderate" and "heavy" grazing does not take into account that grazing should vary over time and space in order to maintain diverse native prairie. The plan does not sufficiently address how grazing intensities will be monitored or how more appropriate grazing regimes will be promoted on public and private lands.	The coarse filter/ecosystem diversity approach focuses on the desired ecosystem conditions; grazing is one of a number of tools that will be needed at varying levels of intensity, timing, and locations to achieve the desired ecosystem conditions
(9) [p. 7 / lines 18, 32 & 33] Spell out SoGCN/EDM throughout the document.	We have included definitions of acronyms used in the document following the glossary in Section 1.
(12) [p. 8] American white pelican: 1. management – a) protect nesting colonies from human intrusion (post, fence off, etc.); b) monitor disease incidence in nesting colonies; monitor water quality near nesting colonies; c) create safe non-vegetated islands for nesting 2. research – a) how modified flood regimes/water management practices affect food supply; b) tolerance or lack thereof to boaters near nesting colonies, c)	Incorporated this information where it did not overlap with existing information.

pelican foraging habits and impacts on local fisheries 3. education – a) about disease and potential to spread it; b) about not disturbing nesting colonies; c) about pelican fish-eating habits and how probably doesn't impact fish stocks; d) for hunters about identification	
(12) [p. 8] Trumpeter swan: 1. management – a) regulate water regimes at traditional nest sites; b) monitor water quality near nest sites and at cygnet rearing areas; c) post signs around nest sites to ask public not to disturb 2. research – a) level of human/other disturbance at SD nests; b) reaction to human/other disturbance; 3. education – a) hunters about identification; b) landowners – about dealing with t. swan nests on their property	Incorporated this information where it did not overlap with existing information.
(12) [p. 8] Whooping crane: 1. management – 2. research – a) identify and monitor crane staging/migratory sites in SD; b) banding studies 3. education – a) hunters about identification; b) bird-watching public about identification and reporting sightings;	Incorporated this information where it did not overlap with existing information.
(12) [p. 8] Willet: 1. management – 2. research – a. responses to drought (nesting habitat, food supply, chick rearing, etc.); b) population trends; c) ideal grazing regime for nesting, brood rearing 3. education – landowners – grassland & insect pest management around nest & brood rearing sites;	Incorporated this information where it did not overlap with existing information.
(12) [p. 8] Long-billed curlew: 1. management – a) integrated pest management – so don't kill invertebrate prey; b) short grass management, maintain mosaic of short & mixed grass; c) protect known territories (because curlews are site faithful); 2. research – responses to different grazing/burning regimes; 3. education – landowners – grassland management around nest & brood rearing sites;	Management recommendations related to habitat are already included in the ecosystem diversity goals; non-habitat related recommendations are already included in document.
(12) [p. 8] Marbled godwit: 1. management – a) protect larger blocks of appropriate grassland with mix of wetlands; b) maintain/create shallow wetlands with emergent vegetation margins for brood rearing; c) protect staging/migration areas; d) control nest and chick predators 2. research – a) identify important migration or staging areas; b) ideal grazing/fire regime in different SD ecosystems; c) studies of productivity 3. education – landowners – grassland management around nest & brood rearing sites, identification	Management recommendations related to habitat are already included in the ecosystem diversity goals; non-habitat related recommendations are already included in document.
(12) [p. 8] Wilson's phalarope: 1. management – a) maintain/create shallow wetlands with emergent vegetation margins for nesting and brood rearing; b) control cattle trampling of nests; c) control nest and chick predators 2. research – a) breeding distribution; b) response to different fire/grazing regimes; c) response to drought	Management recommendations related to habitat are already included in the ecosystem diversity goals; non-habitat related recommendations are already included in document.

3. education – landowners: grassland management around nest & brood rearing sites, identification	
(12) [p. 8] Black tern: 1. management – a) provide artificial nest platforms; b) maintain stable water levels in nesting colonies during nesting season; c) post signs near nesting colonies to discourage human disturbance; d) create or maintain highly productive wetlands with proper mix of emergent vegetation; e) control/reduce pollution into nesting, feeding wetlands 2. research – a) experimental tests of different types of nest platforms; b) landscape level habitat selection during breeding season (i.e., mix of different types and sizes of wetlands needed for successful nesting); c) breeding distribution; d) response to drought 3. education – landowners: management of black terns on their land (artificial nest structures, importance of stable water levels, pollution control)	Incorporated this information where it did not overlap with existing information.
Section 7	
(9) [p. 1] Spell out CWCP	changes made in final document
Appendices	
(4) Appendix 6 – Field Bindweed which infests the highest number of acres in SD and Perennial Sow thistle which is becoming a significant problem around wetlands should be added to the list of noxious weeds – both are encroaching into native prairie habitat in certain portions of the state.	This website was added to the document as a more comprehensive source of information: **http://www.natureserve.org/getData/plantData.jsp**

[1]Grammatical and spelling error comments are not listed in this table and were simply addressed in the revised document.

[2]The ID # corresponds to the respondent listed in Appendix 7.7 - Table 1.
[3]Science and the Endangered Species Act. 1995. National Academy Press. Washington, D.C.

[4]World Wildlife Fund, Northern High Plains Ecoregion, P.O. Box 7276, Bozeman, Montana 59771
Tel: (406) 582-0235 – contact: Cortland Barnes (406) 582-0236 / www.worldwildlife.org

Forest, S.C., H. Strand, W.H. Haskins, C. Freese, J. Proctor and E. Dinerstein. 2004. Oceans of Grass: A Conservation Assessment of the Northern Great Plains. Northern Plains Conservation Network and Northern Great Plains Ecoregion, WWF-US, Bozeman, MT.

[5] The first number in the bracket indicates either a page number or Table/Figure number in the DRAFT review document and the second number, if present, refers to line numbers on that particular page. If there are no page numbers then the comment is a general comment for that particular section.

13 – Comment from the Mountain Lion Foundation

The Mountain Lion Foundation, a national nonprofit conservation and education organization dedicated to protecting mountain lions and their wild habitat to ensure that our wildlife heritage endures for future generations, presents the following comments on the South Dakota Draft Comprehensive Wildlife Conservation Plan. We thank the South Dakota Game, Fish and Parks ("SDGFP") for considering our comments and recommendations.

The introduction to the plan states that "The South Dakota Comprehensive Wildlife Conservation Plan (hereafter CWCP) serves as a strategic vision and plan of action for statewide wildlife conservation." With this purpose in mind, and given the scientific recognition of mountain lions as a keystone and focal species, we were surprised that they were not only not included in the Plan, but that SDGFP specifically

decided to avoid addressing the important issues and concerns raised by the SDGFP's proposed mountain lion hunt, set to begin October 1, 2005. The CWCP also notes the species was excluded because it has its own management plan. However, as we have argued in previously submitted comments, the Draft Mountain Lion Management Plan failed to describe the ecological importance of mountain lions, the potential threats to their viability, and how SDGFP plans to ensure the persistence of mountain lion populations in the Black Hills and other parts of South Dakota for future generations. Hence, there exists no comprehensive conservation plan for the species in South Dakota. For these reasons, we request that the GFP include mountain lions in the CWCP, and give consideration to the points raised in this letter..

WHY MOUNTAIN LIONS ARE ECOLOGICALLY IMPORTANT

Mountain lions are a "keystone species", which means that they play important ecological roles. Power et al. (1996) defined keystone species as those whose ecological "effect is large, and disproportionately large relative to its abundance." Mountain lions are considered a keystone species because of their strong influence on ecosystem dynamics and because they live at relatively low population densities (Logan and Sweanor 2001). Also, the wide-ranging mountain lion is considered an important focal species for efforts to conserve native ecosystems and biodiversity at the landscape level (Beier 1993, Logan and Sweanor 2001). Their removal can lead to significant changes in Mountain Lion Foundation the landscape and the loss of biodiversity and ecological integrity (Terborgh et al. 1999). The ecosystem itself is affected by the killing of a keystone species like the mountain lion. In one study, the absence of mountain lions and jaguars from a series of forested islands created by a dam in Venezuela led to a rapid increase in the number of plant eaters; this in turn had a devastating effect on native vegetation (Terborgh et al. 2001). The "domino effect" of removing or seriously diminishing the population of a species like the mountain lion is not only potentially perilous, it is also scientifically unpredictable – and so utmost caution should be taken with any program that affects the species. In fact, mountain lions need not be completely removed from an area to have negative effects on the ecosystem. Rather, the decline of a mountain lion population below some threshold size may result in decreased species diversity; this then can trigger an ecological chain reaction that ends with degraded or simplified ecosystems (see Soule et al. 2003) and potentially permanent (negative) effects on the entire environment.

Because the virtual or effective absence of mountain lions leads to significant changes in some features of its ecosystem, wildlife agencies should strive to maintain population sizes that are "ecologically effective" rather than simply those that are "minimally viable." Minimum viable populations are defined as the smallest isolated population having a good chance of surviving for a given number of years despite the foreseeable effects of demographic, environmental, and genetic events and natural catastrophes. Preeminent conservation biologist Michael Soulé and associates (2003:1239) have argued that "conservation plans should contain a requirement for ecologically effective population densities; these are densities that maintain critical interactions and help ensure against ecosystem degradation. This goal replaces the de facto nonecological practice of requiring only the attainment of minimum viable populations." They conclude that "[e]cosystems are complex and always changing. For these reasons, conservation should facilitate extensive spatial access for highly interactive native species, according to their needs and ecological opportunities. In particular, highly interactive species…should be given the benefit of the doubt in our management and recovery efforts."

To our knowledge, SDGFP has neither determined what it believes are the minimum number of mountain lions needed to ensure their viability in the Black Hills, nor how many are required to maintain ecological effectiveness. It is also apparent that SDGFP has no reliable data on the number of mountain lions in the Black Hills, even as a starting point for the analysis. The collection of this information is a vital step in developing a comprehensive conservation plan for the species and, indeed, for the entire ecosystem in which they live.

THREATS TO THE VIABILITY OF MOUNTAIN LION POPULATIONS

Wildlife and conservation biology experts recognize that once the population of a particular species becomes too small, extinction of that population is inevitable. It is a matter of common understanding that it is not necessary to kill all members of a population to cause the eventual extinction

of a population of lions. A population may become functionally extinct if the number of individual animals falls to a level at which the population is unable to maintain itself due to health, age, lack of breeding age individuals, or other reasons. The primary threat to the long-term viability of mountain lion populations and metapopulations is human activity, and specifically the loss, degradation and fragmentation of habitat and excessive human-caused mortality, also known as overkill (Murphy et al. 1999, Logan and Sweanor 2001). Populations that are small and isolated, such as the Black Hills population, are particularly vulnerable to extinction (Beier 1993).

Mountain lions were previously driven to extinction in the Black Hills in the early 1900s because of human efforts to eradicate them. In recent decades, protection of the population from human-caused mortality has allowed it to recover. Given this apparent success, wildlife managers appear to presume that the mountain lion population is now secure. However, increasing human development in mountain lion habitat and increasing levels of mountain lion kills in the Black Hills will continue to put pressure on this small and isolated population.

As human densities in the Black Hills continue to increase so does the probability that the mountain lion population will be again driven to extinction (Woodroffe 2000). According to U.S. Census data, the human populations in Custer, Pennington and Lawrence counties grew 17.7%, 8.9%, and 6.6% from 1990 to 2000, respectively, with a corresponding increase in construction of homes in and adjacent to mountain lion habitat. This leads to loss and fragmentation of wildlife habitat, which can sever the linkages between core habitat areas, thereby isolating cougar populations. Isolation prevents mountain lions from moving among neighboring populations, leading to genetic inbreeding and ultimately extinction. Also, placement of roads across mountain lion habitat divides populations, allows greater access by humans, and greatly increases the likelihood that vehicles will kill or maim lions and their prey. Human-caused mortalities in those habitat fragments may pose the most serious threat to long-term cougar viability (Murphy et al. 1999).

Unfortunately, SDGFP has presented no analyses of how current and future levels of mountain lion kills in the Black Hills and Prairie Units will impact the mountain lion population. This is especially problematic given the current proposal to enact a sport hunt. Though sport hunting can impact mountain lion populations in several ways, we have little understanding of the extent or duration of that impact (Sunquist and Sunquist 2002). Researchers in Utah and New Mexico found that after simulating a sport hunt by removing 27% and 47% of mountain lions, respectively, from their study areas, the population did not recover to preremoval levels for 24 and 31 months, respectively (Lindzey et al. 1992, Logan and Sweanor 2001). Hunting can depress populations until the habitat is recolonized by individuals dispersing from surrounding habitat (provided there is connectivity with surrounding populations), creating a sink effect (*i.e.*, neighboring populations are drained of their young lions because they are killed when they disperse into the empty “sink” area) (Lindzey et al. 1992, Sweanor et al. 2000, Stoner 2004). Even minimal human-caused reductions in a lion population for two consecutive years can limit a population’s ability to rebound because of other mortality factors including territorial battles and injuries sustained during the capture of prey (Lindzey et al. 1992). The resilience of a lion population to hunting depends “on the rate of immigration into the population and [the] availability of recruitment-age female progeny.” Immigration rates, particularly of females, will be influenced by the intensity of hunter kills in adjacent populations (in this case Wyoming).

Additionally, by killing or removing adult resident mountain lions, particularly females, sport hunting may affect the dynamics of mountain lion populations and social relations among surviving adults and subadults (Anderson 1983; Murphy et al. 1999). Sport hunting further represents an unnatural selective pressure since hunters typically select for the largest mountain lions and may thus be affecting the genetic heredity of populations (Anderson 1983; Murphy et al. 1999).

In a 1993 paper published in the journal *Conservation Biology*, Dr. Paul Beier suggested that a minimum of 1,000 to 2,200 square kilometers is necessary to prevent localized extinctions of mountain lions, provided that connectivity with neighboring core areas is maintained. Moreover, there needs to be at least 50 adult animals in the population to ensure the population remains viable for more than 100 years -- provided that individuals from other populations are allowed to immigrate to the area (Personal Communication, 8/17/05). In her 2003 Dissertation on the Black Hills mountain lions, Dorothy Fescke cautioned that:

the importance of immigrants to the Black Hills should not be understated. First, it is likely that immigrant animals were responsible for re-establishing the Black Hills population and, thus, likely would aid in offsetting future population declines due to natural disturbances (e.g., prey crashes, large-scale fires) or non-natural mortality (legal or illegal killing, mortalities due to collisions with vehicles).

While the Black Hills contains more than 6,000 square kilometers of high quality habitat (Fescke 2003), SDGFP's estimates that there are only 10 breeding age males and 40 breeding age females in the South Dakota part of the Black Hills, just meeting Beier's suggested minimum requirement of 50 adults. This number would be reduced to 25 if the proposed hunt quota is met in the Black Hills Unit alone. This does not account for other forms of mortality, including lions killed for depredation or by automobiles. Further, as mountain lions don't recognize geopolitical boundaries, allowing landowners west of the Missouri River to kill one mountain lion a year on their property will result in additional deaths of Black Hills mountain lions. Moreover, the Western Prairie Unit hunt will cut off or significantly reduce immigration into the Black Hills from the South Dakota side.

CONCLUSIONS

SDGFP has requested comments and suggestions for conservation actions that would benefit those species needing the most protection. Given the precarious status and unknown population numbers of mountain lions – combined with the increasing injury to their habitat and thus their chances for survival – SDGFP should take special precautions and consider the mountain lions in the CWCP. The Mountain Lion Foundation urges SDGFP to present in the CWCP a strongly articulated vision of how it intends to conserve mountain lions in South Dakota. This plan should include a focus on conserving adequate habitat and landscape connectivity to ensure that the Black Hills contain viable and ecologically effective mountain lion populations into the future. Steve Torres, former mountain lion coordinator for California Department of Fish and Game, offered the following recommendations for cougar conservation (Torres et al. 2001):

1) Redefine mountain lion management in a conservation biology context that recognizes their ecological role;

2) Manage for long-term viability of population systems that include predator/prey relationships rather than single species;

3) Establish population monitoring and habitat models to define and maintain essential habitat; and

4) Manage for ecological systems at the regional, or metapopulation, level.

MLF supports these recommendations, and offers the following additional recommendations:

• **Develop a *truly* comprehensive conservation plan – not one that fails to address keystone species and damage to the entire ecosystem**. SDGFP, in collaboration with other local, state and federal agencies, and NGO's, should identify and protect sufficiently large habitat cores and the corridors to link them to ensure the long-term viability of mountain lions and their prey.

• **Support and continue scientific research to establish site-specific population data** essential to understand the biological impact of ongoing kills on mountain lion populations (i.e., sex ratio, age structure, mortality factors and rates, kitten production and recruitment, population size estimates) for any populations where lions are to be killed for reasons other than removal of individual lions necessitated by verified, direct and immediate threats to public safety. The Mountain Lion Foundation offers its extensive expertise, and that of other conservation biologists, to assist in this regard.

• **Implement an aggressive public education program on how to coexist with mountain lions**. We support SDGFP's efforts to improve public and livestock health and safety by educating South Dakota's citizens about how to avoid contact and conflict with predators, how to

avert predators from populated areas, and about the public benefits of a sustained predator population. Such education should be funded at least to the same degree that hunter safety and opportunities are promulgated. The Mountain Lion Foundation offers our expertise to SDGFP and other interested parties to implement this recommendation.

• **Establish strong penalties to discourage and prohibit the killing of lions outside Department policies, and for killing a female lion or kitten for lack of ability to accurately sex in the wild** (e.g. fines, making possession of the body or skull of a female lion or kitten illegal.)

In sum, our organization is dedicated to the protection and long-term conservation of mountain lions, and their irreplaceable value to the public as keystone predators and as symbols of our vanishing wilderness. We therefore request that CWCP include mountain lions as a focal species.

Sincerely,
Christopher M. Papouchis
Lynn Sadler
Conservation Biologist President and C.E.O.

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15 – Comment from Nancy Hilding, President: Prairie Hills Audubon Society

Comments on the Draft SD Comprehensive Wildlife Conservation Plan- July 2005

We believe a 30-day comment period to be inadequate for review of this document and request an extension. We believe that a 30-day comment period, which closes about 30 days before you must produce a final document and only one public meeting, shows a rush job. The reason you may get away with an inadequate public involvement process is because the document is so tame/non-controversial. If the document is designed to have no effect on public policy, just facilitate research or grants/subsidies to willing providers, it has no controversy. Many species are at risk because their habitat needs fly in the face of public or private policy and thus controversy is at the core of managing for at risk species and can't really be avoided.

We believe this document is an opportunity forgone. This document appears to be handled like a make work project, where the SDGFP is going through the motions, to insure continued USFWS funding, but without a real commitment by the Department to the process. A document that actually addressed the underlying issues, would be highly controversial and would go through at least some of the kind of debate/public meetings/repeated drafts like the Mountain Lion Plan or the Black Tailed Prairie Dog Plan did.

We believe this lack of commitment is high lighted by the lack of any action that has real "teeth". The Plan states on page 3 Section 1 "The Comprehensive Wildlife Conservation Plan will help guide voluntary and cooperative actions, and will not institute mandates or restriction on uses of private land". The endlessly repeating phrase in the species section, subset on "Planned Action/Recovery Plan for Habitat ", which says "Develop cooperative programs with agencies, landowner, and private organizations to meet the conservation goals for ecosystem diversity important for _____ habitat ' highlights the lack of commitment by SDGFP to this effort.

.The State does have authority to mandate changes that could protect species and the public policies of the State, either through failure to use its existing authority or misuse of the authority it does use, are sometimes a major part of the problem our at risk species face.

SDGFP itself has the authority to solve or promote solutions to many wildlife diversity problems, such as attempting to list buffalo as a wildlife species, (instead of just domestic livestock) or to propose revision to the existing Black-tailed Prairie Dog Conservation and Management Plan to remove the 1 mile buffer or improve the safety net, or to delay and Mountain Lion hunting season until you have better population science/data. On your page on Sage Grouse, you have listed voluntary action items designed to reduce accidental take, but ironically you still have a hunting season. You also have a hunting season for Prairie Chicken. SDGFP sets the policies about trapping beaver. The DENR and Board of Minerals and Environment can pass laws to regulate water quality and protect fish/wildlife and it interacts with Army Corp of Engineers/NRCS about stream modifications, dams and wetlands under sections of the Clean Water Act. Another Board, ?the Water Resources board? may also has authority to effect fish/wildlife habitat. The failure to make any commitments, evaluations or recommendations to use any regulatory or enforcement powers of the state to protect species or their habitats, reflects SDGFP lack of will and lack of commitment to protection and restoration of at risk species in the State.

Also in recent years the legislature sees Bills about restricting conservation easements, or purchase of private lands for conversion to public lands. The State has the authority to set law about acquisitions/allocations of land for conservation purposes.

Also missing is any action relative to land acquisition; why will tax dollars be paying landowners to maintain habitat via incentive, in perpetuity instead of identifying key locations and buying the property? For example, why doesn't the Plan identify all the red colored habitat squares and report on the relative property values of property in all the red squares and evaluate the relative cost of purchasing acres in the red color squares? This is a controversial issue in SD and guess what, land purchase is not mentioned

(that we noticed). Land costs may be cheap in some ecosystems and may be much more cost effective and secure tactic in some places in the long run, than landowner incentives or habitat improvement projects. Conversely incentives or conservation easements may be more cost effective in other zones. The relative cost effectiveness of purchase/easements/incentives needs to be evaluated. We have SDGFP purchased wildlife protection lands for hunted species, why not for at risk non-game wildlife too?

Key Element # 6.

We suggest you actually address item 6 of the key elements section, (page 2, section 1) which is "Descriptions of procedures to review strategy at intervals not to exceed ten years."; we can't find this section in the document. Given the inadequacy of the Document, we hope an aggressive plan for review is included and in future reviews you will include a review of the public policy of the State that hurts at risk species and their habitats or fails to take advantage of authority of the State, that it was granted in order to protect them.

We also believe lots of species status are in flux or at least their security and risk levels are subject to debate. The black-tailed prairie dog is highly at risk due to the states ill considered Conservation and Management Plan, which creates a 1 mile buffer potential kill zone, along property lines, with a gutless "safety-net" that relies on colony acres both on tribal and non-tribal lands. Reliance on colony acres on tribal lands to establish a safety net value is stupid planning by the state, as you have no jurisdiction over tribal actions. Under SD plan all non-tribal prairie dog colonies could be eradicated, as long as the tribes keep about 3/4 of their prairie dogs. There is also recent plague found in SD, which makes the 2005 Management Plan obsolete. As the prairie dog is at risk so are all associated species. Its populations could be massacred, pursuant to the Management Plan, between now and 10 years from now.

The mountain lion population levels are subject to debate, with cougar scientists around the nation criticizing SD's population estimates and modeling. The effects of the proposed hunting season on such population are also subject to debate. The status of this species could change drastically.

A mountain plover was seen at Conata Basin/Badlands last years. There has been an unconfirmed blue grouse sighting in Wyoming Black Hills. There are sightings of gray wolves. The status of many species may change in the next ten years, so how does SDGFP plan to amend or change the Plan as populations flux?

We suggest this plan create a "watch list", a list of species of merit, whose status with respect to the Plan's criteria, could change between planning cycles.

Readability

I can't read much of the fine print on the Ecosystem Diversity Matrix pages, without a magnifying glass. There appears to be much relevant information in this tiny type. It makes reading and understanding the document very difficult.

Recovery/re-introduction plans

The draft Plan should have a section on recovery or reintroduction of extirpated species such as the blue grouse, mt. Plover, wolf, bear and buffalo. Why doesn't this plan list all extirpated species and what the Department plans to do or not do about them and why? Why doesn't this Plan talk about what to do about stray moose, or other species that are attempting to recover or migrate to SD? Why doesn't it discuss potential re-introduction plans?

The State tried to reintroduce blue grouse in the past, but believes the reintroduction not successful. We have heard of an unconfirmed sighting of blue grouse, over the border in Wyoming Black Hills.

Mountain Plover may be recovering in Conata Basin, as one was sighted recently.

. The gray wolf may be reintroducing itself. Rumors exist about it in the Black Hills.

What about the sightings of Black Bear, which the GFP department always believes are animals escaped from Bear Country? Why if the State questions black bear sightings, does it keep the Bear on the state's T & E list?? The Department shot the moose that wandered into Rapid City, a very controversial act. Why doesn't it mention the species, who are well established elsewhere, but whose
Ranges are peripheral in SD or may become peripheral in SD? You may not wish to assign as high a management priority to them, but to some people, such as birders, these species are important.

State's T & E Species.

The mountain plover, black bear, and gray wolf are all on the States list of T & E species, November 10, 2004yet don't appear in the Draft Plan. Item number 1 in your criteria on Section 4 page 1 is "State and or federal listed species for which the State has a mandate for recovery. I think if you read state law on T&E species (SDCL 34A-8 –(1), (2), (3), (4), (6)), you will discover that the state by statute has a mandate to recover all of its' T & E species, including the wolf and the bear.

> 34A-8-6. Departments to manage, protect, and restore endangered and threatened species. The Department of Game, Fish and Parks and the Department of Agriculture shall perform those acts necessary for the conservation, Management, protection, restoration, and propagation of endangered, threatened, and non-game species of wildlife.

This failure to include bear and wolf, which are state listed species, highlights the problems with the Plan with respect to top predators and controversial species. If you want this Plan to be non-controversial, that you can process with a 30-day comment period and one public meeting, how can you include the bear or the wolf? And by choosing not to mention or develop action plans for those state listed species of Mt Plover, Black Bear and Grey Wolf, in your Plan, don't you violate 34A-8-6 and create a cause for litigation of this Plan, under state law?

Bison

As bison is classified as a livestock in the state and not classed as a wildlife, you actually don't have any non-tribal bison wildlife, although you have non-tribal bison livestock in the State. Thus the bison as wildlife is extirpated from the non-tribal jurisdictions of the state of SD. There is an issue with Bison, in breeding with cattle and losing genetic purity. Thus we don't see why Bison, aren't listed as a species of concern and don't see why this document doesn't address all the public policy issues associated with managing Bison as wildlife and provide a recovery plan for creating free roaming, wildlife bison herds, at least on the Grasslands.
As I remember the National Grassland Management Plans, they all blamed the failure to manage for Bison as wildlife on public lands as a result of state policy.

Inactive Prairie Dog Towns,

We are not sure what the habitat values to wildlife of inactive Prairie Dog towns, are and we wish you would go in more detail to justify this habitat category. Which species use and for how long after abandoned?

Habitat Security

Roads and peoples houses/development pose new threats to wildlife. Should you have a matrix someplace to address or quantify/identify places were conflicts with people are less intense? Should you relate levels of development/population densities to at risk habitat types? Are some habitats more hurt by local people densities than others?

Predators

You chose to avoid putting prairie dogs or bison or beavers in the list of species to be watched, but you put them into the disturbance categories and set goals for percents of habitat types to be preserved, that at least addresses their issues somewhat. We believe they should also be managed for as species of concerns, not just habitats of concern, but at least you address them in some way. You just ignore the ecological functions of top land based predators altogether.

We believe the mountain lion, gray wolf and black bear, which are species that may not be extirpated, need to be addressed in some place in this document, which discussion includes their distribution (or lack of it) in all the eco-regions of SD. We also believe the grizzly bear must also be mentioned, although it is extirpated. You must have some section that discusses the role of top predators of all abiotic zones: land, water and air and discuss their importance to ecoregions/ecosystems and what has happened to them and how you will manage for or replace their roles, where they are missing.

You should discuss the impact of their absence on ecosystems and ecoregions.

We will send you some time today a slew of comment letters on the proposed Mt Lion Management Plan and Hunting Season, which we submit as appendix. We believe these letters document the fact that the viability of the Mt Lion in this state is about to be put at risk due to over hunting.

We believe the issue of over hunting is not limited to SD, for example Oregon is currently considering an extreme hunting proposal. We think any assumptions about the security of Mt Lion populations in SD and the west that under lay the decision not to put the Mt Lion in this document may be faulty.

Eco-region imbalance of species

We believe some species such as mountain lion or elk and maybe mountain sheep, may have breeding populations in one ecoregion, but not are as well established in other eco-regions, where they once occurred. This plan should disclose lopsided recovery of species, where they may have breeding populations in one eco-region, but have been lost from or are struggling/developing in the other eco-regions or where there are connectivity issues and the populations are too isolated from other populations. This should be a special category of species—ones whose distributions are lopsided/at issue.

Climate:

Did exceptionally harsh winters affect the ecoregions wildlife/plants and become disturbance events?

Insects/disease as disturbance:

Thanks for noting fire and grazing and prairie dogs and flood as disturbance, but you forgot a major one, which is insect/fungus/disease outbreak, especially the insects that occur in the Black Hills Forests, such as the mountain pine or Ips beetles. There is also some root fungus or something that kills trees. These can create massive type conversions from forests to grasslands in the Black Hills. We have heard historic accounts of locust outbreaks in parts of the West and perhaps these occur in SD also. We don't know if gypsy moths, which we think are introduced species, have much effect in SD, but are there other insects which effect eco-regions in cycles?

There is a new disturbance event, which is plague, which modifies the prairie dog ecosystem, It is an introduced disturbance, but it may deserve mention some place.
Its recent arrival in SD needs to be added to your discourse someplace and its existence in SD should affect prairie dog management plans and may need to be reflected in your habitat charts. We don't know if any other historic/introduced diseases exist which effected/effect plants, fish/birds, beavers or bison or elk or deer/antelope etc, at high enough population impacts to be disturbance events. Are there any?

Comments on Specific Ecosystem Diversity Matrix Pages;

Great Plains Steppe Ecoregion – Forested Ecosystems

You indicate that fire is the disturbance event of importance, were floods also important to cottonwoods/sand bars on bigger rivers?

Great Plains Steppe Ecoregion – Aquatic Ecosystems

Is turbidity sometimes a habitat factor in prairie streams; i.e. some fish actually need muddy water to survive. And this creates a strange dance with the Beneficial uses under the states clean water laws. Turbid streams, (where the fish that need that -- not crystal clear water – are benefiting from the suspended solid or turbidity "pollution") end up in streams with a lower beneficial use for fisheries, as the DENR is fixated on the fish that need clear mountain streams. I.e.: the states system of beneficial uses assigned to streams, needs to be revamped for the fishes that need turbidity.

Thus beavers and river size and gradient, may also need another function, which is turbidity. The SD-DENR/Wyoming DEQ are also concerned about water temperature
and intermittent/permanent stream classification. Does temperature matter on the prairie?
Can't dams effect temperature/turbidity, and make it cooler/clearer than normal?

As far as we can tell many prairie and mountain streams that are "intermittent" have"string of pearls" phenomena, where there are springs, pools, stream sections that are perennial strung between intermittent sections. Do these type streams have any special functions? You leave off intermittent streams in your Steppe Aquatic Ecosystem page.

Can you/should you differentiate somewhere in the text, charts, between any streams that have introduced fish and any streams without introduced fish or indicate the percent of water bodies so modified?

Black Hills Ecoregion

Riparian and Shrub steppe

Was it just Bison or also Elk/deer that grazed riparian areas in the Hills?

Forested Ecosystems,

We have always wondered if the FS fixation on Structural stages of Ponderosa Pine, to delineate wildlife habitat, is really a function of convenience; their need to save time by using their existing timber data base, rather than collect new biological data in the field, and not that tree size/canopy closure are important habitat features. Openings, old growth, snags, litter on the forest floor, cover type, undergrowth matters, mixed tree stands, mixed canopy heights and distance to water matter, but does small, medium and large trees sizes really matter—or is it just how trees are cataloged in their timber systems? Is this paradigm perpetuated by convenience not wildlife reality? How many species care whether living tree sizes are small, medium or large, don't they care which tree species and whether they are alive or dead first? So vertical and horizontal diversity matter and size of a snags matters, old growth conditions matter but how much does size of average live pine trees in a pine stand matter? Which species use small pines as habitat?

14 – Comment from Defenders of Wildlife

Thank you for the opportunity to comment on South Dakota's Comprehensive Wildlife Conservation Plan. The document provides an impressive synthesis of South Dakota's knowledge of wildlife and habitat. In addition, the plan includes a fairly extensive presentation of public input into the plan. In particular, the frequently asked questions section was interesting and informative. We do have a few comments and observations which we have organized here into three categories: Assessment (i.e. species, habitat and threat assessments), Strategy (i.e. prioritized conservations actions) and Implementation (i.e. next steps for moving the plan forward and monitoring through an adaptive management process).

I. Assessment

One of the strengths of the South Dakota plan is its goals. The plan's purpose is clearly presented in the introduction which provides a solid framework for the rest of the document. In addition, the plan strives for "adequate ecological representation" which is defined as maintaining at least 10% of historical acreage for each ecosystem type. Having these specific acreage targets will be extremely useful for implementation and monitoring purposes. Defenders supports the protection and maintenance of historic habitat types, but given the extensive alteration of the current landscape, specific areas of high species diversity existing today are important as well, regardless of whether these were historically present in the landscape.

In order to arrive at these target acreage numbers, South Dakota has undertaken an extremely complex assessment of historical habitat types through analysis of soils, vegetation and disturbance regimes. The emphasis on disturbance and historical ecological process is important and frequently overlooked in habitat taxonomies. Though impressive, the presentation of this assessment is extremely technical and difficult to follow. The assessment methodology often dwarfs the presentation of threats and actions. It will be difficult for non-expert readers to follow the methods and come away with a clear understanding of what needs to be done. We recommend clarifying these methods by either re-writing this section or providing a clear summary in non-technical language. Some changes could be simple, for example, the term "coarse filter" is not as familiar to people as "habitat." In addition, the matrices, though excellent for identifying levels of ecosystem diversity, could be moved to an appendix while retaining a brief summary of the methods and the results in the body of the text. This allows expert biologists to see, understand, and critique the methods, while non-experts such as land use and transportation planners and average citizens can get the main points and use the document fully.

The threats assessment is a good start. We agree that alteration and conversion of "species compositions, structures or functions" and alteration of ecological processes are two of the greatest threats to wildlife today. It is especially useful to see the acreage of lands affected by various land uses in each ecoregion. In reviewing the other State plans, we found it helpful to see the threats and corresponding conservation actions presented for each habitat type side by side. This organization allows the reader to see clearly how the State plans to address each threat in turn. It also ensures that every threat has a corresponding action. For example, the riparian/wetlands ecosystem in the Great Plains Steppe ecoregion has been significantly affected by agriculture. This threat could be addressed by implementing agricultural BMPs such as riparian buffers, integrated pest management, fencing to keep cows out of streams, and using farm bill dollars through specific programs such as EQIP to encourage farmers to manage their lands partially to benefit wildlife. The species descriptions in Section 4 are organized with paired threats and actions. We recommend a similar approach to habitats types.

One component missing from the plan that Defenders sees as critical, is the identification of priority conservation areas. Identifying priority areas ensures that conservation efforts are more coordinated and efficient, thereby maximizing the use of limited conservation dollars. These are best identified and presented through maps showing existing protected areas and high quality, unprotected habitat. We are pleased to see that South Dakota has identified target acreage numbers. However, protecting a certain number of acres can be meaningless for many species if scattered throughout the landscape. We believe it is critical to have a strategic plan for identifying those areas where habitat protection and restoration are most appropriate. Many current conservation plans target large blocks of contiguous habitat and habitat

corridors that can provide connectivity. If it is not possible to include such a map in this current draft, creating one needs to be a top priority for next year.

II. Strategy

As stated above, identifying clear acreage goals is an important first step in ensuring that conservation actions take place. However, it is unclear how exactly South Dakota plans to achieve these goals. The three main management actions listed in the plan (Section 6, pg. 7) include: 1) creating partnerships; 2) implementing and creating new landowner incentives programs; and 3) determining the amount of historic habitat currently present in the landscape. The third action is actually a research action. The first two are definitely necessary but at this time are too vague to describe necessary actions on the landscape to maintain or restore habitat conditions to achieve stated goals. The other research actions for the State are good. We were pleased to see that these were not focused on species surveys but rather developing a better understanding of ecosystem processes and land management techniques.

The plan also includes actions under the species accounts. These are only slightly more useful than the management actions. For example, the habitat action listed for most of the species is "to develop cooperative programs" with a variety of stakeholders. Appendix 7 gives a list of State programs, but it is unclear whether these are what the action lists refer to. It would be useful to include these programs in the main body of the plan, preferably in the ecosystem sections. Defenders has developed a report that discusses many of the various incentive programs that can be used to encourage private landowners to manage their lands compatibly with wildlife. Here is the link to the full report: (http://www.biodiversitypartners.org/bioplanning/tools/index.shtml).

Defenders strongly advocates focusing actions on habitats rather than individual species. Addressing habitat issues helps an entire assemblage of species. This approach is more comprehensive and cost effective than the single species approach. Many of the listed species actions are applicable to numerous species. For example, reducing pollution and controlling invasive species, which are actions for the Elktoe Mussel, will benefit all aquatic species including marcoinvertebrates that may not even be identified. These actions should be moved into the riparian/wetland sections of the plan.

For many States, the actions lists are the bulk of the document. We recommend including action lists in each of the ecosystem sections after the threats to that ecosystem are presented. The North Dakota and Nebraska state wildife strategies both have very useful conervation action lists for focal areas which may serve as models for your state.

III. Implementation

There are a few elements that we believe are crucial in order to smoothly transition from planning to implementation. These include clearly defined leadership roles, some discussion of funding, and a complete monitoring plan. The South Dakota plan has done an excellent job of presenting the roles that various agencies, the Tribes and other stakeholders have played in creating the plan itself. The discussion of public participation was especially extensive. Once the actions lists are more specifically developed, it would be useful to identify which partners would be best able to implement each action. For example, Minnesota has committed at least one full time DNR employee to implementing their plan. It wasn't clear if the plan will have a standing implementation committee to continue the process. We believe that thes kinds of commitments will help ensure a smooth transition to the implementation phase.

Lack of funding is a major barrier to conservation in any State. A clear presentation of available funds or potentially available funds helps provide a reality check as to what is feasible. It is also important to identify creative additional funding sources such as the Farm Bill, transportation mitigation dollars, ballot initiatives, and Federal invasive species control grants (http://invasivespecies.gov/toolkit/grants.shtml). The discussion of funding in South Dakota's plan in the introduction is limited to traditional federal wildlife sources such as Pittman-Robertson, Dingell-Johnson and Endangered Species Act. Iowa included an excellent description of existing and needed future funds in their plan. We recommend using it as a model.

The monitoring component of the South Dakota plan has some significant strengths. In particular, the 10% habitat maintenance goals provide clearly defined criteria for measuring progress. We were pleased to see that much of the monitoring plan is focusing on tracking this progress and on monitoring habitat condition. Defenders has produced a report on monitoring which advocates not only monitoring habitat condition, but also land use changes and conservation actions. Creating a spatial database of these actions would help in assessing how completely South Dakota is achieving ecological representation. Enlisting citizen volunteers can be a cost effective way to help monitor species or taxa. Here's a link to the full report: http://www.biodiversitypartners.org/infomanage/monitoring/01.shtml

Concluding Remarks

Overall, the South Dakota plan is an excellent assessment. It contains a wealth of information about the State's species and habitats. Clearly, extensive time and effort has been put into cataloging ecosystem diversity and determining target acreages. However, it falls short as a strategic document with clear and convincing conservation actions focused on important habitat areas of the landscape. Much of the writing is too technical for the document to be useful to a variety of users and other documents will be needed to communicate the plan to land managers. We hope that these suggestions are useful to you. Please contact us if you have any questions regarding our comments. Thank you again for making the document available for public review.

Sincerely,

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General response to the above, comment letters from the Mountain Lion Foundation, the Prairie Hills Audubon Society, and Defenders of Wildlife:

These comments were reviewed and, where appropriate, changes were made in this document. Some specific points are addressed here:

Point	Response
insect/fungus/disease outbreaks as a disturbance factor in Black Hills	Insect/fungus/disease are known disturbance events but are also captured in the overall fire regime through cause and effect.
plague as a disturbance event: are there other examples?	Disturbance events were selected that influence the majority of ecosystem diversity in the landscape. There are other types of disturbance that should be considered relative to species habitat needs as well but that do not contribute to the majority of ecosystem diversity on the landscape.
Great Plains Steppe Ecoregion • Forested Ecosystems - what about floods as a disturbance event? • Aquatic Ecosystems - what about turbidity impacts in prairie streams? • Is there special value in "string of pearls" phenomenon of intermittent streams? This habitat type is missing from Aquatic	Forested ecosystems are considered upland systems for the purposes of this plan; riparian/wetland ecosystems include forested conditions that are influenced by flooding. Turbidity was discussed as a possible impact on streams. Intermittent streams are included in the Aquatic ecosystem classification.

Ecosystem. • Can you differentiate between streams with and without introduced fish? Black Hills Ecoregion • Riparian and Shrub steppe - did only bison graze Black Hills riparian areas? • Forested Ecosystems - questions whether Forest Service emphasis on P. pine structural stages is legitimately related to wildlife.	Bison were the major grazing influence on riparian areas but there were other species influences as well.
Section 4 • need better distinction between habitat and nonhabitat	*addressed in the document*
Section 5 • grazing impacts in Black Hills; many small wetlands don't show up on NWI that are at risk • Mortality - add category (legal harvest/trapping, poisoning and accidental killing); add lead shot residue in wetlands and prairie dog towns; add disturbance from hunting • Mining - refer to all water pollution sources, not just from heavy metals • Forest Management - add removal of snags and downed material • Land/Water Management Impacts - add recreation • additional categories - Development of buildings, etc., Transportation, Energy Development	Grazing impacts in Black Hills are discussed in Section 5. NWI is the best available information for mapping wetlands. Lead shot is essentially poisoning. Hunting is a form of human disturbance already discussed. Heavy metals changed to contamination in document. Recreation is a form of human disturbance. Energy development was added to document. roads are a form of movement barrier or direct conversion of habitat.