Chapter 6. Conservation Actions

Relevant Required Elements:
#4 – Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions.

Focus of Chapter 6:
Similar to Chapter 5, this chapter reviews the ecological background for South Dakota's planning approach, but from the perspective of habitat- and species-specific actions needed to address the loss of ecosystem diversity and associated historical disturbance regimes.

Also, in common with Chapter 5, is the use of a standardized approach to describing conservation actions. This standardization facilitates sharing species and habitat goals and partnering across political boundaries. Conservation actions associated with terrestrial, riparian-wetland, and aquatic systems are examined in detail, using the relevant CMP categories. Following this evaluation is a similar assessment of conservation actions relevant to SGCNs. SGCNs are evaluated individually, with results available in a conservation actions appendix. Also discussed are the most prevalent conservation actions categories for each SGCN taxonomic group.

One of the most meaningful conservation actions is the identification of terrestrial and aquatic COAs, which were introduced in the previous SDWAP. This process also reinforces the importance of this document as a statewide planning document. The COA identification process, including data sources and resulting maps, can assist partners interested in prioritizing rare species and native habitat efforts. This chapter includes detailed descriptions of how COAs were developed.

Chapter 6 summarizes conservation actions relevant to aquatic and terrestrial species and habitats sorted by CMP first-level conservation actions categories.

6.1 Introduction

The goal of the coarse filter strategy is to provide the framework to evaluate appropriate objectives for conserving ecosystem diversity. The SDWAP does not attempt to return South Dakota to a "historical" condition. The Plan focuses on providing sufficient amounts of functionally similar ecosystems represented across all ecoregions for native species to continue to persist in South Dakota. The term used to describe this is "representation." "How much is enough," i.e. adequate representation of an ecosystem, is a difficult number to estimate. Therefore, we are using existing resources to help us determine core conservation areas. These areas will help protect, enhance, and restore the habitats and ecosystems we described in Chapter 3 and 4 and their associated SGCNs.

Habitat loss has been reported to be the leading threat to biological diversity at the species level (Barbault and Sastrapradia 1995, Temple 1986). Habitat loss and its effects on biological diversity can result from actual loss of habitat, alteration of disturbance processes, reduction in the size and connectivity of habitat patches, and populations shifting from a single population to a metapopulation. Each of these four areas of concern relative to habitat loss can influence representation and lead to the question of "how much is

enough." 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 that habitat is to be usable by the species. This is a question of whether the available habitat in a landscape is of a sufficient quality or patch size to support a population. Obviously, the more habitat that is lost the higher the likelihood that the remaining habitat will not occur in sufficient size or quality to sustain the species.

The final concern addresses the distribution or arrangement of habitat within a landscape. When a landscape contains adequate habitat, a species will often be distributed throughout the landscape in a relatively continuous and contiguous manner. If sufficient high-quality habitat remains, (and the species can freely move within the habitat) the landscape will likely support one population of the species with a high probability of persistence. As available habitat is lost, through either natural or anthropogenic factors, fewer areas (or patches) are available to support the species. Movement between areas of high-quality habitat becomes more difficult. 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 corridors for species to minimize isolating conditions. If the occurrence of an isolated population is produced by alteration of the landscape, then the management of the resulting population becomes more challenging.

Thus, the determination of representation from a species viability perspective is a complicated question. Due to this complexity, fine-filter or species-based approaches to conservation 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 are contemplated, the resulting information and analysis needs become staggering. In addition, trying to meet the needs of each species on landscapes altered significantly from historical conditions may result in conflicting land management goals.

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

To maintain or restore ecosystem diversity throughout South Dakota and provide sufficient ecosystem representation, several conservation actions need to be accomplished. Table 6.1 outlines several areas where conservation actions can be taken followed by in depth discussions in the sections following. The cultivated land and urban/developed categories are removed from Table 5.1 because they are not

considered "habitat." They are included in Figure 3.2 to showcase the current landscape of South Dakota.

6.2 Conservation Action Categories

Land Management – Terrestrial Systems

South Dakota will address the conservation needs by restoring terrestrial ecosystems and by promoting natural disturbance processes such as fire, grazing practices that mimic historical grazing patterns, and thinning of forest stands. South Dakota continues to see increasing partner support for helping manage terrestrial systems across the state. Private lands' voluntary conservation programs continue to grow and expand to help landowners with ecosystem restoration and land stewardship by providing cost share and technical assistance. Restoration of native ecosystems on public land continues through planting of high diversity native grass and forb plantings, woody habitat plantings, and wetland restoration. Ongoing management of public lands includes prescribed fire, grazing, invasive species removal (native and non-native), spraying, mowing, and other practices to improve ecosystem health. One possible goal for SDGFP and partner entities in the next few years would be to continue expanding the number of private lands biologists and farm bill biologists in the state to help landowners with land management practices for maintaining and promoting native ecosystems.

To alleviate impacts of climate change to working lands, South Dakota can focus on continuing to help landowners with water development projects focused on relieving water stress. Private landowners often experience periods of drought and periods of deluge, but during drought years a landowner might not have water available for livestock in all pastures. Improving water availability will allow rotational grazing to continue to mimic historical bison movement. Continuing to provide voluntary conservation programs to help landowners and their operations remain resilient is an important benchmark of success for this action item.

SDGFP and others promote the use and enjoyment of the state's natural resources for a variety of recreational pursuits. Cole and Landres (1995) discuss various options to promote coexistence of wildlife and habitat resources with recreation opportunities. Options include restricting the amount and type of recreational use, spatially distributing use, and enhancing site durability of heavily used areas. Spatial considerations also include selecting areas that can sustain heavy use and avoiding sites with rare or vulnerable habitats. Recommended planning steps include identifying rare species and habitats to help avoid future impacts, conducting long-term studies on recreational impacts to populations and communities, and using an experimental design rather than correlation analyses.

The Leave No Trace campaign promotes minimal impact practices for outdoor recreationists. Leave No Trace's seven principles are compatible with the habits of ethical sportsmen, sportswomen, and other outdoor users.

1. Plan ahead and prepare.
2. Travel and camp on durable surfaces.
3. Dispose of waste properly.
4. Leave what you find.
5. Minimize campfire impacts.
6. Respect wildlife.
7. Be considerate of others.

Table 6.1. Conservation Actions for Habitat Restoration, Enhancement and Protection.

Actions for Habitat Restoration, Enhancement, Protection	Grasslands	Forest	Riparian Areas	Wetlands	Badlands	Shrublands	Lakes/Reservoirs	Rivers/Streams
A. TARGET RESTORATION / STRESS REDUCTION ACTIONS								
1. Land / Water Management								
1.1 Site/Area Stewardship	X	X	X	X	X	X	X	X
1.2 Ecosystem & Natural Process (Re)Creation	X	X	X	X	X	X	X	X
2. Species Management								
2.1 Species Stewardship	X	X	X	X	X	X	X	X
2.2 Species Re-Introduction & Translocation	X	X	X	X	X	X	X	X
2.3 *Ex-Situ* Conservation							X	X
B. BEHAVORIAL CHANGE / THREAT REDUCTION ACTIONS								
3. Awareness Raising								
3.1 Outreach & Communications	X	X	X	X	X	X	X	X
3.2 Protests & Civil Disobedience								
4. Law Enforcement & Prosecution								
4.1 Detection & Arrest								
4.2 Criminal Prosecution & Conviction				X				
4.3 Non-Criminal Legal Action								
5. Livelihood, Economic & Moral Incentives								
5.1 Linked Enterprises & Alternative Livelihoods								X
5.2 Better Products & Management Practices	X	X	X	X		X	X	X
5.3 Market-Based Incentives	X	X	X	X		X		
5.4 Direct Economic Incentives	X	X	X	X	X	X	X	X
5.5 Non-Monetary Values	X	X	X	X	X	X	X	X
C. ENABLING CONDITION ACTIONS								
6. Conservation Designation & Planning								
6.1 Protected Area Designation &/or Acquisition	X	X	X	X		X	X	X
6.2 Easements & Resource Rights	X	X	X	X	X	X	X	X
6.3 Land/Water Use Zoning & Designation	X	X	X	X	X	X	X	X
6.4 Conservation Planning	X	X	X	X	X	X	X	X
6.5 Site Infrastructure							X	X
7. Legal & Policy Frameworks								
7.1 Laws, Regulations & Codes	X	X	X	X		X	X	X
7.2 Policies & Guidelines	X	X	X	X	X	X	X	X
8. Research & Monitoring								
8.1 Basic Research & Status Monitoring	X	X	X	X	X	X	X	X
8.2 Evaluation, Effectiveness Measures & Learning	X	X	X	X	X	X	X	X
9. Education & Training								
9.1 Formal Education	X	X	X	X	X	X	X	X
9.2 Training & Individual Capacity Development	X	X	X	X	X	X	X	X
10. Institutional Development								
10.1 Internal Organizational Management & Administration	X	X	X	X	X	X	X	X
10.2 External Organizational Development & Support	X	X	X	X	X	X	X	X
10.3 Alliance & Partnership Development	X	X	X	X	X	X	X	X
10.4 Financing Conservation	X	X	X	X	X	X	X	X

Along with land stewardship and restoration at smaller scales on private and public lands, South Dakota plans to continue larger scale management, including restoration of missing or severely degraded ecosystems. Grassland conversion, wetland drainage, and over or under utilization of livestock on grasslands and shrublands (sagebrush areas) are among the top large-scale goals for South Dakota. Natural habitat continues to be converted and/or taken over by invasive (native and non-native) species. Using voluntary conservation programs on private lands can help stop conversion to allow minimal loss. Helping private landowners financially and with technical assistance can make a large impact on restoration goals for natural ecosystems and processes that once thrived in South Dakota. Public lands managers will continue to restore and maintain the state's public areas. Most land in South Dakota is privately owned, making private land conservation extremely important. Projects that address connectivity and provide corridors for SGCNs and other species will also remain high priorities for land management conservation action.

Wetland/riparian/watershed management – Riparian-wetland Systems

South Dakota will address the conservation needs by restoring wetland ecosystems and promoting natural disturbance processes such as fire, grazing, and natural wet/dry cycles. The state continues to see increasing partner support for the restoration and enhancement of wetland systems across the state as part of the North American Waterfowl Management Plan (NAWMP) with implementation through the Prairie Pothole Joint Venture and Great Plains Joint Venture. Private lands' voluntary conservation programs continue to expand to help landowners with ecosystem restoration and land stewardship by providing cost share and technical assistance. Restoration of native ecosystems on public land continues through the restoration of drained wetlands, grazing management, and restoration of uplands within watershed boundaries. Management of public wetlands is ongoing and includes prescribed fire, grazing, invasive species removal, weed spraying, mowing, and other actions to improve ecosystem health. Private lands biologist positions have been dramatically increased in recent years, increasing capacity for habitat delivery and technical assistance on private lands.

Along with land stewardship and restoration at smaller scales on private and public lands, South Dakota's aquatic ecosystem conservation action goals include continuing landscape scale management in line with Joint Venture goals. This includes restoring missing or severely degraded wetland and riparian ecosystems. Financial incentives and technical assistance to private landowners can incrementally make significant impacts on restoring the function and values of wetlands and riparian systems that have been lost or degraded.

Land/water management – Aquatic Systems

South Dakota will address conservation challenges by restoring aquatic ecosystems and promoting natural disturbance processes such as fire, grazing, and natural wet/dry cycles. Conservation actions to address aging impoundment infrastructure, fish migration barriers, and degraded waters can be cost-prohibitive. The state continues to experience increasing partner support for restoration and enhancement of aquatic systems. New funding sources and staffing allocations have allowed increased work to address conservation needs surrounding lakes/reservoirs and rivers/streams. A major benefit to any aquatic restoration effort is that benefits apply not only to rare or game species, but to all species in a system. This benefit helps in the habitat realm but also in finding funding sources and partners. Efforts have focused on removal of barriers, adding habitat complexity and diversity in both lotic and lentic systems, and implementing best management practices. These efforts will continue, with expanded work to continue enhancement and restoration of aquatic habitats.

Species management – Terrestrial Systems

Terrestrial ecosystems support an array of species across the state, and each species has its own set of requirements. Some species requirements overlap, and others do not. For example, grassland nesting birds require a wide-ranging set of habitat requirements. Some species require exposed bare soil, others require dense tall plants, and some require a mixture of both. Therefore, it is difficult to address one individual species for management. Instead, one goal is to focus on best management practices to support the most species possible by using the coarse filter approach. Setting up burning and grazing rotations can benefit terrestrial species versus burning or grazing an entire parcel of land. Depending on the situation and the population of an individual species, a translocation process might be suitable after proper planning.

Species management – Riparian-wetland Systems

Wetland and riparian ecosystems support an array of species across the state, each with its own niche and set of requirements. Like terrestrial species, some wetland dependent species requirements overlap, and others do not. For example, many species of waterbirds require different wetland classes during different parts of their life cycle. To address this management challenge, a conservation goal is to focus on best management practices to support the most species possible using the coarse filter approach. Burning and grazing rotations can often benefit wetland dependent species versus burning or grazing an entire parcel of land.

Species management - Aquatic Systems

Aquatic species habitat requirements may change seasonally or during different parts of the life cycle. Where it is not cost effective to focus on individual species management, the focus will be on management actions that might benefit multiple species or species groups. Some current conservation efforts have used stocking efforts for species reintroductions, such as reintroduction of Lake Sturgeon to Big Stone Lake. This project includes research to investigate habitat usage as it relates to migration routes and spawning habitats and habitat usage related to all life stages. In this example, evaluation of habitat restoration efforts and restoration of stream/river connectivity will benefit more than Lake Sturgeon, including a wide array of aquatic SGCNs. In addition, work has been completed to assess road stream crossings and inventory culvert barriers to index severity and implement culvert ladder systems to promote fish passage. Management options also include examining best management practices to implement burning and grazing rotations to restore natural system modifications.

Creating awareness – Terrestrial Systems

Communication is essential for conservation and species management and can occur in many forms. Continuing to expand outreach and awareness of our SDWAP and terrestrial ecosystems is a continuing, long-term goal. It is important to continue informing the public about the ecosystem services our native systems provide, including clean air, clean drinking water, and carbon sequestration. In addition, knowing which species to plant and where to plant them plays a crucial role in managing for native ecosystems and eliminating habitat fragmentation. Current awareness campaigns, such as the "Where Good Things Grow," should continue to be promoted.

Creating awareness – Riparian-wetland Systems

Continuing outreach related to SDWAP implementation will include participation in communications efforts of multi-state Joint Ventures and the Central Flyway Council as well as internal efforts. We will continue to inform the public of the ecosystem services our wetland and riparian systems provide, which include clean air, clean drinking water, and carbon sequestration. Fostering public awareness will help create the social and political support needed to conserve wetland and riparian habitats. Current efforts, such as the "Habitat Pays" campaign, will continue to promote the value of wetlands and riparian areas.

Creating awareness – Aquatic Systems

Communication and education continue to be an essential component to conservation, restoration, and species management. Continuing to expand outreach and awareness of our SDWAP, lakes/reservoirs, and rivers/streams ecosystems will continue to be a SDGFP priority. Outreach will include participation in communication efforts of multi-state partnerships like the education and outreach committee of the Midwest Glacial Lakes Partnership and internal efforts, such as the annual SDGFP AIS Communications Plan, which is available upon request. Other outreach efforts occur through participation in lake associations, river work groups, and various outdoor/sportsmen and women groups located around the state. We must continue to find all avenues to inform the public on the benefits of all aquatic ecosystems and the importance of all species, whether game or nongame. Fostering public awareness will help create the social and political support needed to conserve aquatic resources and associated species.

Livelihood, economic incentives – Terrestrial and Riparian-wetland Systems

As the cost of living continues to increase, it becomes more difficult for landowners and others to provide for their families with a sustainable livelihood. Current farm policy generally incentivizes over production of grain crops leading to conversion of marginal lands. The Federal Farm Bill is the largest source for these dollars and SDGFP leverages these programs through its private lands and cooperative biologist positions with Non-Governmental Organizations like Pheasants Forever and Ducks Unlimited. As mentioned above, voluntary conservation programs are a powerful tool to help protect, enhance, and conserve terrestrial ecosystems in South Dakota. SDGFP and many partners continue to work together in pursuing grants and other funding sources to help deliver and provide options to landowners. These term (1-30 years) programs help offset the cost of installing materials for landowners and can also provide economic incentives to promote a healthy environment. These programs are essential to help reduce conversion, promote rotational and varying intensity grazing, and compete with increasing subsidies and safety nets available to crop farmers. The CRP is the largest term program available to landowners and is meant for marginal land that may be under-productive. "Productivity" is a relative term. Regardless, CRP provides a yearly payment to a landowner on their commitment to help conserve land and restore habitat. SDGFP and partners will continue to work together, striving to find new funding sources to help private landowners in South Dakota with conservation practices.

Livelihood, economic incentives – Aquatic Systems

As the cost-of-living increases, it gets exponentially harder for landowners and the public to be able to participate in conservation practices unless it positively influences their bottom line. SDGFP has established a Shoreline Restoration Program to cover most of the costs to establish restoration plots and asks landowners for in-kind match. This is beneficial to both parties as SDGFP staffing is a limiting factor to not only prep and plant but also to then maintain moving forward. The landowner provides match by providing

the needed hands to help prep, plant, and maintain moving forward, which has been very successful. Another benefit to this program is using the neighbor effect to help spread the word on the benefits to the aquatic ecosystem and reduced maintenance and costs to the landowner with a manicured lawn. The South Dakota Department of Agriculture and Natural Resources (DANR) has established a riparian buffer initiative. Establishing healthy riparian buffers is a common conservation practice to improve and protect water quality and overall ecological health of aquatic resources. These few examples of "outside the box" approaches to getting conservation practices to take off can encourage additional similar efforts.

A similar program in development to benefit the private landowner, public, and aquatic resources is the restoration and reconnection of oxbows to the river or stream. This program has been extremely popular in neighboring states and is currently being explored in South Dakota.

Conservation designation and planning – Terrestrial Systems

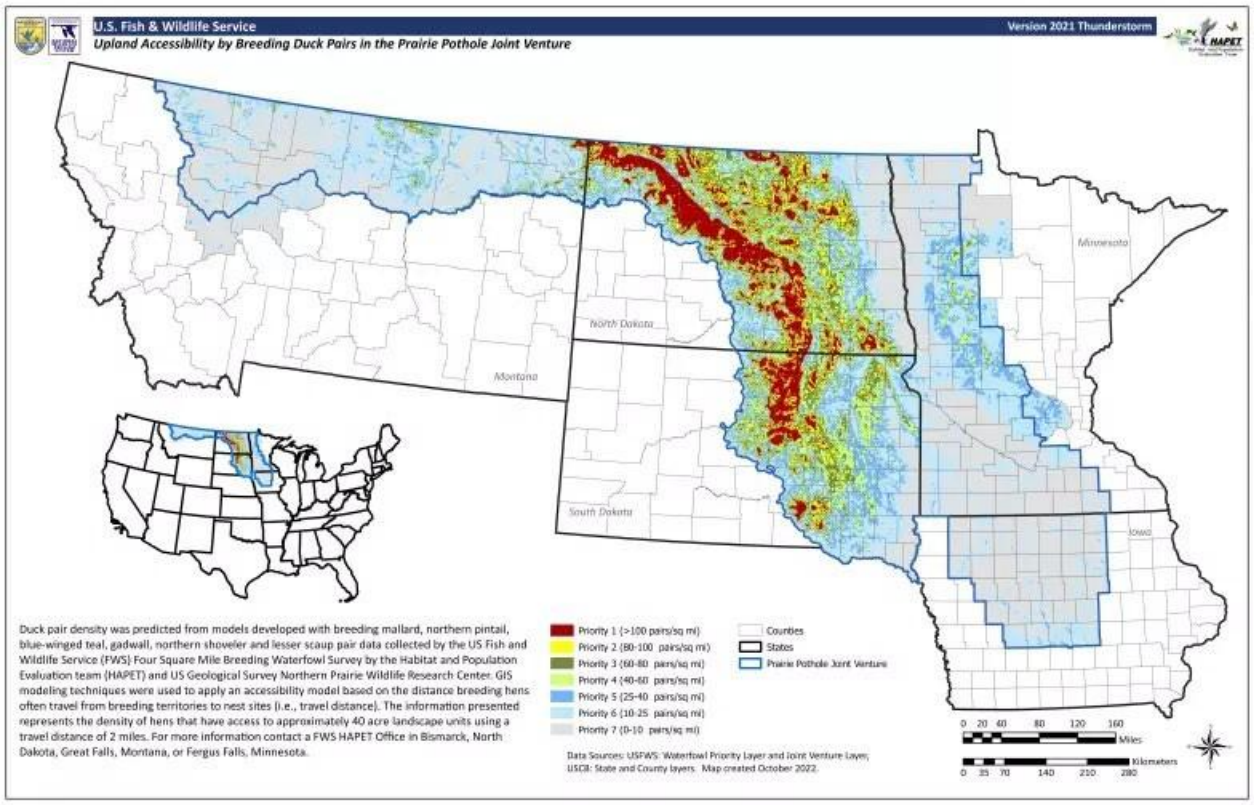
Long-term or perpetually protecting areas with valuable ecosystems is a powerful conservation tool that continues to increase on both public and private lands. SDGFP will continue reviewing opportunities to add more State Parks and Game Production Areas (GPA) across the state from willing sellers and on property that fits within our agency's goals and objectives. Easements are another protection method. Private landowners voluntarily sell resource rights on their lands. These options provide financial incentives to help a landowner, while also protecting the natural resources. In most scenarios, if landowners enroll into an easement or sell resource rights (carbon, wetland, water, etc.) they retain ownership. Restrictions may apply going forward, but depending on the agreement, a landowner may still be able to graze, hay, or harvest timber. Some organizations and agencies specialize in helping landowners with easements. An example is wetland and grassland easement programs offered by the USFWS in the PPR of South Dakota. South Dakota hopes to continue pursuing more options and incentives to permanently protect more terrestrial ecosystems.

Conservation designation and planning – Riparian-wetland Systems

South Dakota has a long history of diverse partnerships focused on conservation planning, technical assistance, and strategic habitat delivery for wetland conservation. Partnerships with diverse stakeholders including NRCS, USFWS, NGOs, FSA, and others have been crucial under the umbrella of the NGPs and Prairie Pothole joint ventures. Habitat delivery is guided in a strategic fashion through research and monitoring projects generated by partners including the Habitat and Population Evaluation Team (HAPET). Figure 6.1 is a well-known example model. These spatially explicit, species-based models help ensure conservation dollars are spent in the most beneficial manner. Long-term or perpetually protecting areas with valuable ecosystems is a powerful conservation tool that continues to increase on both public and private lands. SDGFP will continue reviewing opportunities to add more public lands across the state from willing sellers and on property that fits within our agency's goals and objectives. Easements are perhaps the most cost-effective, long-term protection product for planners. Easements provide financial incentives to help a landowner, while also protecting the natural resources by purchasing certain land use rights, generally burning, draining, or filling wetlands. In most scenarios, if landowners enroll into an easement or sell resource rights, they retain ownership and many working land uses. Although restrictions outlined in the agreement apply, landowners may still be allowed to graze, hay, or harvest timber. Some organizations and agencies specialize in helping landowners with easements. South Dakota hopes to continue pursuing more

options and incentives to permanently protect more wetland and riparian ecosystems.

Figure 6.1. Example of Spatially Explicit Model for Conservation Delivery. Upland Accessibility by Breeding Duck Pair in the Prairie Pothole Joint Venture.



Conservation designation and planning – Aquatic Systems

South Dakota has a long history of diverse partnerships focused on conservation planning, technical assistance, and strategic habitat delivery for wetland conservation and, to a lesser degree, on activities that benefit aquatic ecosystems. Partnerships with diverse stakeholders include NRCS, FSA, USFWS, NGOs, and Fish Habitat Partnerships. SDGFP is an active member of the National Fish Habitat Partnership, which has habitat- or area-specific partnerships that cover portions of the state in the Reservoir Fisheries Habitat Partnership, Midwest Glacial Lakes Partnership, Great Plains Fish Habitat Partnership, and the Fishers and Farmers Partnership. SDGFP has recently become involved with the Southeast Aquatic Resources Partnership through their aquatic connectivity program. Part of this partnership is to network, standardize, inventory, and prioritize stream crossings to address aquatic connectivity projects.

All these partnerships are focused on protecting resources. They are collaborative efforts to develop solutions and share ideas of what works or doesn't work in a particular area. Topics are very broad in easements, agreements, cost share ideas, outside the box ideas, and education/outreach that is not only geared toward agency professionals but also to the public and landowners.

Legal and policy – Terrestrial Systems

Conservation planning and protection of habitats and species are driven by policy and laws. The ESA and the North American Wetlands Conservation Act are laws directly helping protect and/or restore species and their habitats. Policies and laws like these are critical to help save remaining natural habitat and help restore what has been lost. Without such laws and policies, more wetlands would be drained, more forests would be logged, and more species would be harvested to extinction. These laws and policies often work hand in hand with hunting regulations that involve legal enforcement to protect wildlife from being overharvested. Enforcing existing laws and policies are priorities to assure terrestrial systems are protected. Some illegal activities go unreported or unpunished. SDGFP will continue consistent enforcement of wildlife laws with meaningful penalties.

Legal and policy – Riparian-wetland Systems

In addition to voluntary programs, laws and policies are important tools in conservation planning and protection of habitats and species. Swamp Buster provisions of the Federal Farm Bill and CWA regulations are examples. Such policies and laws are critical to help with habitat restoration. Without such laws and policies, more wetlands would be drained, leading to reductions in wildlife habitat and ecosystem functions and services. State level wetland and water quality regulations are the responsibility of the SD DANR. Enforcing existing laws and policies is critical to assuring protection of wetland and riparian habitats. Advocating for wetland friendly policies is an important tool to slow future wetland loss. SDGFP will continue to work directly with partners on advancing such policies and through the Prairie Pothole Joint Venture policy committee and Central Flyway Council.

Legal and policy – Aquatic Systems

Conservation planning and protection of habitats and species is driven by policy and laws. Swamp Buster provisions of the Federal Farm Bill and CWA regulations are primary examples of these. In more permanent aquatic ecosystems, laws and regulations regulate what and how much material is placed in rivers and lakes. Policies and laws are critical to help save remaining natural habitats and restore what has been lost. Without laws and policies like these, more wetlands would be drained, leading to reductions in habitat for wetland dependent species and ecosystem services. Drained wetlands contribute to increased occurrence and severity of flooding events, which also lead to loss or reduced habitats in lakes and river ecosystems.

At the state level, wetland and water quality regulations are promulgated and enforced by the SD DANR. SDGFP has a few policies to help protect lake and river/stream shorelines via Shoreline Restoration Application and Chemical Control Aquatic Vegetation Applications. Both applications work to limit or contribute to helping to protect aquatic resources and consider all project aspects before allowing work to be done. SDGFP also works with counties and townships to promote best management practices that can be applied at these levels as another means of protection. Enforcing existing Administrative Rules and Codified Laws of South Dakota will continue to remain a priority to assure our aquatic resources are protected. These include laws related to fishing seasons (ARSD 41:07) and AIS (ARSD 41:10:04). Advocating for wetland-friendly policies will be crucial for slowing future wetland loss. SDGFP will continue to work directly with partners on advancing such policies and enforcement.

Research and monitoring – Terrestrial Systems

Considering South Dakota's diverse terrestrial ecosystems, research and monitoring needs are substantial, particularly considering the myriad threats wildlife and ecosystems are facing. Research can range from the species to the landscape level. Since this plan takes a landscape-level approach, an important emphasis is on landscape-level research and monitoring. Continuing to learn about the natural historical disturbance regimes to help inform management decisions statewide is important, although a complex topic area. Multiple variables associated with fire and grazing management make this a research topic that can be conducted with many different objectives. More research on invasive species can help guide management for land managers. An additional important conservation action topic is the evaluation of conservation projects already underway in the state. For example, if a drained wetland is restored, partners should focus on evaluating, monitoring, and researching the results of these projects to highlight their importance. If project funding originates from rare species dollars, project impacts to those species should be investigated to improve future project selection and implementation. Oftentimes completed projects are not followed up on to check the long-term outcome. Following up with landowners or project managers to see how it has helped or hindered their operations would also be valuable information to further advance conservation programs in the state. Improved coordination could include having partners collaborate on a yearly report for all completed conservation projects, instead of each organization writing a separate annual summary. Public land monitoring and research should be emphasized. Where this is lacking, setting up yearly monitoring plots and transects can help guide management decisions and help with the overall health and longevity of these public lands. Creating plots and transects will help give a baseline of research needs to post-graduate or professional degree students or other researchers.

Research and monitoring – Riparian-wetland Systems

Wetland and riparian ecosystems in South Dakota are diverse and conversion pressures are daunting, leading to a variety of research and monitoring needs. Continuing to learn about the natural historic disturbance regimes to inform management decisions statewide is important, with pertinent topics including consolidation drainage, sedimentation, and pesticide contamination. Research is needed on invasive species' impacts to wetland and riparian ecosystems. An additional research and monitoring need is to better evaluate ongoing conservation projects throughout South Dakota, as was discussed for terrestrial systems.

Research and monitoring – Aquatic Systems

Aquatic ecosystems in South Dakota are diverse. Conservation and management are difficult due to multiple alterations and disturbances occurring at the same time; making determining primary causes for change in species and habitat loss difficult to determine. Questions involving impacts of flooding and drought on aquatic ecosystems, aging habitats and infrastructure, sedimentation, AIS, and impacts of tile drainage and pesticide contamination are a few examples of topics needing investigation. An important need is the evaluations of ongoing conservation and habitat projects. For example, following completion of a stream restoration project, partners should focus on evaluating, monitoring, and researching the before and aftermath of these projects to help inform future implementation of such projects. What was the project's long-term outcome, and has the project helped or hindered the landowner's or land manager's operations? An example project is a habitat improvement project at Gary Creek Gulch and the subsequent monitoring and evaluation on a before, during, and after approach. Another

landscape level approach to research and monitoring is the culvert inventory and prioritization tool project, where an inventory of crossings that are severely degraded to restrict fish passage is conducted and recovery/restoration plans developed. This project will benefit SGCNs and help promote an interagency approach as a starting point for discussions on replacements and best management practices to new crossings. Additionally, as AIS continues to spread in North America, new introductions are documented in South Dakota waters, and species that are already present are expanding their ranges. Potential impacts to fisheries are monitored annually through standard fish populations surveys, and specific research projects are initiated to evaluate more specific questions, such as the life-history strategies of invasive carps in South Dakota waters and potential invasion pathways.

Education and training – Terrestrial Systems

With 80% of South Dakota privately owned, it is important to inform the public on proper management techniques and the programs and funding available for landowners. In recent years, many partners have collaborated on prescribed fire, grazing management, and grassland management schools across the state. These trainings provide information to the public on management necessary to help protect and enhance the terrestrial systems in South Dakota. Existing trainings and schools will continue to grow and more topics likely added to continue teaching landowners, land managers, agency staff, and professionals. Educational programs are also important for urban dwellers to enhance their knowledge and engagement with natural resource management. Education and training events on public lands (especially State Parks) will continue to grow to showcase terrestrial ecosystems to all age groups. Signage on trails, age-appropriate resources about ecosystems, newspaper articles, magazine articles, and radio and television ads are all opportunities to reach landowners, urbanites, and youth groups.

Training the next generation on natural resource stewardship is one of the best ways we can ensure the long-term preservation and health of our ecosystems. An example is a recent push to develop a K-12 curriculum to teach children about the importance of grasslands and shrublands. Continued development and use of such curricula will help educate the next generation of South Dakotans.

Education and training – Riparian-wetland Systems

Building social and political support for wetland and riparian area conservation is critical to secure the policies needed conserve and restore wetland and riparian ecosystems in the state. Similar to training opportunities mentioned in the terrestrial systems section, wetland and riparian area related trainings, such as workshops on installing Beaver Dam Analogs (BDAs), will continue to grow and increase awareness on wetland and riparian habitat importance. Sharing information with people living in urban areas is crucial, because the majority of our public now lives in nonrural settings. Education and training events on public lands (especially State Parks) will continue to grow to showcase wetland and riparian ecosystems. Signage on trails, age-appropriate information about ecosystems, newspaper articles, magazine articles, radio and television ads, and social media outlets are ways to reach our various user groups.

A recent effort to encourage development of a K-12 curriculum to teach children about the importance of prairie ecosystems could be expanded to also include the importance of riparian and wetland systems on the landscape.

Education and training – Aquatic Systems

Staff and partners have regular meetings with lake associations and groups, and partners are presenting webinar series during the winter/springtime covering a wide range of topics for management and conservation of aquatic ecosystems or offering opportunities for data collection through citizen science. Additionally, statewide campaigns like Clean, Drain, Dry teach aquatic resource users how to stop the spread of AIS species. It is important to educate aquatic resource users that their actions can have negative consequences when AIS species are unintentionally moved to new waters. All such efforts help to increase awareness on the importance of aquatic ecosystems to landowners, land managers, agency staff, and professionals. As has been mentioned in other sections, including people living in urban areas in information efforts has become more important as most South Dakotans now live in nonrural settings. Outdoor education courses at SDGFP Outdoor Campuses, in nonrural areas, and middle schools in both rural and nonrural areas focus on aquatic ecosystems and AIS.

Institutional development – Terrestrial and Riparian-wetland Systems

South Dakota has numerous public land areas, and some may be neglected due to staffing and time constraints. These constraints may be weather driven, with periods of drought and deluge that are not under the control of the land manager. Additional public lands managers would help improve management for these areas. Similarly, additional funding could allow enhance private land partnerships where more private lands and farm bill biologists could provide the expertise and knowledge of all the voluntary conservation programs available to landowners across the state. Enhanced funding would also allow more diverse program delivery on public and private lands to include habitat practices and programs that target specific habitat needs of plant and animal SGCNs.

Great efforts are made in South Dakota to communicate and collaborate effectively with partners, but there is always room for improvement. Continuing to grow organizations and foster inter-agency collaboration will help push conservation to new heights in the state. This applies to other agencies, organizations, and stakeholder groups with a strong commitment to South Dakota's natural resources. Improving communication between these partner groups will enhance effective and lasting conservation. Train the trainer events occur regularly across the state and can always be improved to include more staff and partners along with more topics to help spread important information on terrestrial systems.

The last general conservation action for terrestrial systems is to raise and secure funds for conservation. New grants and other creative funding sources should be explored to benefit conservation, particularly where partnerships can multiply funding impacts.

Institutional development – Aquatic Systems

South Dakota has many public water resources, but constraints imposed by staffing, time, and weather conditions can limit effective management. To address this issue, SDGFP formulated an Aquatic Habitat and Access Program that works closely with the agency nongame staff in collaborative efforts for habitat management and restoration efforts. Many of these efforts focus on public lands and waters but future efforts could include collaboration with SDGFP Private Lands Biologists, who work primarily within terrestrial habitats. Work on public resources almost always benefit from Best Management Practice efforts applied to private lands in programs, such as riparian buffer strips, grassed waterways, wetland restoration, or

shoreline restorations.

Great efforts have been made in South Dakota to communicate and collaborate effectively with partners. Continuing to grow partnerships and fostering inter-agency collaboration will help drive synergy and improve aquatic ecosystem conservation delivery. This applies to agencies, organizations, and stakeholder groups with a high interest in South Dakota's natural resources. Improving communication between all stakeholders will pay dividends in effective and lasting conservation efforts. Train the trainer events apply to aquatic ecosystems, similar to efforts related to upland, terrestrial, wetland, and riparian ecosystems.

Acquiring and leveraging funding sources for aquatic ecosystem restoration and management efforts is a critical component. Most aquatic ecosystem projects are generally complex, can affect a large range of lands and publics, are usually extremely costly, and require a team effort for completion. Using non-state and non-federal funding sources and leveraging match can dramatically increase the impact of state license dollars. New grants and other creative funding sources should be explored to benefit aquatic conservation in the state.

6.3 Conservation Actions Described by Taxonomic Groups

In addition to highlighting conservation actions in individual SGCN accounts, the IUCN/CMP Conservation Actions Matrix was analyzed at the SGCN level within taxonomic groups for each of South Dakota's 205 animal and 40 plant SGCNs (Appendix Q; https://gfp.sd.gov/UserDocs/nav/SDConsActions.xlsx). The first-level conservation action categories are ranked in importance for all SGCNs considered together. Because this level contains more than one topic, an individual SGCN may be counted more than once within a first-level category if more than one subcategory applies to that species (Table 6.2). When all SGCNs are considered together, the second-level conservation action categories are ranked in importance (Table 6.3). An individual SGCN could be counted once within each of these categories, which is reflected by the smaller number of affected SGCNs.

Table 6.2. Number of SGCNs Affected Under the First-level Conservation Action Categories.

Conservation Action Category	# SGCNs affected
Institutional Development	503
Research and Monitoring	417
Conservation designation & planning	403
Land/water management	314
Species management	235
Education & Training	183
Awareness raising	177
Livelihood, economic & moral incentives	177
Legal & Policy Frameworks	92
Law enforcement & prosecution	0

Table 6.3. Number of SGCNs Affected Under the Second-level Conservation Action Categories.

Conservation Action Subcategory affected	# SGCNs
Basic Research & Status Monitoring	233
Species stewardship	196
Evaluation, Effectiveness Measures & Learning	184
Outreach & communications	177
Alliance & Partnership Development	176
Site/area stewardship	168
Conservation Planning	154
Ecosystem & natural process (re)creation	146
Better products & management practices	133
Protected area designation &/or acquisition	118

Amphibians and reptiles

This group of 22 SGCNs would benefit most from the first-level conservation action categories of land/water management; species management; awareness raising; livelihood, economic & moral incentives; conservation designation & planning; research and monitoring; and institutional development. Many amphibians and reptiles are poorly understood or even feared by the public, so education and outreach to the public about the value of herps to the landscape is needed. Many amphibians are considered indicator species for environmental health, particularly wetlands, so better water quality and overall management of water bodies in the state would be beneficial. Continued monitoring through long-term systematic surveys and research to help characterize herp use of specific habitat types and management practices will help provide information needed to sustain the state's diverse herp communities.

Aquatic insects

This group of 10 aquatic invertebrate SGCNs would benefit most from basic research and status monitoring (10 species), site-area stewardship (10 species), species stewardship, (10 species), outreach and communications (10 species), and better products and management practices (10 species). Many invertebrate species are poorly understood because of a lack of taxonomic experts for understudied groups. In recent years, an increased focus on the importance of native pollinators has drawn attention to the dramatic and sometimes irreversible decline of many native bees, butterflies, and bumble bees. However, many other invertebrates still lack basic knowledge about their distribution and status. Experts should be consulted on the best approaches to addressing conservation actions for aquatic insects and other native invertebrate species.

Birds

For South Dakota's 52 bird SGCNs, the most important conservation action categories are basic research and status monitoring (52 species); species stewardship (48 species); evaluation, effectiveness measures and learning (47 species); outreach and communications (46 species); and ecosystem and natural process (re)creation (43 species). Many of South Dakota's bird SGCNs depend on declining grassland and wetland habitats or they are considered stable species that represent other bird species dependent on rare,

declining, or unique habitat types. Continued monitoring through long-term systematic surveys and research to help characterize avian use of specific habitat types and management practices will help provide information needed to sustain the state's diverse bird communities.

Crayfish

This group of 4 crayfish SGCNs would benefit most from basic research and status monitoring (4 species), site-area stewardship (4 species), species stewardship, (4 species), outreach and communications (4 species), and better products and management practices (4 species). Many invertebrate species are poorly understood because of a lack of taxonomic experts for understudied groups. In recent years, an increased focus on the importance of native pollinators has drawn attention to the dramatic and sometimes irreversible decline of many native bees, butterflies, and bumble bees. However, many other invertebrates still lack basic knowledge about their distribution and status. Experts should be consulted on the best approaches to addressing conservation actions for crayfish and other native invertebrate species.

Fishes

This group of 28 fish SGCNs would benefit most from basic research and status monitoring (28 species), site-area stewardship (28 species), species stewardship, (28 species), outreach and communications (26 species), and better products and management practices (28 species). Many of South Dakota's native nongame fish species are poorly understood and the physical requirements needed for survival are often unknown. Continued monitoring through long-term systematic surveys and research to help characterize fish use of specific habitat types and management practices will help provide information needed to sustain the state's diverse fish communities.

Freshwater mussels

This group of 11 freshwater mussel SGCNs would benefit most from basic research and status monitoring (11 species), site-area stewardship (11 species), species stewardship, (11 species), outreach and communications (11 species), and better products and management practices (11 species). Many invertebrate species are poorly understood because of a lack of taxonomic experts for understudied groups. Freshwater mussels are elusive and sensitive species associated with beneficial ecosystem services that are experiencing unprecedented rates of decline. Experts should be consulted on the best approaches to addressing conservation actions for freshwater mussels and other native invertebrate species.

Gastropods

Five SGCNs from this taxonomic group are found primarily in the Black Hills. The following conservation actions would benefit all 5 species: site/area stewardship; ecosystem and natural process (re)creation; species stewardship; outreach and communications; better products and management practices; conservation planning; policies and guidelines; basic research and status monitoring; and alliance and partnership development. In general, more systematic monitoring and use of results in land planning and resource use would benefit these representative species.

Mammals

Conservation actions needed for South Dakota's 28 mammal SGCNs fall into the following categories: basic

research and status monitoring (18 species); evaluation, effectiveness measures and learning (16); outreach and communications (15 species); alliance and partnership development (12 species); site-area stewardship (11 species); and species stewardship (10 species). Ten of South Dakota's mammal SGCNs are bats. Bats are especially sensitive to disturbance, challenging to survey and study, and in need of specific habitat types for nurseries, hibernation, roosting, and foraging.

Plants

Plants are vital to terrestrial ecosystems and so many other species in the community. Most living organisms require plants to survive and yet they are threatened by so many factors (refer to chapter 5). This revision of the Wildlife Action Plan includes 40 SGCN plants. These 40 species all have similar action items that can be focused on to help their populations remain stable or expand. All 40 plants will benefit from more research/monitoring and evaluation following a research project or a voluntary conservation program implemented on private land. Research and evaluations will help expand the knowledge of plants to understand individual requirements for each species. Most plant species (38 species) can also be positively impacted by improved site and area stewardship, species stewardship, formal education to the public, training practitioners how to manage for a certain species, external and internal organizational management, partnership development, and financing conservation. Educating the public on the value of plants is an important action item to help explain the ecosystem services plants provide. One specific action item for this revision is to promote our state parks and public areas to the public and educate them how a diverse terrestrial ecosystem can benefit them. Furthering education to youth groups on the value of the outdoors and the plants beneath their feet would certainly be beneficial. A few other important action items that can be addressed for plants include improved outreach and communication to inform the public about the importance of plants (30), increase the number of protected areas (35) and easements in the state (34), and improve conservation planning by developing management plans for each species (36). The last two conservation actions that should be addressed are law and policy (8) and land and water zoning (9). There can be more enforcement for certain policies or laws that will help protect plant species. Water and land zoning falls into this category with such actions as stopping wetland draining. If one plant goes extinct, it may have a ripple effect on many other living organisms. Protecting and enhancing our terrestrial ecosystems will benefit plants and the species that rely on them.

Monarch Caterpillar Owen McElroy

Terrestrial insects

This group of 45 SGCNs would benefit most from basic research and status monitoring (43 species), ecosystem and natural process (re)creation (20 species), and species stewardship (20 species). Many invertebrate species are poorly understood because of a lack of taxonomic experts for understudied groups. In recent years, an increased focus on the importance of native pollinators has also drawn attention to the dramatic and sometimes irreversible decline of many native bees, butterflies, and

bumble bees. A more holistic approach to public and working lands management may help avoid continued unintended consequences for native invertebrate species.

6.4 Conservation Opportunity Areas – Overview

COAs were first proposed in the 2014 SDWAP. The goal of this process was to use relevant variables to map areas in South Dakota where increased emphasis on habitat conservation, protection, or management will benefit SGCNs and remaining intact native habitats.

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

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

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

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

Why aquatic and terrestrial COAs were developed separately

Several challenges caused terrestrial and aquatic resources to be considered separately during the COA development process. In this plan, MLRAs help define terrestrial ecosystems. Watersheds and drainages define interacting freshwater systems and act as the primary evolutionary constraint to freshwater

biodiversity. Therefore, defining ecosystems for freshwater biodiversity requires the integration of both ecoregion and drainage boundaries. This difference resulted in the use of different geographical frameworks in our selection process of COAs for terrestrial and aquatic systems.

Terrestrial conservation opportunity areas

Terrestrial COAs allow for the identification of areas that can be targeted for habitat conservation, protection, or management for the benefit of SGCNs and remaining intact native habitats. These COAs can then be tied back to ecological site (Appendix J) and MLRA (Appendix R) to garner more information about disturbance state and soil type. For the creation of ecological sites and terrestrial COAs described below, all GIS analysis and processing was performed in NAD 1983 Albers BLM Montana, North Dakota, South Dakota (WKID: 102399).

To assist with targeted planning for conservation actions, COAs were updated for this SDWAP. The methodology for creating terrestrial COA stayed largely the same. Datasets were updated and a few new datasets were incorporated, most notably the National Audubon Society and BirdLife International's Important Bird Areas. These areas represent the best opportunities for voluntary ecosystem restoration or other effective management actions within South Dakota and may also include areas with large numbers of SGCN or important linkage zones. Identification of COAs also allows for improved or renewed opportunities to build collaborative relationships with landowners and stakeholders in those landscapes, especially those with an interest in fish and wildlife conservation in South Dakota.

Ecological site creation

As described in more detail in chapter 3, ecological sites represent the physical environmental components of an ecosystem (soil, aspect, elevation, etc.). South Dakota's ecological sites are derived from the NRCS soil survey geographic database (SSURGO). The NRCS has delineated over a million polygons covering South Dakota. These polygons correspond to soil components, which in turn correspond to ecological sites. One polygon can correspond to multiple soil components, so we selected the largest soil component for each polygon. For ecological sites, we used NRCS Rangeland Sites instead of Forage Suitability Groups. This process resulted in 325 ecological sites for the State (Appendix J).

Terrestrial COA input layers

The creation of terrestrial COAs for this plan was similar to the COA creation process used in the 2014 Wildlife Action Plan. To start, we acquired square mile hexagons for the state from the Western Association of Fish and Wildlife Agencies (WAFWA) hexagon framework. The hexagon framework divides most of the North American continent into square mile hexagons. These hexagons allow for a uniform mapping unit, as well as the ability to publicly convey information without giving away exact locations of sensitive data.

A protected areas layer was created using various datasets (Table 6.4). These included State and Federal lands, as well as private lands with permanent easements. Figure 6.2 displays percent of square mile hexagons that are protected.

Various wildlife layers were acquired to create a combined wildlife layers dataset (Table 6.5). For those wildlife data that were occurrence records, each point was buffered by a separation distance for that species, as defined by NatureServe. Most data from the South Dakota Natural Heritage program already had separation distances included. For occurrence data where these were not included, we generally used the separation distance for unsuitable habitat and breeding. This combined wildlife layers dataset (Figure 6.4) should not be taken as a true representation of species richness in South Dakota. The input layers used were primarily of rare species, threatened and endangered species, and species of special significance to South Dakota.

We used the same large, intact blocks from the previous Wildlife Action Plan (Figure 6.3). These were derived from an early iteration of the NatureServe Landscape Condition Model (see Hak and Comer 2017 for a subsequent publication). In short, the Landscape Condition Model seeks to indicate the relative ecological condition of an area. These large, intact blocks were categorized into three levels. Level 1 blocks were those with the highest one-third of landscape condition scores. Level 3 blocks were those between 10,000 and 50,000 hectares that had not been classified as Level 1. All remaining areas were classified as Level 2.

There are ten major rivers in South Dakota (Bad, Belle Fourche, Big Sioux, Cheyenne, Grand, James, Little White, Missouri, Moreau, Vermillion, and White). GIS data of these ten rivers were obtained from the NHD and then buffered by one mile.

We also acquired GIS data of the National Audubon Society and BirdLife International's Important Bird Areas for South Dakota. These are areas that have been deemed essential habitat for one or more species of birds. These areas are crucial for wintering, breeding, and migration.

Terrestrial COA creation

We defined our terrestrial COAs as any hexagon where greater than or equal to 50% of its area was protected (as defined by our protected areas layer), or a hexagon that intersected with a large intact block categorized as Level 1, or a hexagon with a species richness greater than or equal to 100 species (from our combined wildlife layers dataset), or a hexagon that intersected with an important bird area. Our final terrestrial COA layer is depicted in Figure 6.5. We then calculated the percent of COA acres within each ecological site (Appendix J).

Table 6.4. Protected Lands Data Sources for Terrestrial Conservation Opportunity Area Identification.

Data Layers
National forest (USFS)
National grassland (USFS)
Wilderness areas (USFS)
Bureau of Land Management
U.S. Army Corps of Engineers
National Park Service
National wildlife refuges (USFWS)
Waterfowl production areas (USFWS)
Game production areas (GFP)
State park and recreation areas (GFP)
SD Office of School and Public Lands
TNC properties
National Conservation Easement Database

Table 6.5. Plant and Animal Species Data Sources Used in Terrestrial Conservation Opportunity Area Identification.

Data	Data Source
Prairie grouse occupancy models	Runia et al. 2021
Greater sage-grouse core area	SDGFP
Greater sage-grouse and greater prairie-chicken leks (those showing use from 2005 or later)	SDGFP
Golden eagle nest data, western South Dakota	SDGFP
Bald eagle nest data	SDGFP, USFWS, and other cooperators
South Dakota Natural Heritage Database	SDGFP and NatureServe
River otter collection and observation data (verified records from 2005 and later)	SDGFP and cooperators
South Dakota second breeding bird atlas data (2008-2012)	SDGFP, RMBO, SDOU, and cooperators
Active prairie dog colonies from 2020 that were greater than 10 acres	SDGFP
Wild turkey distribution data	South Dakota Wild Turkey Management Plan 2021-2030
Annual fall classification survey (elk, pronghorn, mule deer, and white-tailed deer)	SDGFP

Figure 6.2. Map of Square Mile Hexagons by Percentage of Protected Area.

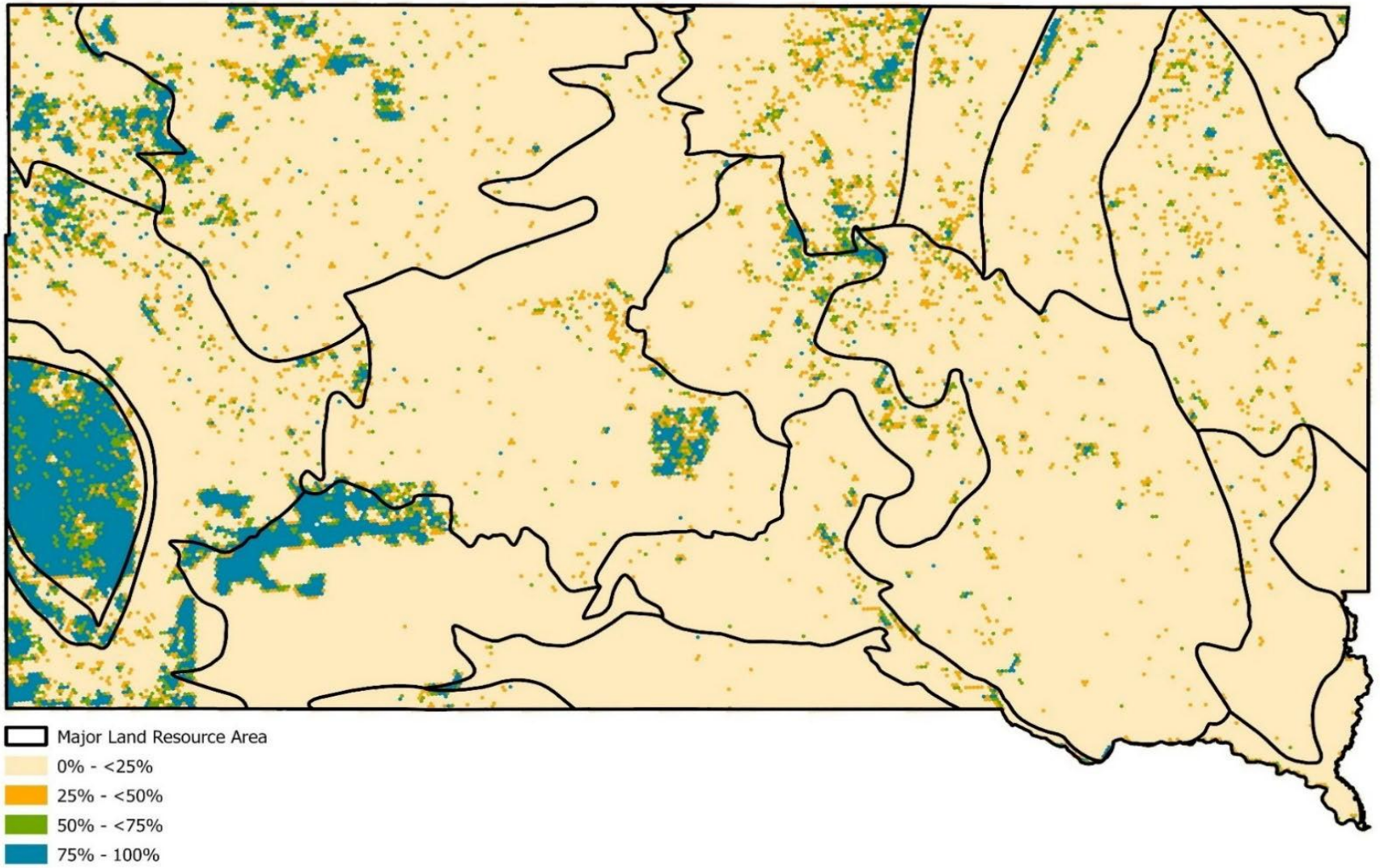


Figure 6.3. Map of Large, Intact Blocks with Limited Amounts of Human Disturbance.

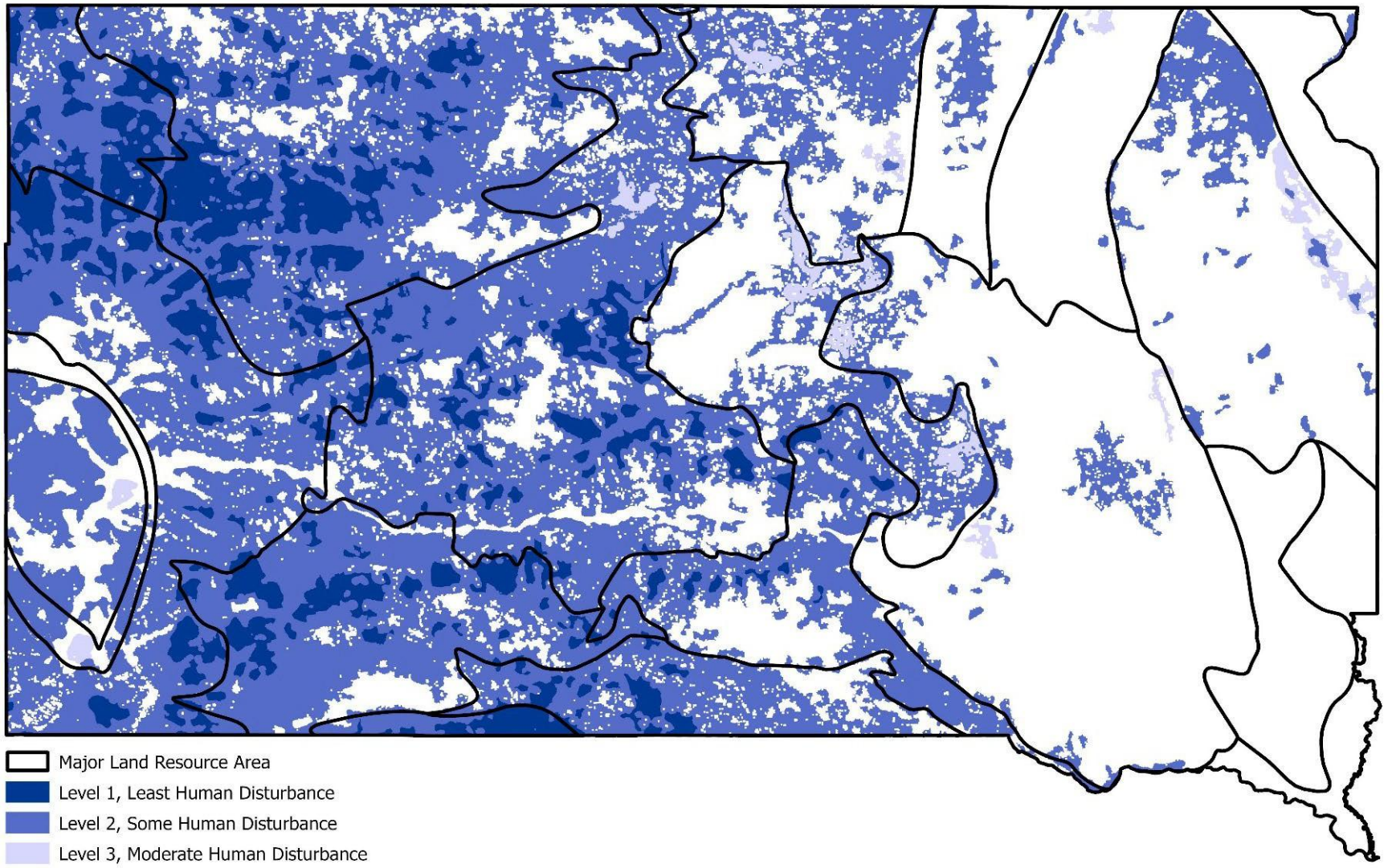


Figure 6.4. Map of Square Mile Hexagons by Species Richness Count.

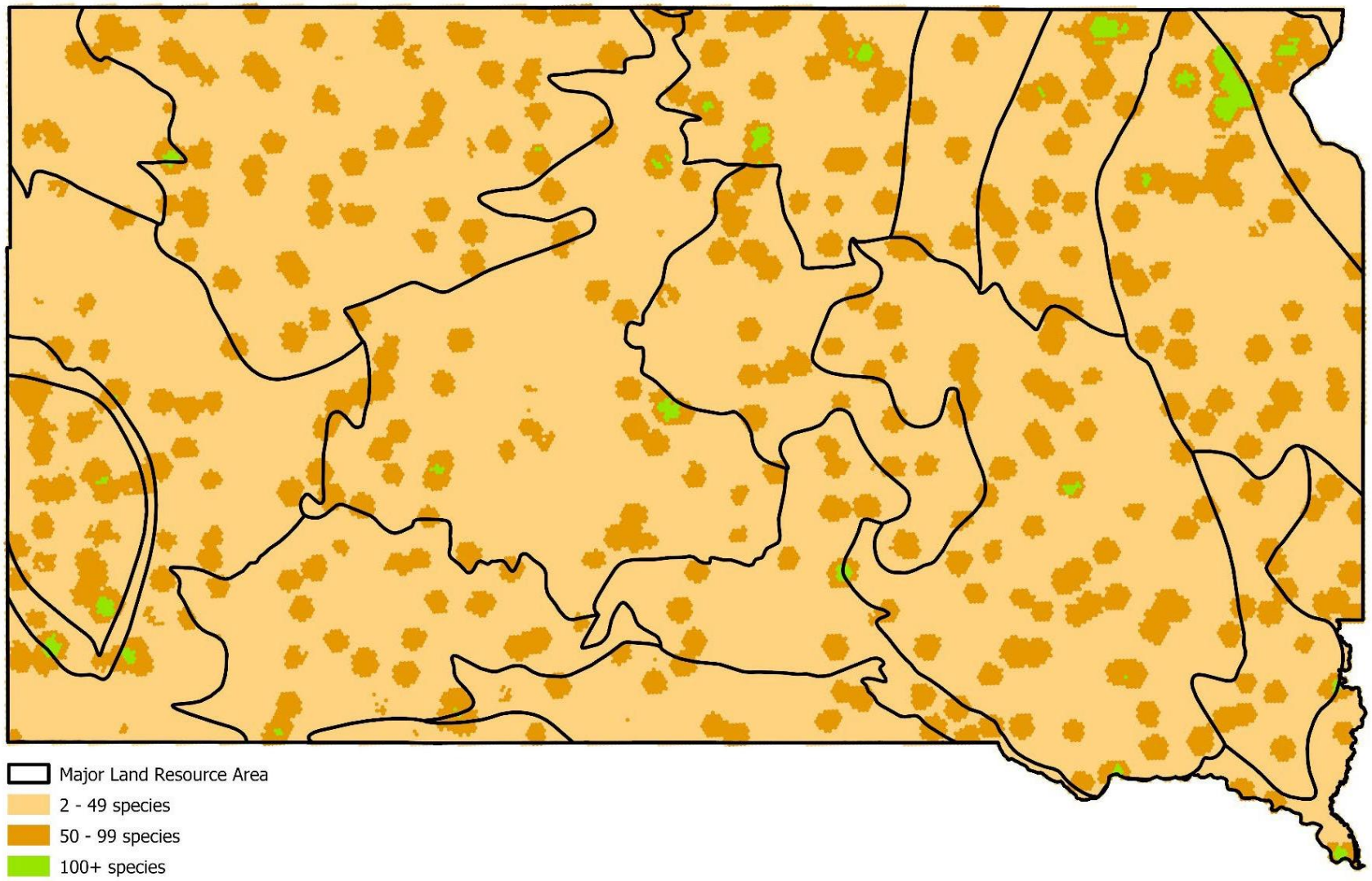


Figure 6.5. Map of Terrestrial Conservation Opportunity Areas.

Aquatic conservation opportunity areas

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

The USGS's HUCs were identified as the aquatic riverine classification hierarchy used as the geographic framework for developing COAs (Seaber et al. 1994, Jones et al. 2022). From this classification system, watersheds (HUC_10 boundaries) were selected as the abiotic conservation targets in the selection process for identifying COAs. To fully address the biotic targets, aquatic SGCNs were used as the primary focus within the COA selection process.

Conservation strategy

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

Basic Elements of the Conservation Strategy:

I. Develop separate COAs for each sub-basin (HUC_8 boundary);
II. Identify at least two COAs within each sub-basin (HUC_8 boundary);

Through this conservation strategy we provided an ecosystem approach to biological conservation and represented a wide spectrum of the diversity of macrohabitats across South Dakota. This strategy was developed to represent multiple populations for SGCNs to select a wide range of COAs for protecting these species throughout South Dakota. We then established quantitative and qualitative assessment criteria for selecting COAs at the watershed (HUC_10) level.

Assessment criteria

Watershed (HUC_10) level COA selection criteria were selected on a hierarchical system (listed in order of importance):

I. Highest confirmed species richness for SGCNs (See Species Richness section and Fig. 6.7);
II. Lowest Human Stressor Index (HSI) value (See HIS section and Fig. 6.8);
III. Highest percentage of public ownership (See Watershed Ownership/Stewardship Status section, Table 6.9, and Fig. 6.11)

When necessary, additional aquatic COAs were selected to capture underrepresented SGCNs with limited ranges (contained only within one or two individual watersheds (HUC_10) across the entire state). In that way all aquatic SGCNs were represented by at least one COA.

Each selected COA was named to generally correspond with the name of the largest tributary stream contained within the boundary of the watershed (HUC_10 boundary).

Aquatic Species of Greatest Conservation Need

A complete listing of SGCNs is found in Table 2.1, which includes 53 aquatic SGCNs (Table 6.6).

Table 6.6. List of Aquatic SGCNs Used in the Conservation Opportunity Area Development Process for the South Dakota Wildlife Action Plan.

Common Name	Scientific Name	Federal Status[a]	State Status[b]	SGCN Criterion[c]
FISHES				
Banded Killifish	*Fundulus diaphanus*		E	1
Blacknose Shiner	*Notropis heterolepis*		E	1
Blackside Darter	*Percina maculata*			3d
Blue Catfish	*Ictalurus furcatus*			3b
Blue Sucker	*Cycleptus elongatus*			3d
Burbot	*Lota lota*			3h
Carmine Shiner	*Notropis percobromus*			3f
Central Mudminnow	*Umbra limi*			3f
Finescale Dace	*Chrosomus neogaeus*		E	1
Flathead Chub	*Platygobio gracilis*			2a
Hornyhead Chub	*Nocomis biguttatus*			3f
Lake Chub	*Couesius plumbeus*			3f
Lake Sturgeon	*Acipenser fulvescens*			3b
Logperch	*Percina caprodes*			3d
Longnose Sucker	*Catostomus catostomus*		T	1
Northern Pearl Dace	*Margariscus nachtriebi*		T	1
Northern Redbelly Dace	*Chrosomus eos*		T	1
Paddlefish	*Polyodon spathula*			3b
Pallid Sturgeon	*Scaphirhynchus albus*	E	E	1
Plains Sucker	*Pantosteus jordani*			3e
Plains Topminnow	*Fundulus sciadicus*			2a
Sauger	*Sander canadensis*			3d
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*	T		1
Sicklefin Chub	*Macrhybopsis meeki*		E	1
Southern Redbelly Dace	*Chrosomus erythrogaster*			3e
Sturgeon Chub	*Macrhybopsis gelida*		T	1
Topeka Shiner	*Notropis topeka*	E		1
Trout-perch	*Percopsis omiscomaycus*			3h

Table 6.6 (continued). List of Aquatic Species of Greatest Conservation Need Developed for the South Dakota Wildlife Action Plan.

FRESHWATER MUSSELS				
Common Name	**Scientific Name**	**Federal Status[a]**	**State Status[b]**	**SGCN Criterion[c]**
Black Sandshell	*Ligumia recta*			3e
Creek Heelsplitter	*Lasmigona compressa*			3e
Elktoe	*Alasmidonta marginata*			3e
Flat Floater	*Utterbackiana suborbiculata*			3h
Hickorynut	*Obovaria olivaria*			3e
Higgins Eye	*Lampsilis higginsii*	E		1
Mapleleaf	*Quadrula quadrula*			3e
Pimpleback	*Cyclonaias pustulosa*			3e
Rock Pocketbook	*Arcidens confragosus*			3e
Scaleshell	*Potamilus leptodon*	E		1
Yellow Sandshell	*Lampsilis teres*			3e

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

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

[c] SGCN Criteria –

1 = State or federally listed species for which the state has a mandate for recovery (listed as threatened or endangered);
2a = Species that are regionally or globally imperiled* and for which South Dakota represents an important portion of their remaining range;
2b = Species that are regionally or globally secure* and for which South Dakota represents an important portion of their remaining range; or
3a – 3 h = Species with characteristics that make them vulnerable, including any of the following:
3a are indicative of or depend on a unique or declining habitat or resource in South Dakota;
3b require large home ranges/use multiple habitats;
3c depend on large habitat patch sizes;
3d depend on an ecological process (such as fire) that no longer operates within the historical range of variation;
3e are limited in their ability to recover on their own due to low dispersal ability or low reproductive rates;
3f have a highly localized or restricted distribution (endemics);
3g concentrate their populations during some time of the year; or
3h have significant information or data needs

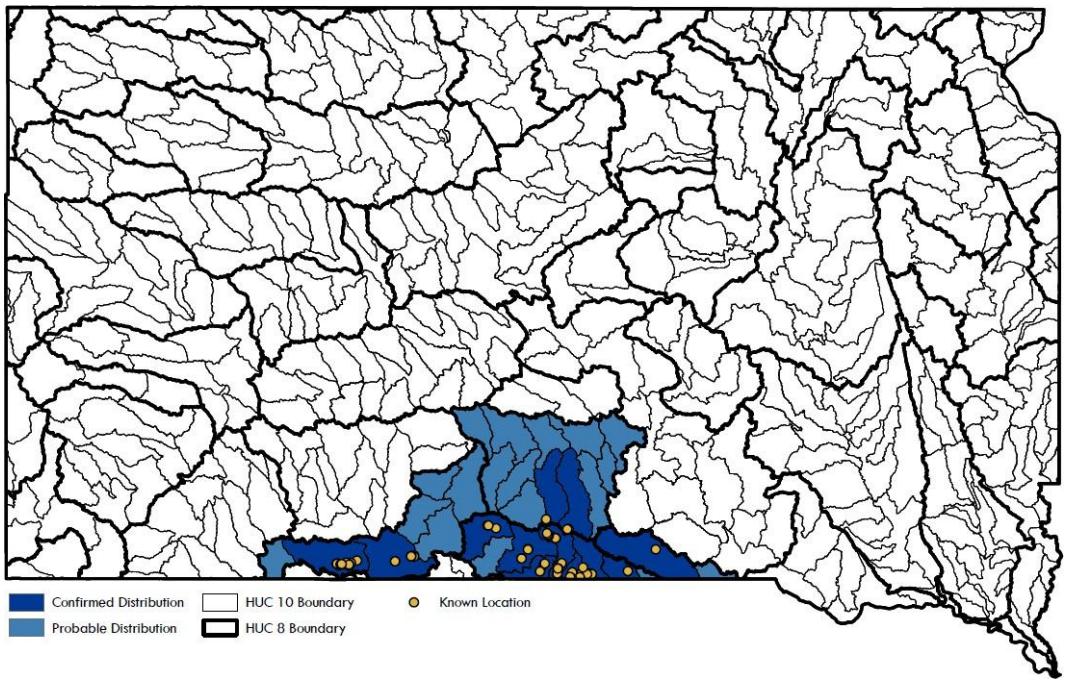
Species distributions can be displayed in a variety of ways, including:

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

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

Known species distributional data are primarily point records dating as far back as 1853 (SDNHD). Historical records were defined as records dating prior to 1990. This date was chosen based on sampling techniques becoming more standardized during this time. Historical records were not used in our current species distributional maps or in the COA selection process. Current records were those from January 1, 1990 through December 31, 2024. For the COA selection process only confirmed watersheds (HUC_10) were used for fishes and freshwater mussels. A confirmed species status was defined as HUC_10, watershed for which a current collection point was reported within the SDNHD (Figure 6.6). A probable species status was defined as the area outside a HUC_10 watershed without current collection point records, while still contained within the HUC_8, sub-basin boundary (Figure 6.6). Both confirmed and probable species richness records were used in the individual species statewide distribution maps.

Figure 6.6. Sample Map Defining Confirmed and Probable Distributional Records at the Watershed (HUC_10) and Sub-basin (HUC_8) Boundary Levels, Respectively.

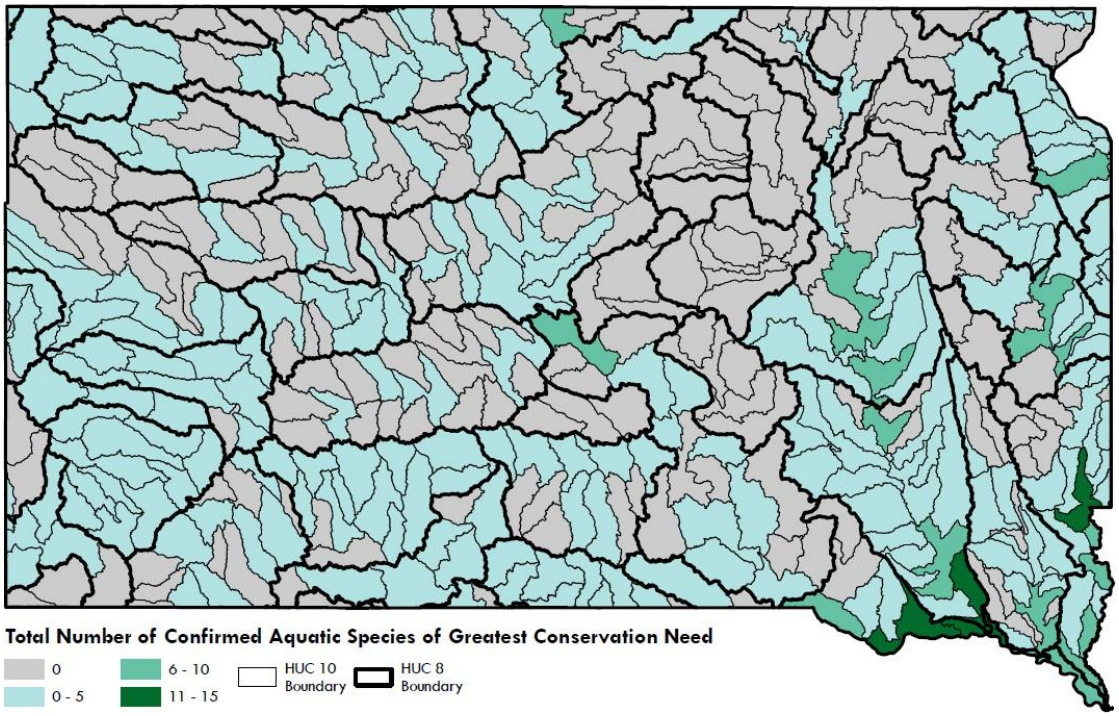


Individual species statewide distribution maps were developed for 28 fish and 11 mussels listed as SGCNs. Four crayfish and ten aquatic invertebrates lack distribution maps, due to a lack of distribution information. Individual distribution maps contain point data from the SDNHD, confirmed records at the HUC_10 watershed level, and probable records from the HUC_8 boundary level. Individual distribution maps for SGCNs can be found within the species profiles section (Appendix B).

Species richness

Species richness is one of many measures of biodiversity and one way of assessing the representation of species and all unique riverine ecosystems across South Dakota. Considering the 39 aquatic SGCNs with distributional data, we used confirmed species distributional data to collectively determine the richest HUC_10 watersheds across South Dakota (Figure 6.7). This information was the first step in the COA selection process.

Figure 6.7. Map of Overall Confirmed Species Richness (Fish and Freshwater Mussels, Excluding Aquatic Insects and Crayfish) for Species of Greatest Conservation Need for HUC_10 Watershed Boundaries.



The highest species richness (11-15 species) across all aquatic taxonomic groups occurs within the Missouri River region, and more specifically within the Lower Big Sioux, Lower James, and Lewis and Clark Lake sub-basins (HUC_8).

Limitations of species distributional data

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

Human Stressor Index (HSI)

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

A list was generated of the primary human activities known to negatively impact the ecological integrity of South Dakota rivers and streams. From this dataset the highest resolution and most recent geospatial data were assembled for each of those stressors (Table 6.7). Most of the geospatial data were acquired from the U.S. Environmental Protection Agency (US EPA), U.S. Army Corps of Engineers, U.S. Geological Survey (USGS), SD DANR, Nature Conservancy, and the MLI Conservation Blueprint.

Table 6.7. List of the Global Information System (GIS) Coverages and Their Sources Obtained or Created to Identify Existing and Potential Future Stressors to the Aquatic Species of Greatest Conservation Need in South Dakota.

HUMAN STRESSOR DATA LAYER	DESCRIPTION	SOURCE
% Land cover in cropland	% of the land that is used in the cultivation of crops (i.e. corn, soybeans, etc.).	USGS, 2023 NLCD data)
Nutrient reduction	Identifies nutrient loading that leads to hypoxia issues in downstream waters. It prioritizes areas based on a catchment's contribution to the loading of nitrogen, phosphorus, and suspended sediments.	MLI Conservation Blueprint-USGS
Small structure inventory	Human-made, culverts that allow livestock, people, vehicles, etc. to cross streams via roadways.	SD DOT
Dams	Federally licensed barriers reported to the USACE that impound, collect, or store water.	US Army Corps of Engineers, USACE USGS National Dam Inventory
Permitted discharges	Permits for companies to discharge wastewater into rivers. Permits detail what is allowed to be discharged and monitor how much.	2024 EPA DANR Surface Water discharge
Aquatic Network Connectivity	Prioritized areas based on the length of hydrologically connected flowlines and diversity of unfragmented aquatic habitat in the state.	MLI Conservation Blueprint;-TNC's Resilient Rivers dataset
Climate Resiliency	This layer identifies the ability of lands and waters to function under changing climate conditions.	MLI Conservation Blueprint; The-Nature Conservancy's Resilient Land Mapping Tool

Statistics for the 7 individual human stressors (i.e. % cover, degree of fragmentation, density per km^2) for each of the 458 watersheds (HUC_10, Hydrologic Unit Code) in South Dakota were generated. All metrics were calculated for each individual watershed. Relativized rankings (range 1 to 5) were then developed for each of the 7 stressors (Table 6.8). These rankings are relative to the range of values obtained throughout South Dakota. A rank 1 denotes a relatively low disturbance value for that particular stressor, while a rank 5 indicates a relatively high level of disturbance.

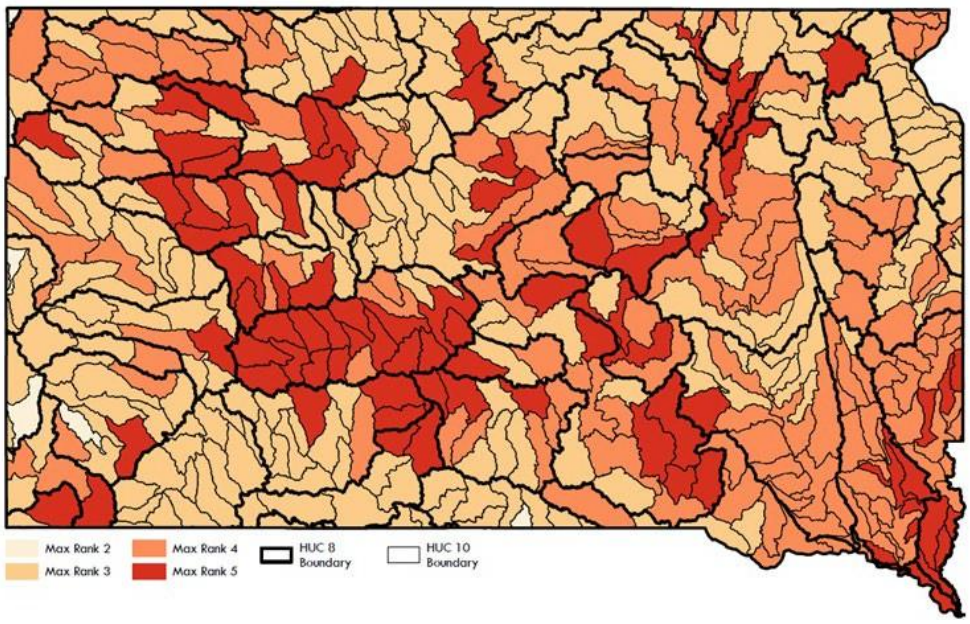
Table 6.8. Seven Stressor Metrics Included in the Human Stressor Index (HSI) and the Specific Criteria Used to Define the Five Relative Ranking Categories for Each Metric Used to Calculate the HSI for Each Watershed (HUC_10).

	Relative Ranks				
Human Stressor Metric	**1**	**2**	**3**	**4**	**5**
% Land cover in cropland	0-20% of HUC_10	21-40% of HUC_10	41-60% of HUC_10	61-80% of HUC_10	81-100% of HUC_10
Nutrient Reduction	Low nutrient load, not a natural asset	Low nutrient load, natural assets	Median nutrient load, not a natural asset	Median nutrient load, natural assets	High nutrient load
Density of road stream crossings (#/km^2)	0-0.25	0.26-0.5	0.51-.75	0.76-1	1+
# of dams	0	1-4	5-9	10-14	15+
Density of permitted discharges (#/km^2)	0	0.01-0.23	0.24-0.48	0.49-0.56	0.57-0.90
Aquatic Network Connectivity	Above average	Slightly above average	Average	Slightly below average	Below average
Climate Resiliency	Least resilient	Less resilient	Slightly less resilient	Average Resilience	Slightly more resilient

The relativized rankings for each of the 7 stressors were then combined into a three-digit HSI. The first number reflects the highest ranking across all 7 stressors (range 1 to 5). The last two numbers reflect the sum of the 7 stressors (range 9 to 21). This index value allows us to evaluate both individual and cumulative impacts. For example, a value of 512 indicates relatively low cumulative impacts (i.e. last two digits = 12 out of a possible 21), however, the first number is a 5, which indicates that one of the stressors is relatively high and potentially acting as a major human disturbance within that individual watershed (HUC_10).

Figure 6.8 shows a map of the 458 watersheds (HUC_10) by the first value in the HSI (range 1 to 5). More than 50% of the watersheds received a relative ranking value of 4 or 5, and another 48% have a relative ranking value of 3, indicating that most watersheds (HUC_10) are to some degree disturbed or impaired from at least one of the 7 human stressors in the HSI. Eight watersheds (HUC_10) received a rank of 2 and zero were ranked in the lowest value of 1. The largest stressor affecting the ecological integrity of riverine ecosystems in South Dakota is dams.

Figure 6.8. Map Showing the First Value in the Humans Stressor Index (HSI) for Each of the Watersheds (HUC_10) in South Dakota. A Value of 1 Indicates Relatively Low Human Disturbance, While a Value of 5Iindicates a Relatively High Human Disturbance. No Watersheds Have a Value of 1 and Only 8 Watersheds Have a Value of 2.



When examining the spatial pattern of the last two values in the HSI, we find that cumulative disturbance tends to be highest in eastern South Dakota and along the Missouri River (Figure 6.9). The watershed (HUC_10) with the highest cumulative value of 21 lies within the extreme lower Big Sioux River and along the Missouri River near Cow Creek. This similar pattern holds true for the full 3-digit HSI across South Dakota with the Bad River sub-basin (HUC_8) having the highest HSI overall (Figure 6.10). Areas with less disturbance are found within the Minnesota, Upper White, Keya Paha, and Lower Belle Fourche sub-basins (HUC_8).

Figure 6.9. Map Showing the Last Two Values in the Human Stressor Index (HSI) for Each of the Watersheds (HUC_10) in South Dakota. A Value of 9 Indicates an Extremely Low Level of Cumulative Stress. The Highest Possible Value was a 21. The Higher the Value for the Last Two Digits, the Higher the Degree of Cumulative Disturbance.

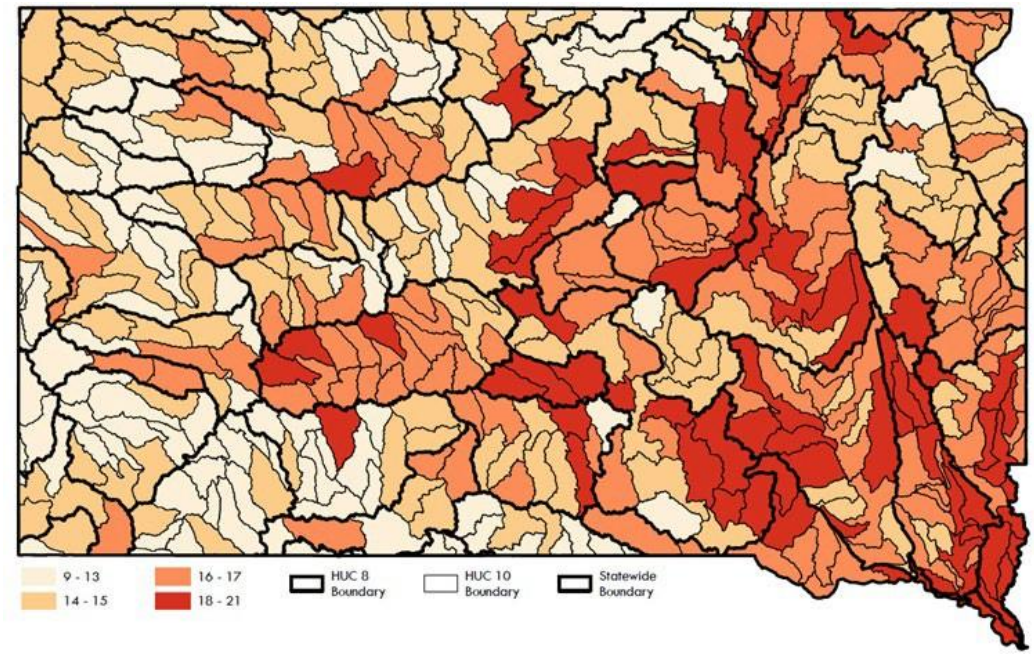
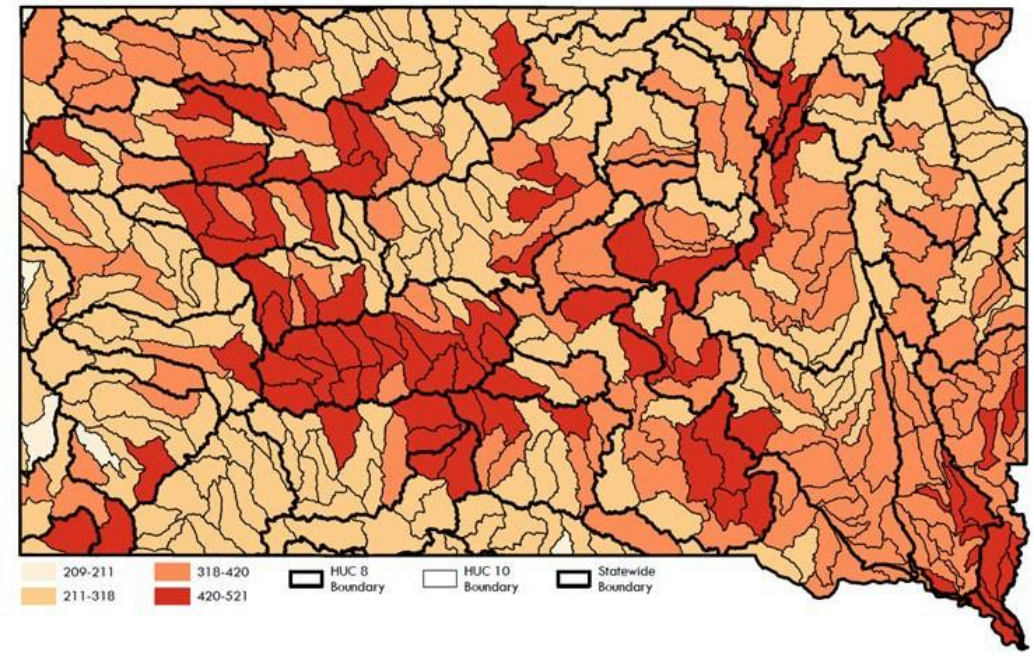


Figure 6.10. Map Showing the Cumulative Human Stressor Index (HSI) for Each of the Watersheds (HUC_10) in South Dakota. The First Number Represents the Highest Value Received Across all 7 Human Stressor Metrics, While the Last Two Numbers Represent the Sum of the Scores Received for Each of the 7 Metrics.



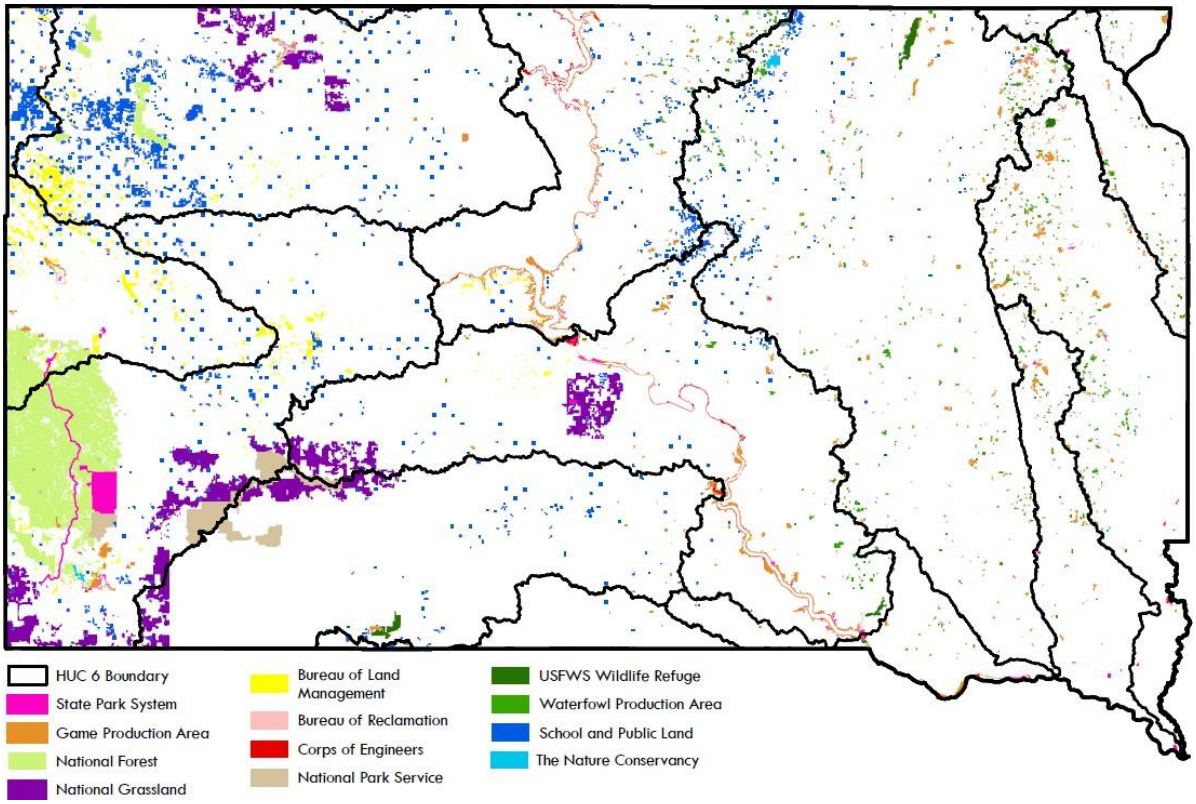
Watershed ownership/stewardship status

Land ownership/stewardship management can help provide information to decision makers in the selection of new COAs and/or identify changes in management of existing public land holdings. Digital coverage of public land boundaries was obtained from various agencies (Table 6.9). Twelve land ownership/stewardship categories were identified and mapped, including but not limited to, lands owned by the USFWS, the USFS, SDGFP, the BLM, Bureau of Reclamation (BOR), the NPS, and privately owned lands (Figure 6.11). Ownership/stewardship layers did not include CRP lands, Conservation Reserve Enhancement Program (CREP) lands, or wetland and grassland easements. Additionally, CRP and CREP lands were not included due to their management status. These lands lack permanent protection status and have relatively short enrollment periods. The last step in the hierarchical system for selecting aquatic COAs was based on watersheds (HUC_10 boundaries) with the highest percentage of public ownership.

Table 6.9. List of the Geographic Information System (GIS) Coverages, Their Sources, and Percent Coverage Obtained or Created to Account for Local and Watershed Ownership/stewardship in South Dakota.

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

Figure 6.11. South Dakota Land Ownership/stewardship Map with Basins (HUC_6) Overlaid.



Over 80% of the land area in South Dakota is privately owned and managed. Federal and state agencies own approximately 5.7% and 2.3% of the land area in South Dakota, respectively (Table 6.9). Most of the public lands in South Dakota are located west of the Missouri River in the Cheyenne River basin (Figure 6.11).

Limitations of ownership/stewardship data

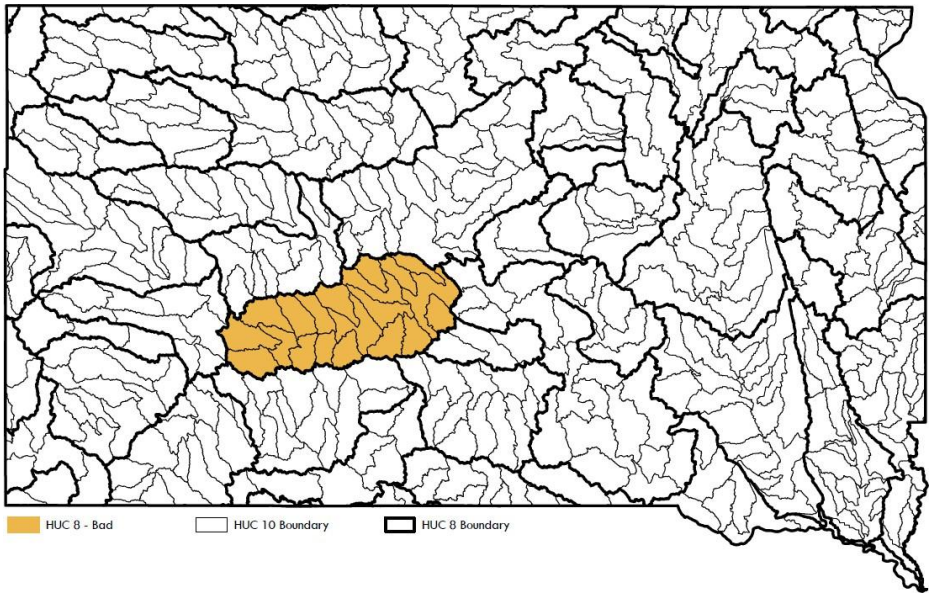
The land ownership/stewardship map represents a collection of stewardship maps provided by a variety of sources, however by no means does it represent the full array of conservation initiatives across South Dakota. These maps were created solely for the purpose of the final selection criteria in the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

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

Walking through the aquatic conservation strategy and assessment process

The Bad River sub-basin (HUC_8) served as the pilot area for the statewide COA selection process and tested the conservation strategy and assessment process (Figure 6.12).

Figure 6.12. Map Showing the Bad River Sub-basin (HUC_8) that was Selected to Meet All Elements of the Basic Conservation Strategy Developed for the Aquatic Conservation Opportunity Area Selection Process in South Dakota. The Figure Also Shows Watersheds (HUC_10) Within the Bad River Sub-basin.



The Bad River sub-basin contains twenty watersheds (HUC_10). A minimum of at least two COAs were identified for each sub-basin (HUC_8).

The assessment criteria were used on all twenty watersheds to select two individual watersheds that warranted conservation (COAs). COAs were selected based on the following hierarchical criteria in order of importance: highest species richness (confirmed species occurrences) for SGCNs (Figure 6.13), lowest HSI value (Figure 6.14), and highest percentage of public ownership (Figure 6.15).

Figure 6.13. Map Breaking Down the Assessment Criteria for the Bad River Sub-basin. Conservation Opportunity Areas Were Selected by a Hierarchy System Based on First Looking at the Highest Species Richness.

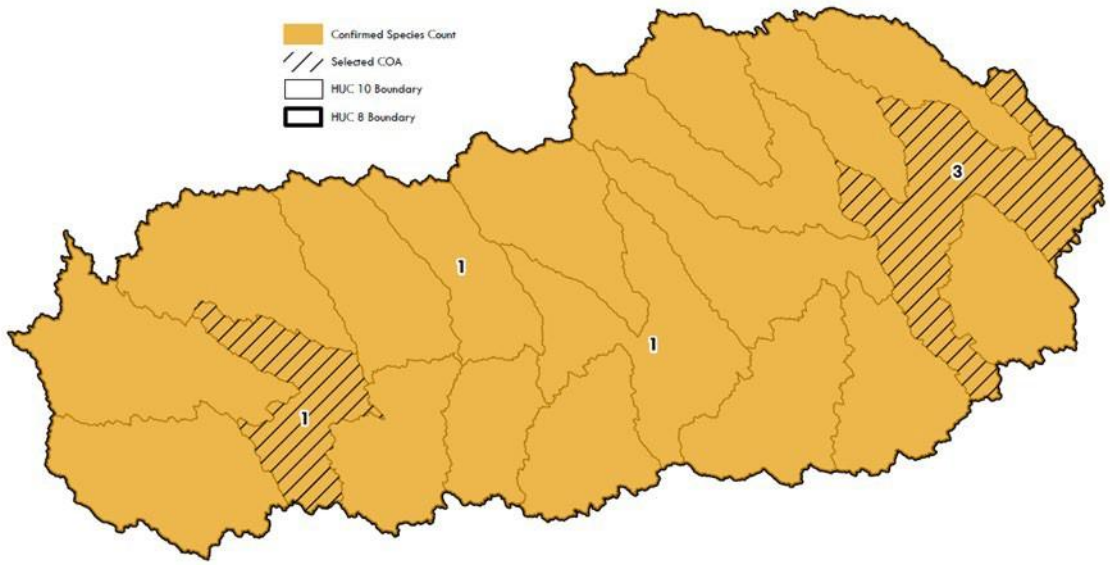


Figure 6.14. Map Breaking Down the Assessment Criteria for the Bad River Sub-basin. Conservation Opportunity Areas Were Selected by a Hierarchy System Based Secondly Looking at the Lowest Human Stressor Index Value.

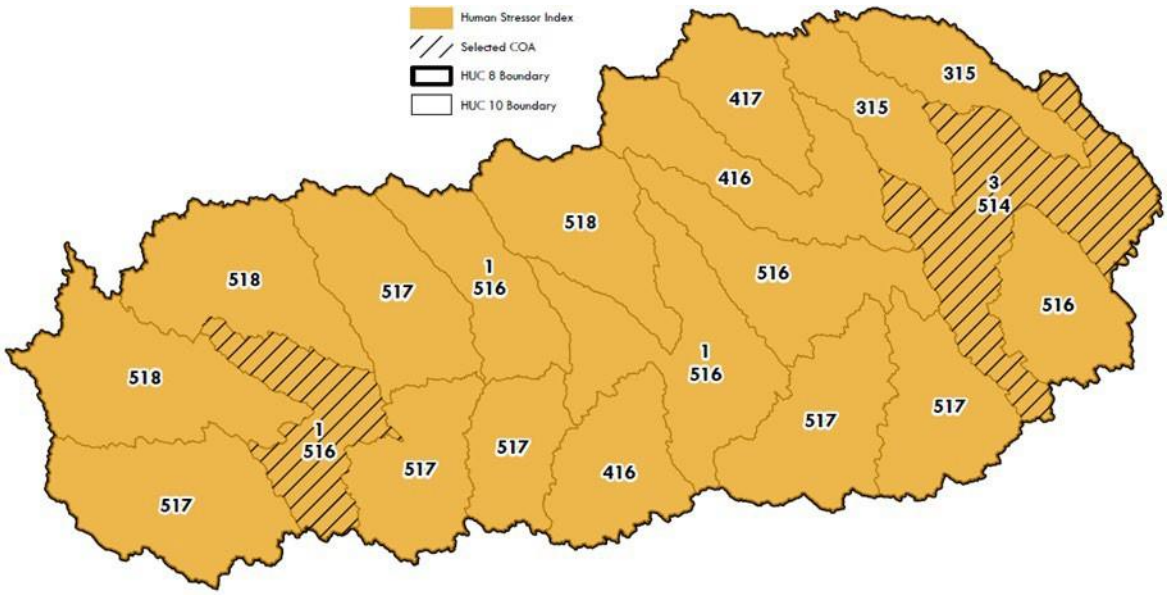


Figure 6.15. Map Breaking Down the Assessment Criteria for the Bad River Sub-basin. Conservation Opportunity Areas Were Selected by a Hierarchy System Lastly Looking at the Highest Percentage of Public Ownership.

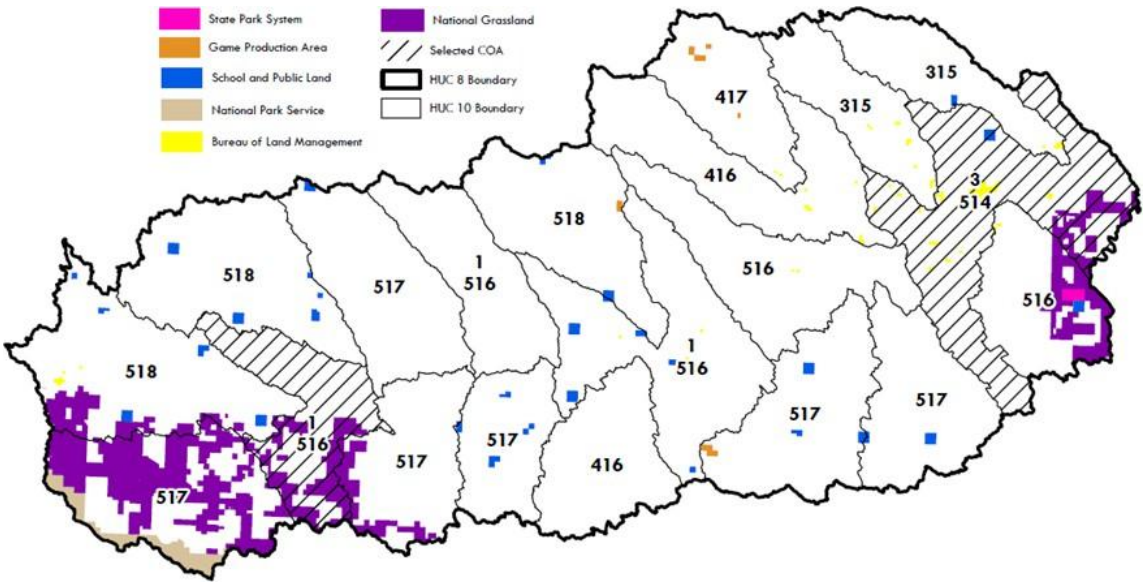
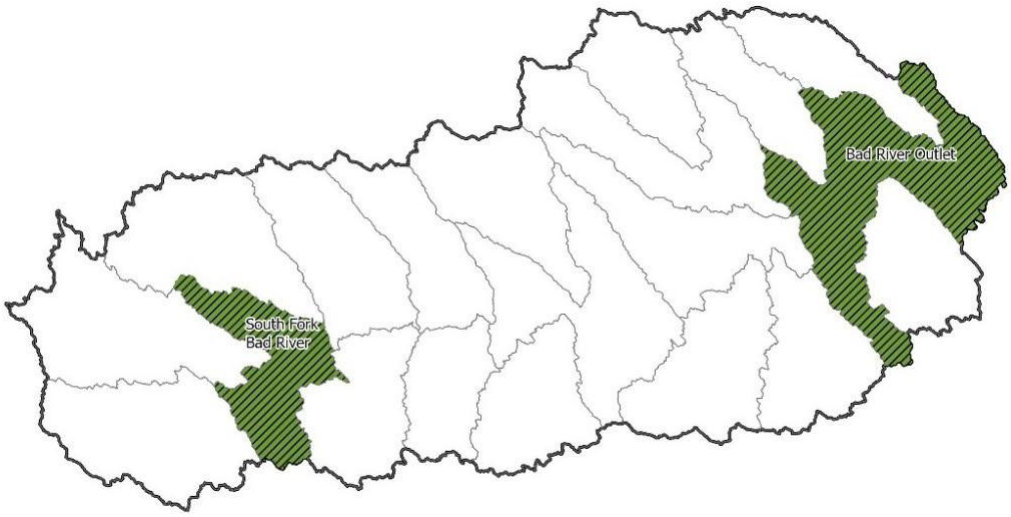


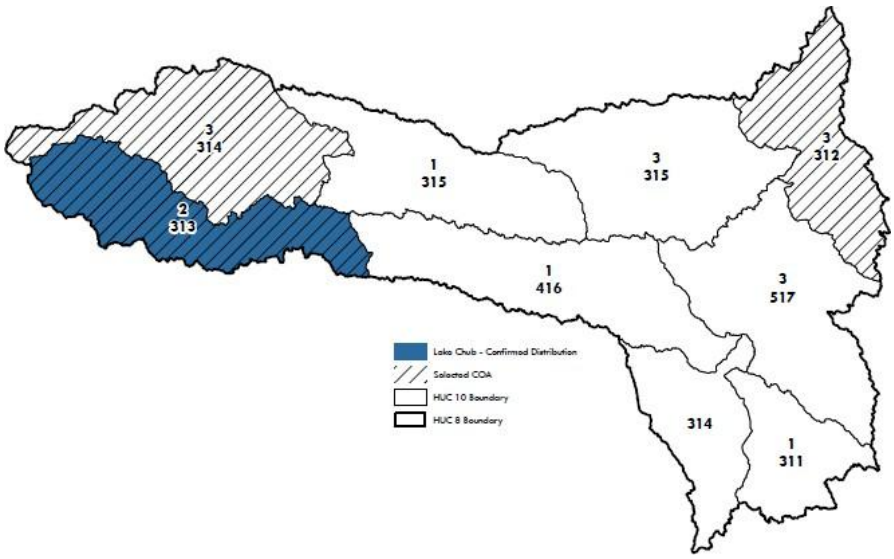
Figure 6.16. Map of the Two Conservation Opportunity Areas Selected for the Bad River Sub-basin.



The selected COAs within the Bad River sub-basin were chosen based on greatest species richness, lowest HSI, and highest percentage of land stewardship. The Bad River Outlet COA was selected based on a species richness of 3 and a HSI value of 514 (Figure 6.16). The majority (92%) of the watershed (HUC_10) is privately owned with only eight percent in public ownership. The South Fork Bad River COA

was selected based on a species richness of 1 and a HSI of 516 (Figure 6.16). The majority (77%) of the watershed (HUC_10) is privately owned with only 23% in public ownership. This process was repeated across all sub-basins (HUC_8) across the state with a minimum of two COAs being selected for each sub-basin (HUC_8). If no SGCNs were found within the sub-basin no COAs were selected. One additional watershed (HUC_10) was selected within the Middle Cheyenne-Elk sub-basin due to it being the only watershed _HUC_10 with confirmed Lake Chub presence (Figure 6.17). This COA was included solely due to the presence of an underrepresented SGCN with a limited range.

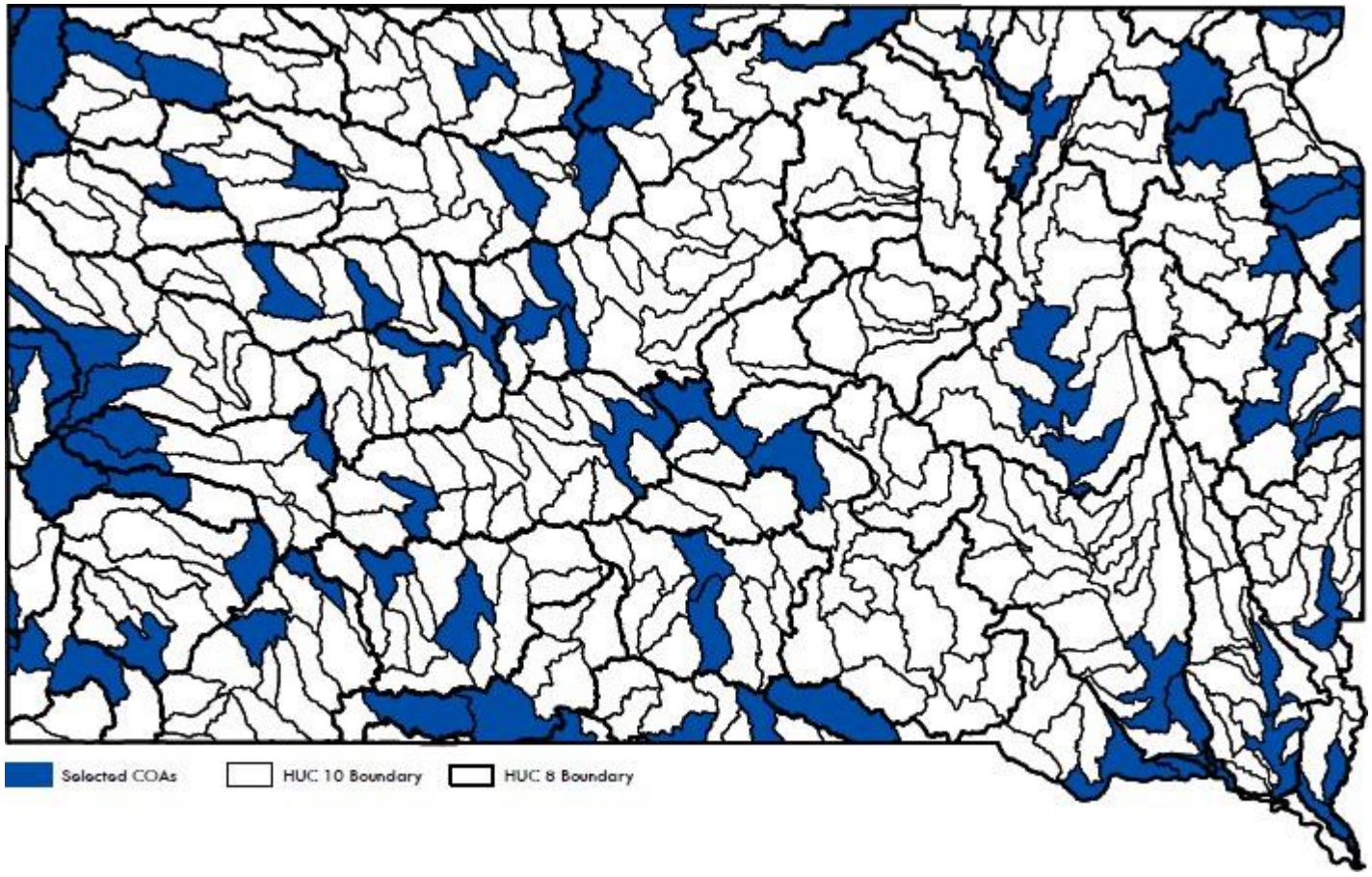
Figure 6.17. Map of the Two Conservation Opportunity Areas Within Middle Cheyenne-Elk Sub-basin (HUC_8) that were Selected to Meet All Elements of the Conservation Strategy and Assessment Process in South Dakota. An Additional COA Was Selected Because It Represented the Only Watershed (HUC_10) with Confirmed Presence of Lake Chub, a Species of Greatest Conservation Need.



Discussion

Statewide, 73 COAs were identified through the conservation strategy and assessment process (Figure 6.18). Figure 6.18 does not depict the current situation but rather shows priority areas to better maximize limited resources while still representing the full extent of distinct aquatic ecosystems and habitats across South Dakota. These COAs represent the broad diversity of stream ecosystems and riverine assemblages within South Dakota and cover a relatively small percentage of the landscape. In terms of land area, the COAs cover 8.7 million acres, or approximately 18% of the state. All 39 aquatic SGCNs are contained and represented by at least one COA within the state. To conserve the overall ecological integrity of South Dakota, efforts cannot be limited to the land area and streams contained within the selected COAs. However, the selected methodology provided an efficient and effective strategy for the long-term conservation of relatively high-quality examples of the various ecosystem and community types that exist across the state.

Figure 6.18. Map of 73 Aquatic Conservation Opportunity Areas Selected to Meet All Elements of the Aquatic Conservation Strategy and Assessment Process Across South Dakota.



The selected COAs provide the framework to identify areas with the greatest potential to maintain or restore large areas to desired conditions to maintain South Dakota's aquatic biodiversity. In addition to being important for conserving South Dakota's aquatic biodiversity, COAs show where users (e.g., natural resource professionals, NGOs, state and federal agencies, and landowners) can make informed decisions. These decisions can include where to focus research and monitoring to fill information gaps, where to expand incentive programs, and where to restore to native conditions.

The coarse and fine filter strategies for identifying COAs provide the framework for maintaining and conserving aquatic biodiversity in South Dakota. However, the amount of land required to maintain and restore native ecosystem diversity remains a large question, due largely to our relatively poor understanding of the ecological relationships, habitat requirements, and limiting factors for aquatic SGCNs. At a minimum, the strategy used focuses on providing COAs across all unique drainages, regions, basins, and watersheds while representing the full array of aquatic SGCNs.

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

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

6.5 Conservation Actions Summary

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

Land and water management

1. Restore missing or degraded terrestrial systems such as wetland, grasslands, shrublands, forests, and aquatic systems such as lakes, reservoirs, rivers, and streams.
2. Continue or expand efforts to control exotic and invasive species across South Dakota whether they are native or non-native species or found in terrestrial or aquatic systems.

3. Expand staffing to allow more public land and water management due to the large number of public areas in the state.
4. Evaluate South Dakota public lands and waters for opportunities to contribute toward ecosystem diversity goals.
5. Expand private lands staff to promote voluntary conservation programs and continue providing technical assistance to private landowners.
6. Continue to promote the benefits of using natural disturbance regimes on public and private land. Disturbances include large ungulate grazing and prescribed fire.
7. Promote best management practices and provide land managers with adequate stocking rates or explain the best time of year to use prescribed fire to help promote natural disturbance patterns.
8. Address climate change by helping land managers with water development projects to alleviate the implications of drought and other abiotic factors.
9. Continue to evaluate impoundment infrastructure to either update to ensure longevity or consider removal to eliminate a potential barrier and restore natural wetlands to the landscape.
10. Continue to evaluate dam and crossing structures on rivers and streams to potentially reduce or eliminate fish passage barriers.
11. Promote best management practices around both lotic and lentic systems to expand efforts to enhance and restore aquatic habitats.

Species management

1. Promote best management practices to address the coarse filter approach.
2. Promote rotational management to allow some habitat to support individual species.
3. Identify SGCNs that might require translocation to help their population expand and survive.
4. Look for opportunities to reintroduce SGCNs into their native habitats and enhance habitat deficiencies to increase survival.
5. Evaluate habitat restoration efforts to ensure success of reintroductions and that all life stages are accommodated.

Creating awareness

1. Identify new approaches to inform the public of the ecosystem services healthy terrestrial and aquatic systems provide.
2. Continue informing and providing technical assistance to land managers on best locations to restore certain species and reduce or repair habitat fragmentation.
3. Identify new campaigns to promote and continue existing successful campaigns, such as “Where Good Things Grow” for grasslands or the “Clean Drain Dry” campaign to discourage spread of AIS.
4. Continue to participate in multi-state collaborations like the Midwest Glacial Lakes Partnership to bring ideas from other areas.
5. Continue to participate in local level groups and organizations like lake associations, river work groups, and various outdoor/sportsmen and women groups.

Livelihood, economic incentives

1. Identify new funding sources to promote conservation programs that provide private and public land and aquatic resource managers with cost share help to offset their cost out of pocket.
2. Continue working with partners to collaborate on grants and other funding sources to work together on terrestrial and aquatic conservation projects vs. working independently.
3. Continue to look for "outside the box" approaches to getting conservation practices to take off.

Conservation designation & planning

1. Continue to promote the current strong partnerships between agencies and organizations while looking to build new or expand partnership opportunities.
2. Use models and research to take strategic approaches to conservation and habitat program delivery to maximize benefits.
3. Keep opportunities for conservation programs and delivery diverse and prioritize permanent protection of key habitats when possible.

Legal and policy

1. Remain engaged with state Congressional delegation members on development of new Farm Bill policy.
2. Continue to promote enforcement of road right-of-way mowing restrictions and investigate wildlife value of this habitat type.
3. Support policies that help promote native terrestrial systems such as the North American Wetland Conservation Act.
4. Increase enforcement and penalties for laws that protect habitat.
5. Enhance data sources used in environmental review process.

Research and monitoring

1. Develop a better understanding of the effects of natural disturbance regimes on plant species compositions, structures, and functions of ecosystems.
2. Develop a better understanding of exotic and invasive plant species distributions and spread relative to priorities for ecosystem diversity.
3. Evaluate, monitor, and research before and after conservation practices being implemented on private lands such as wetland, grassland, and shrubland restorations. Apply results to future management and funding priorities.
4. Collaborate with partners to create a yearly report of all the private lands projects instead of each organization creating their own report. More collaboration yields more effective habitat management.
5. Develop monitoring plots or transects on public lands where they are lacking to allow for long term data collection for research and related management recommendations.
6. Develop a better understanding of the impacts of natural disturbance, such as flooding and drought, have on aquatic ecosystems.
7. Develop a better understanding of the effects of aging habitats and infrastructure, sedimentation, and other changes have on aquatic ecosystems.

8. Evaluate habitat and conservation efforts to ensure they are having the desired effects.

Education and training

1. Continue to educate and develop curriculum for landowners interested in improving their management. Examples include prescribed fire, grassland management, pond management, and grazing management schools.
2. Develop and expand shared information to young people and urban residents about ecosystem services provided by terrestrial and aquatic systems.
3. Use our State Parks as resources to highlight native ecosystems by hosting classes and events.
4. 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 GFP personnel and contractors, in partnership with other individuals, organizations, and agencies. Explore ways to effectively use social media sources.
5. Continue to use and promote the Outdoor Campuses as a source of educational resources for all ages of the public from youth to adults.
6. Continue to participate in multi-state partnerships like the Midwest Glacial Lakes Partnership Education and Outreach committee to bring ideas from other areas.

Institutional development

1. Hire more public land managers where needed to address the large number of public areas across the state. Some sites are not managed for many years and quality is reduced by native or non-native species establishment.
2. Explore hiring more private lands biologists across the state to provide more technical assistance and share conservation programs.
3. Prioritize frequent communication with partners to foster inter-agency collaborations to help push conservation to new heights.
4. Engage with stakeholders to foster working relationships on all aspects of land-management, aquatic resource management, wildlife, farming, ranching, and overall work being done on terrestrial and aquatic systems.
5. Develop and expand partnerships with agencies, organizations, and landowner groups to meet the conservation goals for ecosystem diversity identified for each of South Dakota's ecoregions.
6. Identify applicable federal, state, local, and non-governmental programs that can be used to achieve the representation goals identified and develop coordination among these programs. For example, meet with NRCS to explore these options in existing and future landowner programs.
7. Create and add to existing professional training events so all the partners share a clear conservation message.
8. Continue efforts to identify funding sources to help meet representation goals. SWG funds are a small and unreliable funding source to meet nearly unlimited needs. The Wildlife Action Plan's success will depend on the ability for agencies, organizations, and

individuals to seek out all available grants, meet match requirements, and be successfully awarded.

9. Explore hiring more aquatic habitat biologists across the state to provide more technical and nontechnical assistance and to better address issues on the large number of acres of water on both public and private lands as well as to address the hundreds of miles of rivers and streams that have not been managed for years.