DRAFT

North Dakota State Wildlife Action Plan

May 20, 2025

NORTH Dakota | Game and Fish

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List of Acronyms

CRP	Conservation Reserve Program
FY	Fiscal Year
HAPET	Habitat and Population Evaluation Team
KNWHA	Key Native Wildlife and Habitat Areas
MAFWA	Midwest Association of Fish and Wildlife Agencies
MLI	Midwest Landscape Initiative
NDGF	North Dakota Game and Fish Department (also referred to as 'Department')
SCP	Species of Conservation Priority (note: now referred to as SGCN)
SGCN	Species of Greatest Conservation Need
SGIN	Species of Greatest Information Need
SWAP	State Wildlife Action Plan
SWG	State Wildlife Grants
USFWS	U.S. Fish and Wildlife Service

Acknowledgements

The development and review of this plan involved contributions from numerous colleagues, state and federal agencies, and organizations. Since its first iteration in 2005, existing partnerships have grown stronger, and new alliances have emerged. The list of individuals who knowingly or unknowingly offered their support and input is extensive, and we are deeply thankful to all of you. State Wildlife Grant-funded projects and other partner efforts have been instrumental in shaping this plan, and the wealth of knowledge gained about Species of Greatest Conservation Need is thanks to the exceptional work of researchers, technicians, and students. The Teaming with Wildlife coalition has been a steadfast advocate for the State Wildlife Grants program, Recovering America's Wildlife Act, and the execution of State Wildlife Action Plans, with the primary goal of preventing wildlife from becoming endangered, and for this, we are truly grateful. **Above all, we are grateful to the partners who implemented the plan and helped conserve, enhance, or restore habitats critical to sustaining fish and wildlife species.**

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Maps produced by the NDGF.

SWAP SUMMARY TEMPLATE

To be developed prior to submittal to USFWS.

EXECUTIVE SUMMARY

The 2025 North Dakota State Wildlife Action Plan (SWAP) is a strategy to conserve fish, wildlife, and their habitats with a focus on preventing species from becoming endangered. The 2025 SWAP is a revision of the 2015 SWAP and serves as a 10-year blueprint to guide conservation efforts and funding decisions under the State Wildlife Grant (SWG) program. However, the SWAP is widely used by a diverse array of conservation partners, policy makers, industry professionals, consultants, teachers, and scientists. The SWAP represents a unified effort involving various stakeholders aimed at creating and implementing conservation strategies to ensure the long-term protection and sustainability of the state's fish and wildlife species.

The first North Dakota SWAP was finalized in December 2005. It identified 100 Species of Conservation Priority, including information on distribution, abundance, habitat requirements, threats, conservation actions, and monitoring techniques. It also included information on a host of fish and wildlife that inhabited the state. This proved to be an important point in time as North Dakota had its first comprehensive strategic level plan to address management of nongame and rare or declining fish and wildlife resources. The second iteration of the SWAP was finalized in July 2015 and approved in February 2016. This version identified 115 Species of Conservation Priority and was structured to include a more unified approach to identifying threats and conservation actions by major habitat type. The 2025 North Dakota SWAP expands upon this successful approach.

The SWAP is built upon eight essential elements, identified by Congress, with an overall focus on species of greatest conservation need. The eight elements include: (1) information on the distribution and abundance of species of wildlife including low and declining populations; (2) descriptions of locations and relative condition of key habitats and community types; (3) problems affecting species and priority research or survey efforts needed; (4) conservation actions needed to conserve the identified species; (5) plans for monitoring species and the effectiveness of conservation actions; (6) plans for reviewing the strategy; (7) coordinating with federal, state, and local agencies and Tribal government on the development and implementation of the strategy; and (8) involve broad public participation.

Key components of the 2025 SWAP:

- **Species of Greatest Conservation Need (SGCN) and Species of Greatest Information Need (SGIN):** The previous SWAPs referred to this list as Species of Conservation Priority and were divided into 3 different levels of priority. A major change to the 2025 SWAP is that the principal list will be referred to as SGCN and no levels will be assigned. A second list of SGINs has been developed. While SGCNs are known to be at-risk or in decline, SGINs face uncertainty in terms of their status, range, or level of risk. Furthermore, the 2025 SWAP includes a more thorough assessment of terrestrial and aquatic invertebrates. There are 134 SGCNs and 98 SGINs identified in the 2025 SWAP.
- **Habitats:** The SWAP is a habitat based, rather than a species based approach. Many species require a variety of habitat types throughout their life cycle. To ensure their long-term survival, it's essential to maintain a diverse landscape, including grasslands, wetlands, forests, rivers, streams, riparian and cropland.
- **Threats:** The top recurring threats identified across all habitats include conversion of habitat; invasive non-native species; fire suppression; underutilization of grazing; energy development impacts (e.g., fragmentation, displacement of wildlife, and anthropogenic disturbance); and conservation awareness (e.g., lacking recognition of the critical role resilient habitats provide for wildlife, water quality, and the well-being of North Dakota's communities.)
- **Actions:** The top recurring actions identified across all habitats include offer incentives and programs to protect, enhance, and restore habitat; control or reduce invasive species; offer incentives and programs to implement prescribed fire/controlled burns; support grazing as a grassland management tool; urge ecologically responsible development and suitable reclamation standards; and public education and outreach.

- **Monitoring:** Developing and implementing statewide monitoring strategies for all SGCNs and their habitats is an ambitious task. It requires a flexible approach, ensuring that monitoring is aligned with well-defined performance metrics. The Department and partners regularly evaluate conservation efforts and management treatments through diverse monitoring techniques. New data will refine this process, facilitating the adoption of best practices for managing both species and habitats.
- **Revision:** The SWAP will undergo another revision in 2035, reinforcing its status as a living document that is routinely updated and adapts to changes and new information over time.
- **Partners:** Building and enhancing partnerships is crucial to the success of the SWAP. The effectiveness of these collaborations is demonstrated not only by accomplishments within the SWG program but also by the notable progress made in conserving SGCNs and their habitats through various partner-led initiatives.
- **Public:** Wildlife is entrusted in the care of state wildlife agencies to be safeguarded for its citizens. A key aspect of this role involves keeping the public informed about fish and wildlife topics, both locally and nationally, while also being receptive to their feedback.
- **Wildlife-Associated Recreation and Education:** The SWAP is vital in identifying strategies to conserve wildlife and their habitats, but equally important is to effectively increase public awareness and advocacy through various activities by increasing recreational and educational opportunities for the public. While this is not a required element of the SWAP, it is important for North Dakotans who enjoy the outdoors.

The completion of the 2025 SWAP marks the twenty-year anniversary of North Dakota's dedicated program for rare and declining fish and wildlife species. While significant progress has been achieved over the past two decades, much work remains. As North Dakota faces increasing habitat threats and challenges, the SWAP will be a critical tool for addressing these ongoing issues.

The Western Meadowlark, the state bird of North Dakota, continues to decline at about 1% per year. This iconic bird became the ambassador for the Meadowlark Initiative, a proactive and comprehensive effort to conserve grasslands in the state.

CHAPTER 1
INTRODUCTION

This chapter provides an overview of the State Wildlife Action Plan, the State Wildlife Grant Program, and the purpose it serves for fish and wildlife resources in North Dakota.

FOCUS ON RARE OR DECLINING SPECIES

The North Dakota Game and Fish Department (Department) is typically known for the management of big game species (e.g., White-tailed Deer and Mule deer) and recreational fisheries (e.g., Walleye and Northern Pike) across the state. In addition to those management responsibilities, the Department is also accountable for the management of nongame wildlife. In North Dakota, nongame wildlife represents more than 80 percent of the state's vertebrate fauna. Nearly 400 species of birds, 80 species of mammals, 75 fish, 16 reptiles, and 13 amphibians inhabit North Dakota. Freshwater mussels, crustaceans, and insects are also considered nongame and the exact total of invertebrates inhabiting the state is unknown. Often, nongame are the rarer and/or less studied species. Nongame species are an integral component in the balance of nature. Populations for many of these species are declining or thought to be at-risk. Preventing species from becoming listed as federally threatened or endangered is important. A listing has the potential to influence how public and private land is managed and used. The cost of protection or restoration of a listed species is far greater than preventing its decline in the first place. From an ecological perspective, loss of a seemingly insignificant species can cause other animals to decline or vanish. Such declines are hard to predict as many relationships are not yet well understood. Even so, animals that live in North Dakota are part of the state's legacy, and many people believe the demise of any species is tragic.

Since funding opportunities for nongame species management is limited, North Dakota's State Wildlife Action Plan (SWAP) is a strategy to guide the process of preserving the state's fish and wildlife resources for the future. Unlike previous versions which focused on species of conservation priority (SCP), the SWAP now refers to the list of species of greatest conservation need (SGCN) and species of greatest information need (SGIN) based on research by conservation biologists and input from various taxonomic experts within each discipline (i.e., avian, reptile, invertebrate, etc.).

Due to limited funding availability, Congress provides states with supplemental funding through Title IX of the Commerce, Justice, and State Appropriations Act under the Wildlife Conservation and Restoration Program (WCRP) for conservation of species which typically receive no monetary support. These funds were made available in fiscal year 2001 (FY01), which provided $50 million for distribution among states. In 2002, states received additional funding under a new program, State Wildlife Grants (SWG). Since then, SWG amounts available to all states through the Department of Interior have ranged from $46 to $76 million annually.

The annual apportionment for each state was determined using a distribution formula of 1/3 land area and 2/3 population. No state receives less than 1 percent or more than 5 percent of the total amount each year. Due to North Dakota's sparse population in relation to its large size, it receives the minimum of 1 percent of total funds. The average annual federal apportionment the Department received from FY15-FY24 is $599,051 (Figure 1) and provided North Dakota with approximately $6 million in federal funding (Figure 2) during that time frame. The SWG program is a matching grants program, meaning all federal dollars awarded must be matched with non-federal dollars. Matching funds from the Department along with project partners added nearly another $3 million dollars (Figure 2). Although the match requirement has changed over the years, the current requirement is that all projects require a 35 percent non-federal match for both

implementation and research projects. SWG funding has decreased over the years, but the need for conservation of rare and declining species has only increased.

Although it has yet to come to fruition, the Recovering Americas Wildlife Act (RAWA) has the potential to provide states with a significant increase in funding in the future to address management and conservation of SGCN's. RAWA has undergone several iterations throughout its legislative history, first introduced in 2016, but the bill has yet to receive full bipartisan support in Congress. Even though it has yet to receive congressional approval, optimism remains high within the conservation community that it will someday pass and provide additional resources for North Dakota to implement its State Wildlife Action Plan.

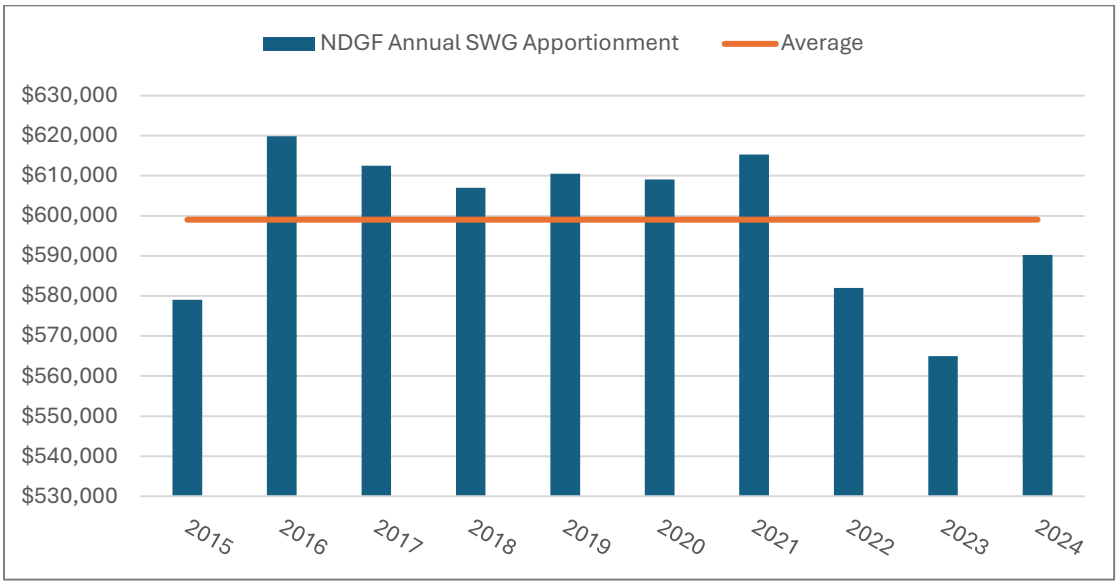


Figure 1. ND Game and Fish Department annual State Wildlife Grant allocation from 2015 – 2024.

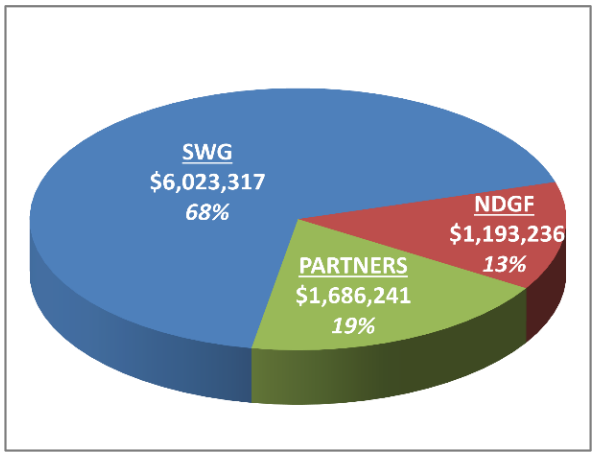


Figure 2. State Wildlife Grant, NDGF and matching partner dollars spent on projects in North Dakota from 2015-2024.

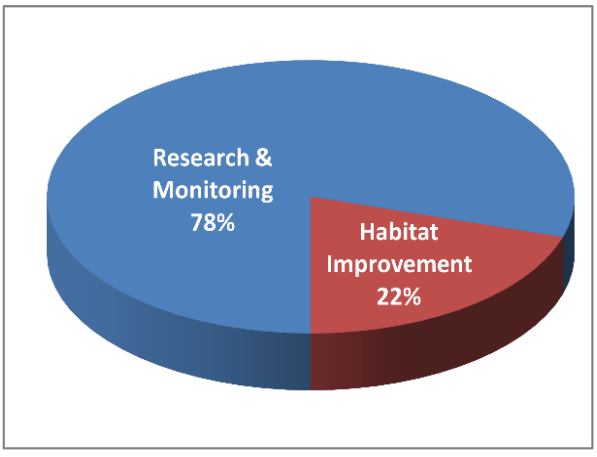


Figure 3. Percentage of State Wildlife Grant funds by project type.

EFFECTIVENESS OF SWAP AND SWG

In the 20+ years the SWG program has been in existence in North Dakota, over 80 individual projects with approximately 45 different partners have been initiated. While the projects have been wide-ranging, they can be described as falling into one of two categories for this report: 1) research and monitoring; and 2) habitat improvement. For the FY15-FY24 reporting period, research and monitoring efforts utilized 78% of SWG funds while habitat improvement projects consumed 22% of funds (Figure 3).

With limited funding resources and an overabundance of needs, the Department strives to balance the amount of survey and research projects while still contributing substantial efforts to improve fish and wildlife habitat. A total of 42 research projects have been conducted over the years on dozens of wildlife species providing much needed information on their presence or absence in certain geographic areas, relative abundance, habitat needs and a variety of other life history traits. Several additional species occurrences have been documented in North Dakota because of these studies. Specifics of SWG projects on species and knowledge gained is provided in the SGCN species accounts.

For habitat related efforts in FY15-FY24, SWG has partnered on about four projects. These projects include efforts to restore/enhance or maintain grassland, riparian, and wetland habitat. During this reporting period, our efforts have resulted in approximately 11,000 protected acres via conservation agreements and/or restoration activities.

While the 2015 SWAP has certainly provided valuable guidance and direction, it is time to review and update the plan. Federal regulations require states to conduct periodic reviews of the SWAP not to exceed 10 years. The Department's 10-year deadline is October of 2025. Because of the size and scope of the SWAP, this process is not done easily in a few weeks or months. As a result, the Department has been working on updating its SWAP since 2023 and has submitted a final draft to the United State Fish and Wildlife Service for consideration in July 2025. Like the effort that was used to create the states strategic plan in 2005, this effort will address the same 8 elements mentioned below.

SWAP REQUIREMENTS

An important distinction or change occurred in 2007 when Congress recommended that states refer to their CWCS as **State Wildlife Action Plans or SWAP**. While the content and purpose of our states plan never changed, we nonetheless refer to it as a SWAP. By accepting State Wildlife Grant funds, North Dakota and all other 49 states committed to completing a SWAP by October 1, 2005, 2015, 2025, then 2035, etc. For guidance, Congress identified eight required elements to be included in each state's SWAP.

The Eight Required Elements

1. The distribution and abundance of species of wildlife, including low and declining populations as each State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of wildlife of the State (referred to as SGCN or SGIN in North Dakota).
2. The location and relative condition of key habitats and community types essential to the conservation of each State's SGCN.
3. The problems which may adversely affect SGCN or their habitats, and priority research and surveys needed to identify factors which may assist in restoration and improved conservation of SGCN and their habitats.
4. The actions necessary to conserve SGCN and their habitats and priorities for implementing such conservation actions.

5. The provisions for periodic monitoring of SGCN and their habitats, for monitoring the effectiveness of conservation actions, and for adapting conservation actions as appropriate to respond to new information and changing conditions.
6. Provisions to review the SWAP at intervals not to exceed ten years.
7. Provisions for coordination during the development, implementation, review, and revision of the Strategy with Federal, State, Tribal, and local agencies.
8. Provisions to provide necessary public participation in the development, revision, and implementation of the Strategy.

While each state's SWAP varies in its content and approach, its general purpose is to identify and focus on "species in greatest need of conservation," while still addressing the "full array of wildlife." Additionally, the SWAP is intended to promote a comprehensive approach to habitat and wildlife management to leverage conservation of all species.

PARTNER SUCCESS STORIES

In development. To be completed prior to submittal to USFWS.

CHAPTER 2
A LOOK AT NORTH DAKOTA

This chapter gives a brief description of the geography, geology, climate and tribal communities of North Dakota.

GEOGRAPHY AND GEOLOGY

North Dakota spans from longitude 97°W to 104°W and latitude 45°55'N to 49°N, making it the 19th largest state in the United States. It stretches 211 miles from north to south and 340 miles from east to west, covering a total of 70,699 square miles. The state is bordered by Minnesota to the east, Montana to the west, South Dakota to the south, and the Canadian provinces of Manitoba and Saskatchewan to the north. North Dakota's highest point is White Butte in the southwestern part of the state, standing at 3,506 feet above sea level, while its lowest point, at 750 feet above sea level, is in the extreme northeast.

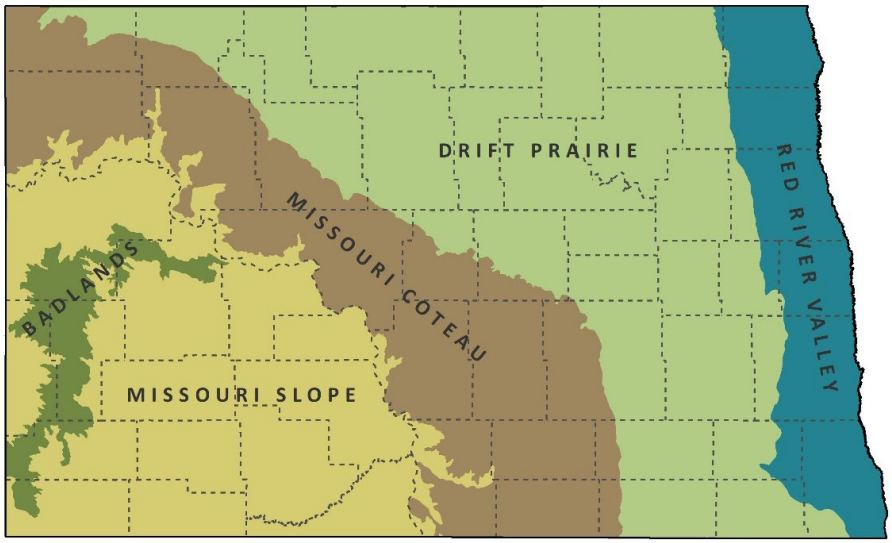


Figure 4. Major ecoregions of North Dakota.

Red River Valley

The Red River forms North Dakota's eastern border, with the Red River Valley extending 30 to 40 miles on either side. This flat plain was once the bed of the ancient Glacial Lake Agassiz, and much of the region is covered by silt and clay deposits typical of a lake bottom. Beach ridges scattered throughout the valley trace the former shoreline of the massive lake at different points in time. The valley gradually rises 500 feet over a bedrock escarpment, marking the natural boundary of the Red River Valley. The fertile organic soil makes this region some of the best farmland in the world.

Drift Prairie

The Drift Prairie stretches diagonally from northwestern to southeastern North Dakota. This glaciated landscape appears mostly flat with gentle, washboard-like undulations. The soil and climate create a transition zone between shortgrass and tallgrass prairie species. The region is dotted with a high concentration of seasonal and temporary wetlands. While grain farming dominates the area, crops such as soybeans, dry beans, corn, and canola are also widely grown.

Missouri Coteau

The Missouri Coteau extends eastward from the Missouri River to the western boundary of the Drift Prairie, marking the western edge of North Dakota's glaciated terrain. Wetlands are abundant along the eastern edge of the Coteau but become fewer towards the Missouri River. The predominant land use in this region is a mix of small grain, corn, soybean, and sunflower farming, along with livestock ranching.

Missouri Slope

The Missouri Slope's sandstone and shale layers were mostly untouched by the glaciers that shaped eastern North Dakota. The area features an irregular topography, with occasional buttes rising above the landscape. Complex drainage systems create breaks in the terrain. Livestock ranching dominates the region, although small grain, corn and sunflower farming is also practiced.

Badlands

North Dakota's Badlands consist of a rugged landscape of buttes, rock outcrops, washouts, and hardwood draws along the banks of the Little Missouri River. The region is defined by poor soils, steep slopes, high erosion, and shortgrass prairie.

CLIMATE

North Dakota's climate is continental and is characterized by large variances in temperature, both on a seasonal and daily basis. Precipitation ranges from low to moderate, and air flow through the region creates windy conditions.

Air Masses

North Dakota is affected by regular changes in atmospheric air masses. Air masses from the polar region bring cold, dry air to the state. Northern Pacific air masses produce warmer, drier conditions, and tropical masses bring warm, wet weather. The Rocky Mountains frequently block air masses from the southern Pacific Ocean from reaching the state.

Temperature

North Dakota's average annual temperature ranges from 37° F in the northern part of the state to 43° F in the south. January is the coldest month. Temperatures average from 2° F in the north to 17° F in the southwest with an average of fifty days below 0˚. July is the warmest month with temperatures averaging 67° F in the north and 73° F in the south. Temperatures over 90˚are common. North Dakota's highest temperature was 121° F and the lowest -60° F, were both recorded in 1936.

Precipitation

Annual precipitation ranges from 13 to 20 inches a year (Figure 5). The average increases from west to east, with the southeast receiving the highest average precipitation. Winter precipitation is highest in January. June is the wettest month receiving 3 to 4 inches of rain. Areas such as the Turtle Mountains receive higher rainfalls than the surrounding plains, due to higher elevations.

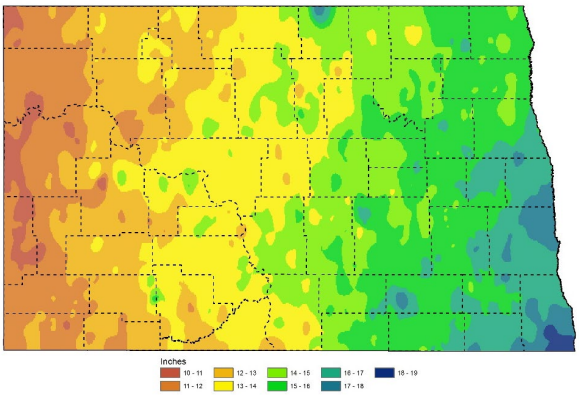


Figure 5. Average season (April – September) precipitation for 30 year period ending 2010.

A Changing Climate

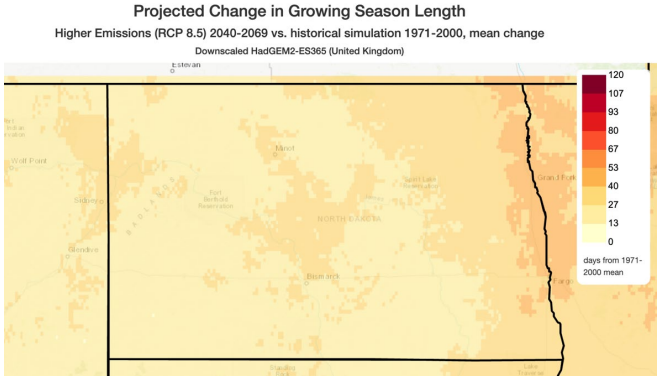
A shift in long term temperatures and weather patterns is referred to as climate change. As these patterns shift, North Dakota could be impacted in several ways: more severe droughts, increased flooding, changes in growing season, etc. It is important to understand climate change and predicted patterns to anticipate and prepare for how a changing climate alone, or in combination with other threats, might impact the state's wildlife and habitat. The following are relevant climate models, selected by subject matter experts, which offer a look at key climate variables most crucial for consideration: growing season length, temperature minimum and maximums, precipitation and its seasonality, drought, and flood risk.

Justification for Approach:

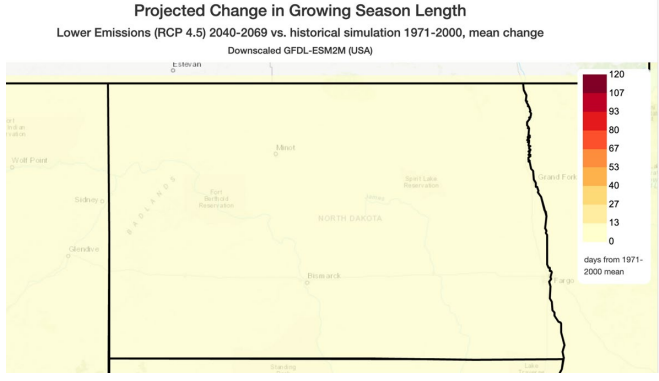
- The time-period used for all climate projections is a mid-century planning period centered around 2055 (2040 - 2069); this time-period allows the incorporation of climate change into both short-term and long-term planning.
- A climate change scenario planning approach was used to select a set of plausible yet contrasting future conditions that encompass the range of critical uncertainties for the climate variables of interest in North Dakota (Lawrence et al., 2021; Miller et al., 2022).
    - A combination of 20 global circulation models CMIP5 (GCMs) for two emission scenarios (RCP4.5 RCP 8.5) were used to select the representative potential climate futures; divergent GCM-RCP combinations were assessed by examining bivariate plots of the following climate variables: wintertime (Dec-Feb) minimum temperature, wintertime (Dec-Feb) precipitation, summer (Jun - Aug) precipitation, growing season length, climatic water deficit, spring runoff, and days with a heat index > 90°.
        - The following GCM-RCP combination were chosen to represent two scenarios
            - HadGEM2-ES365 RCP 8.5 [hotter conditions throughout the year, increase in wintertime precipitation and decrease in summertime precipitation, extended growing season with increased summertime drought] 'hot drought'
            - GFDL-ESM2M RCP 4.5 [warmer conditions largely evident in winter, averaged wintertime precipitation and increased summertime precipitation, no change in growing season length, reduced summertime drought] 'warm and wet'
            - Maps provided below represent both possible future climate scenarios that span the range of critical uncertainties
    - From the specific GCMs chosen to represent the future climate scenarios, it was confirmed that they had adequate model performance (Joyce & Coulson, 2020).

Growing Season Length

1. "Growing seasons and frost-free periods are lengthening" due to rising temperatures, which may be beneficial for some crops; however, crop yields will be negatively impacted due to "heat and moisture stress… increase weed competition, and pest expansion". (Figure 6)
2. Relevant to both cropland and other habitats



Dark orange 40-53 days, medium orange 27-40 days, light orange 13-27 days.

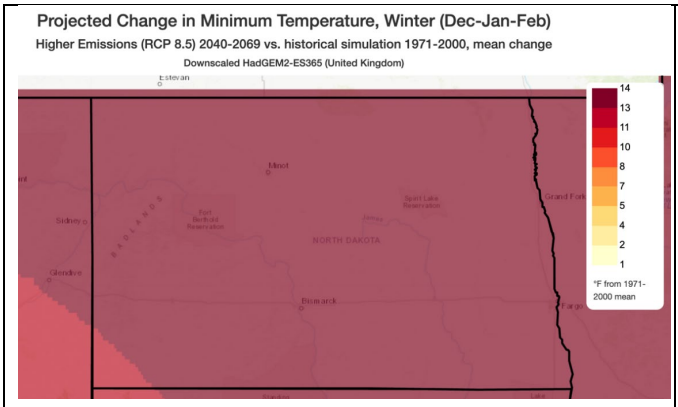


Light yellow 0-13 days.

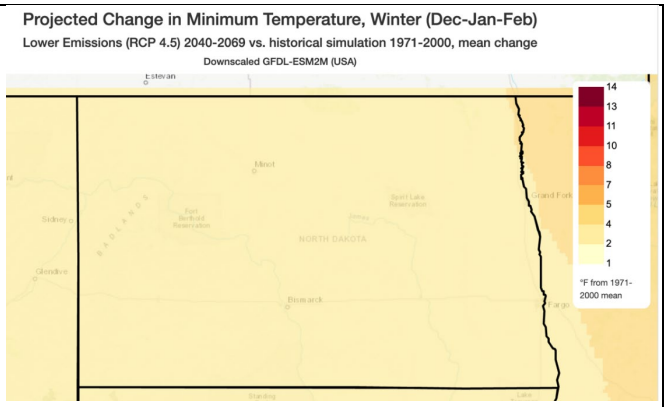
Figure 6. Projected growing season length for both 'scenarios.'

Temperature minimum and maximums

1. "Since 1900, the annual average temperature in the Northern Great Plains has increased by 1.6-2.6 degrees F, and North Dakota has experienced the largest increase in the region. While ND's summers have "warmed little," the number of very cold days has decreased across the region; since 2000, North Dakota's number of very cold days has been below the long term average."
2. This winter warming trends is projected to increase with changing climate (Figure 7).
3. Days over threshold high temperatures are also expected to increase (Figure 8).

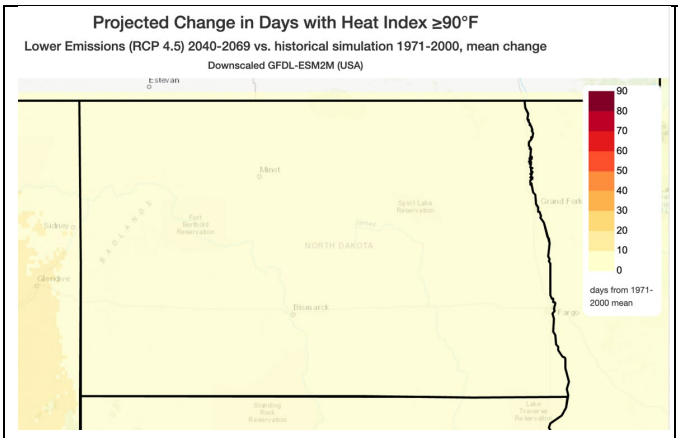


Dark red 13+ degrees F, light red 11-13 degrees F.

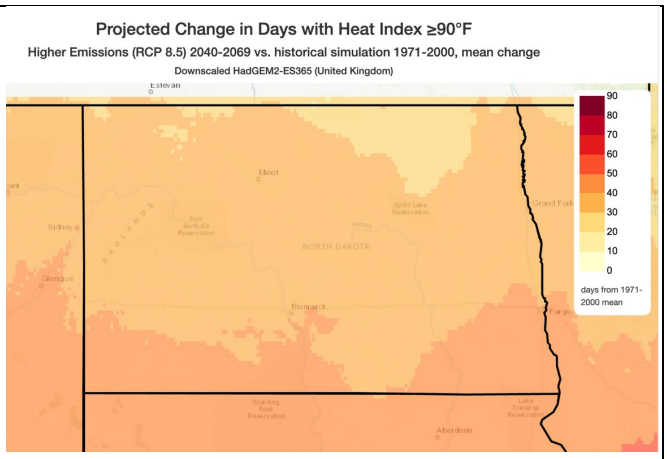


Light orange 2-4 degrees F, medium orange 4-5 degrees F.

Figure 7. Projected wintertime minimum temperature for both 'scenarios.'



Light yellow 0-10 days.

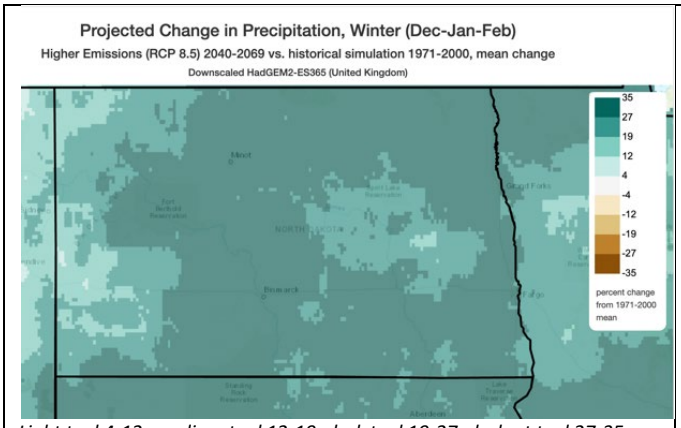


Lightest orange 10-20 days, light orange 20-30 days, medium orange 30-40 days, dark orange 40-50 days.

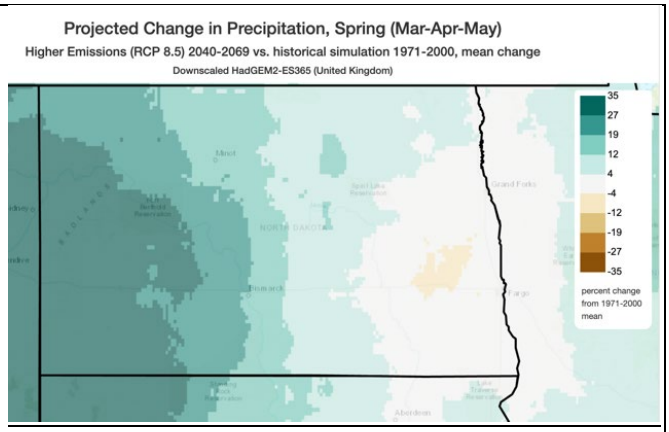
Figure 8. Projected change in number of hot days for both scenarios.

Change in Precipitation- Snow and seasonal dynamics

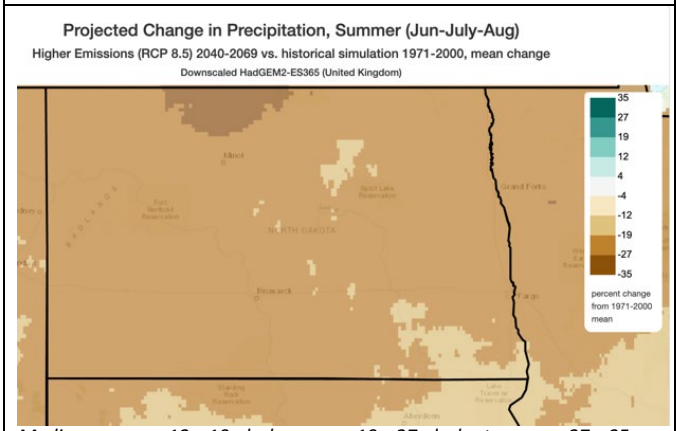
1. From 1950 to 2010, the number of snow-cover days declined within the region.
2. Despite projected increased wintertime precipitation (Figure 9), warmer temperature will drive faster snow loss
   i. Snow can have large cascading influences on the impact of other climate trends (creates different antecedent conditions)
3. Drought
   ii. The Northern Great Plains region is experiencing unprecedented extremes related to changes in climate, including severe droughts, floods, and wildfire.
4. Flash droughts driven by warmer temperatures may increase in impact in North Dakota, with a possible of Intensity of floods
   iii. There is a higher risk of floods with overall increasing projected precipitation, but the likelihood of these events is less certain due to higher precipitation variability overall
      i. "Heavier rainfall, combined with changes in land use and other factors such as soil moisture and snow, is leading to increasing flood damage."
      ii. Flooding has been more common in the east while drought has been more common in the west in North Dakota (Figure 10)



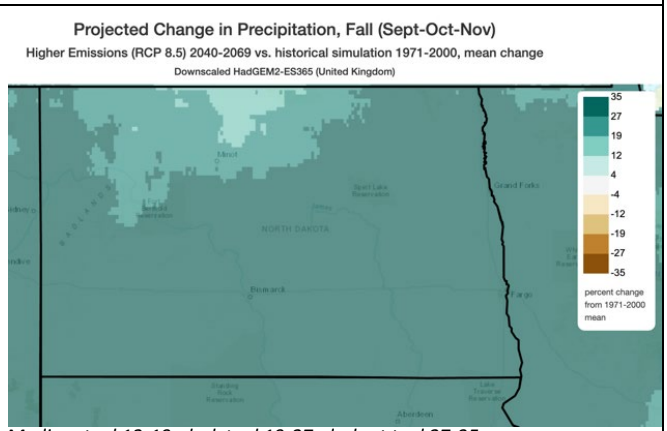
Light teal 4-12, medium teal 12-19, dark teal 19-27, darkest teal 27-35.



Lightest orange -12- -4, lightest teal -4-4, light teal 4-12, medium teal 12-19, dark teal 19-27, darkest teal 27-35+.

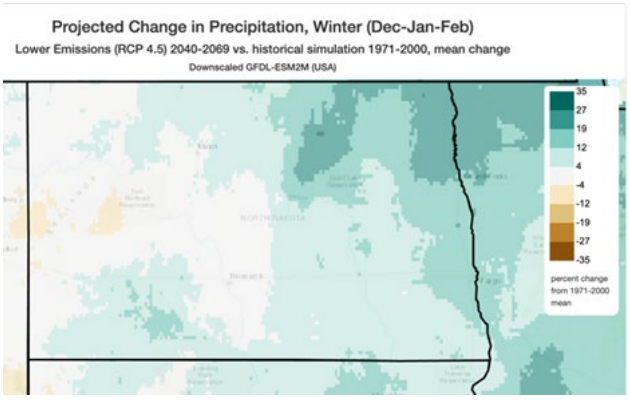


Medium orange -12- -19, dark orange -19- -27, darkest orange -27- -35.

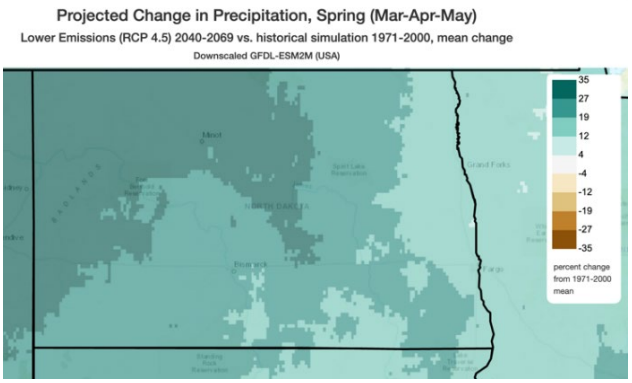


Medium teal 12-19, dark teal 19-27, darkest teal 27-35.

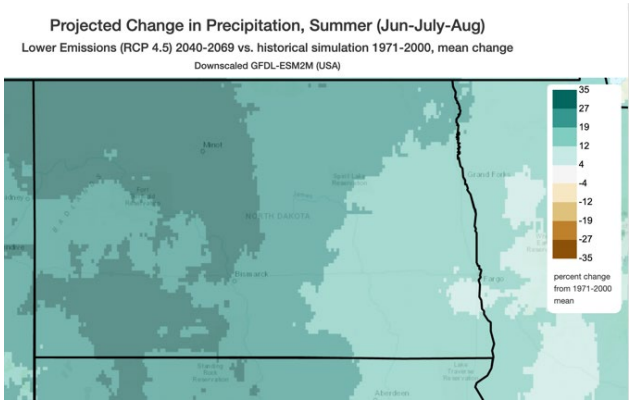
Figure 9. Projections for percent change in precipitation across the four seasons for the 'hot drought' scenario.



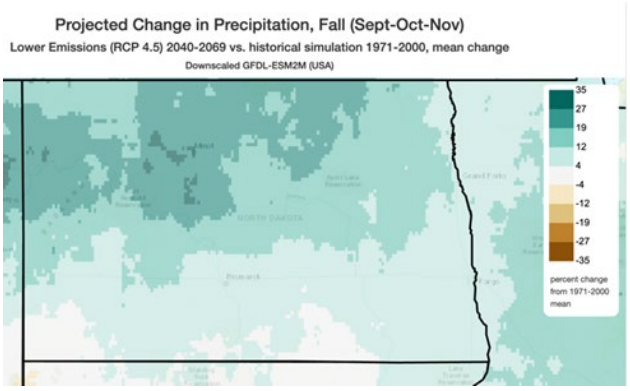
Light yellow -4- -12, lightest teal -4-4, light teal 4-12, medium teal 12-19, dark teal 19-27.



Light teal 4-12, medium teal 12-19, dark teal 19-27, darkest teal 27-35+.



Medium orange -12- -19, dark orange -19- -27, darkest orange -27- -35.



Light teal 4-12, medium teal 12-19, dark teal 19-27, darkest teal 27-35.

Figure 10. Projections for percent change in precipitation across the four seasons for the 'warm and wet' scenario.

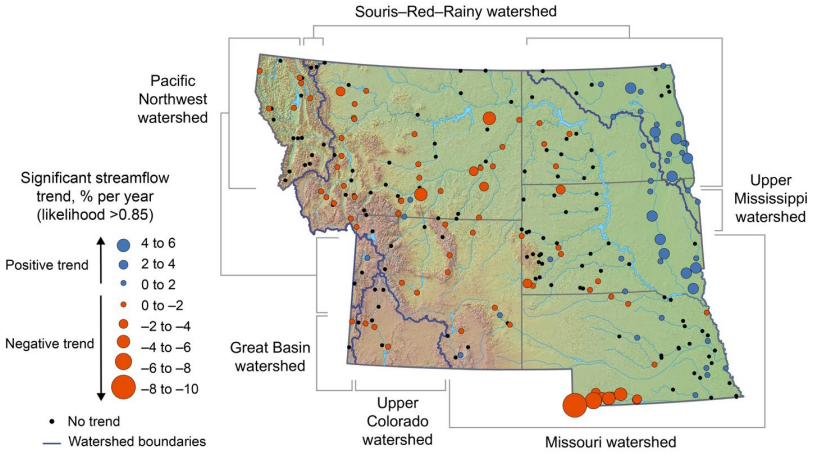


Figure 11. Water Resource Regions and Rivers, trends in annual peak streamflow, 1961-2020.
This map of the water resource regions and rivers within the region shows distinct east–west differences in trends in annual peak streamflow for 1961–2020, expressed as percent per year, where the size of the dot is relative to the size of the trend. Red dots are downward trends, and blue dots are upward trends. A likelihood-based approach is used to report these trend results. When a trend is identified, the trend likelihood value (likelihood = 1 – p-value/2) associated with the trend is between 0.85 and 1.0. In other words, the chance of the trend occurring in the specified direction is at least 85 out of 100. Smaller black dots are sites for which there were sufficient data for trend analysis, but likelihood was less than 0.85; that is, these sites do not exhibit a substantial trend in either direction.
Figure credit: USGS, NOAA NCEI, and CISESS NC.

Adapting to a Changing Climate

Climate change can impact fish, wildlife, and the habitats they depend on in significant ways: shifts in species ranges, changes in behavioral or morphological traits, shifts in phenology, changes in species composition, increased pressure from non-native species, changes in predator/prey dynamics, etc. With a better understanding of how climate change, in conjunction with other stressors, might impact North Dakota's wildlife and habitats, we can make better management decisions.

Climate Case Study: Climate Resiliency and Management Planning

Conversion of native vegetation poses one of the greatest challenges wildlife face in North Dakota and throughout the Great Plains (Figure 12). North Dakota has lost approximately 72% of its native grasslands, with conversion of the remaining grassland systems a continued threat (NDGFD, unpublished). As conversion continues across the landscape, landowner programs that aim to keep native habitats intact and the restoration of vital habitats are becoming critical practices to halt and reverse declines in biodiversity (Lyons et al. 2023, Menz et al. 2013, Suding et al. 2015, Torok et al. 2021). There are several ways land managers might consider climate change while executing these practices.

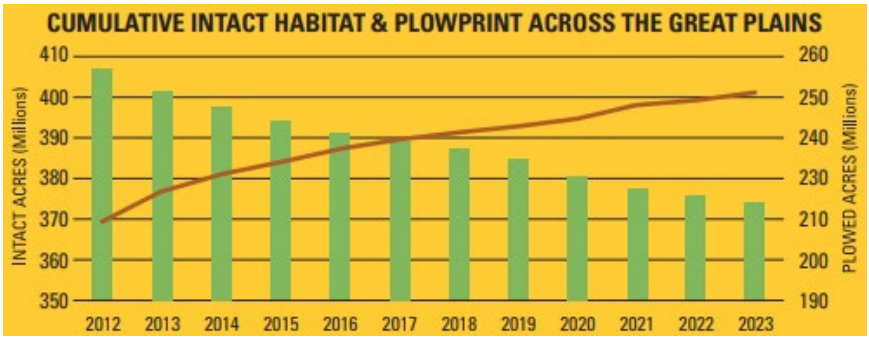


Figure 12. Intact native habitat and plowed acres across the Great Plains from 2012 to 2023 (2024 Plowprint Report).

1. Because the amount of available native habitat is continually being reduced due to conversion, restoring habitat has become an important practice to ensure enough habitat remains on the landscape. However successful restorations are expensive and require long term commitments, limiting the amount of acres land managers can feasibly restore. Acknowledging these obstacles, land managers are then charged with the difficult task of ensuring limited resources go towards projects that will provide the greatest "bang for their buck". One way land managers can begin to prioritize is by considering a changing climate and the projects ability to aid in climate resiliency. The Midwest Landscape Initiative, using data from The Nature Conservancy, has mapped areas throughout the Midwest that are climate resilient. Climate resiliency identifies lands and waters that can properly function under changing climate conditions. These areas are prioritized based on landscape diversity and connectedness. Components of the dataset include data from the resilient and connected network (RCN), recognized biodiversity values, connectivity and climate flow scores, geophysical settings, landforms, landscape diversity values, local connectedness metrics, and terrestrial resilience scores. The map in Figure 13 shows the least resilient to the most resilient lands based on these data. Using this information, land managers can make better decisions on where to prioritize restoration projects. Area's that are most resilient are comprised of healthy native communities and restoring areas adjacent to these parcels can expand and/or connect these areas of refugia and will likely have much greater benefits than restorations done in areas surrounded by least resilient lands.

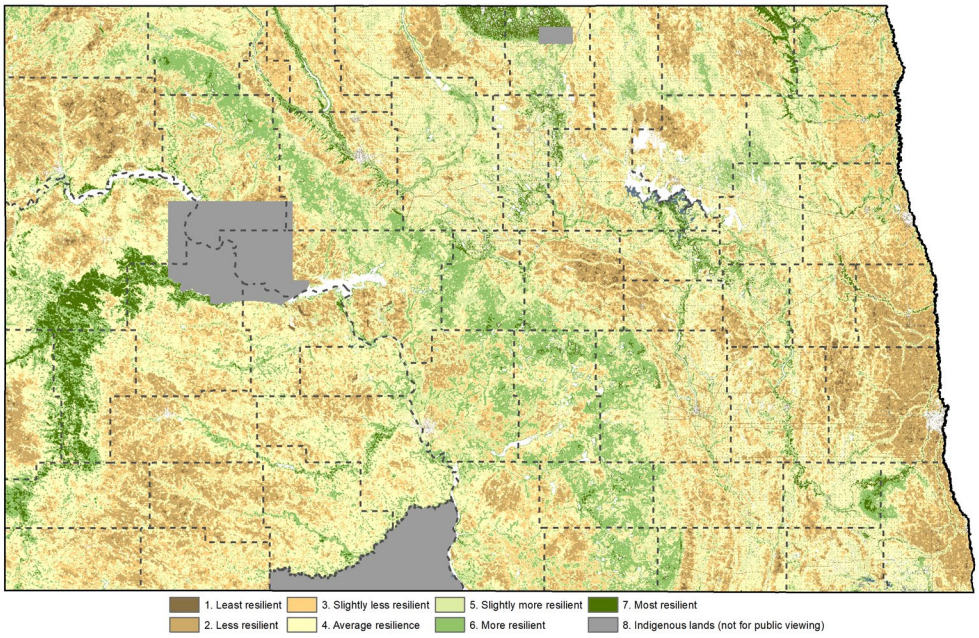


Figure 13. Priority areas based on landscape diversity and connectedness (Midwest Conservation Blueprint).

2. Like the climate resilient lands, the MLI, using the UN Environment Program World Biomass and Soil Carbon dataset (Soto-Navarro et al., 2020), has also mapped areas of climate resilience with a focus on carbon sequestration (Figure 14). These areas are prioritized based on the amount of above and below ground carbon stored. Areas that store higher amounts of carbon will play an important role in long term climate trends. Land managers can utilize this data to prioritize areas to protect, focusing on those with a higher capacity to store carbon.

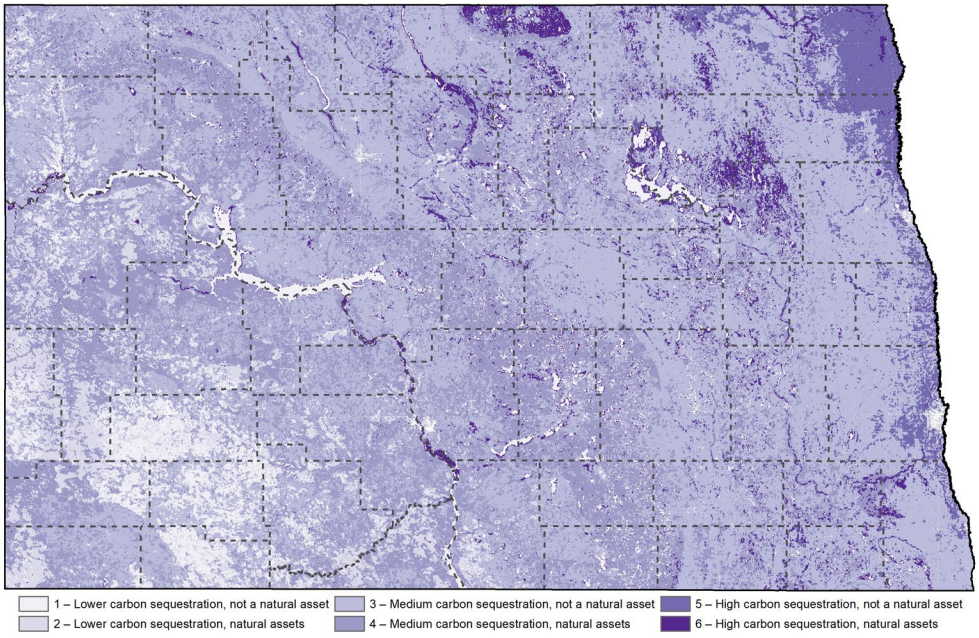


Figure 14. Priority areas based on the amount of above and belowground carbon stored (Midwest Conservation Blueprint).

TRIBAL COMMUNITIES

Tribal communities have played an important role in shaping North Dakota's history (State Historical Society, North Dakota Indian Affairs Commission). North Dakota is comprised of the traditional territories of Michif Piyii (Métis), Očhéthi Šakówiŋ, Yanktonai, Assiniboine, Mandan, Hidatsa, and Arikara, Hunkpapa, Tséstho'e (Cheyenne), Sisíthuŋwaŋ, Anishinabewaki, Itazipco, Apsáalooke (Crow), Bdewakantuwan (Mdewakanton), and Niitsítpiis-stahkoii (https://native-land.ca/). Today, in North Dakota there are five recognized tribes: the Mandan, Hidatsa, & Arikara Nation (Three Affiliated Tribes), the Spirit Lake Nation, the Standing Rock Sioux Tribe, and the Turtle Mountain Band of Chippewa Indians, as well as one Indian community: the Sisseton-Wahpeton Oyate Nation. There are more than 30,000 indigenous residents in North Dakota and several million acres of tribal land.

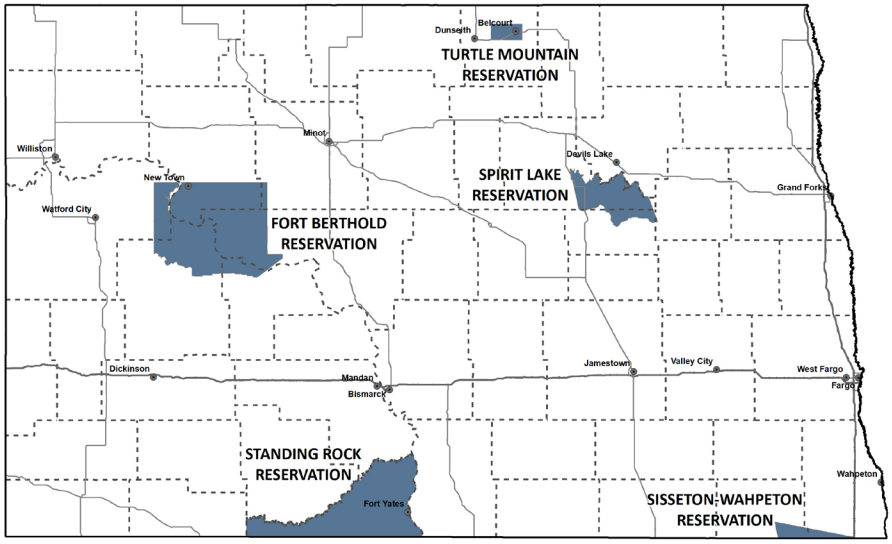


Figure 15. Tribal reservations of North Dakota.

The Importance of Culturally Significant Natural Resources to Tribal Communities in North Dakota

Culturally significant natural resources are essential to the well-being, identity, and sovereignty of tribal communities in North Dakota. These resources, including native plant species, wildlife, sacred landscapes, and water bodies, are integral to traditional practices, ceremonial life, and intergenerational knowledge transfer. For many tribal nations, the relationship with these natural elements is guided by long-standing stewardship principles that emphasize balance, respect, and sustainability.

The North Dakota State Wildlife Action Plan recognizes that effective conservation must include Indigenous perspectives and honor tribal knowledge systems. Respectful engagement with tribal governments is critical to understanding the cultural dimensions of wildlife and habitat management. Furthermore, the conservation of culturally important species and landscapes supports broader ecological and social goals, including the preservation of biodiversity, the protection of treaty rights, and the promotion of community resilience.

Developing relationships with tribal nations and implementation of conservation strategies enhances the relevance and long-term success of the SWAP. This approach aligns with shared values of protecting natural heritage for future generations while acknowledging the unique relationships that tribal communities maintain with the land and its resources.

TRIBAL SUCCESS STORIES

In development. To be completed prior to submittal to USFWS.

CHAPTER 3
SPECIES OF GREATEST CONSERVATION NEED

This chapter outlines how the following element was identified:

Element 1: information on the distribution and abundance of species of wildlife, including low and declining populations as each State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's Species of Greatest Conservation Need (SGCN).

OVERVIEW

Congress identified the eight required elements to be addressed in the State Wildlife Action Plans (SWAP), which requires an update every 10 years. Element #1 is: *information on the distribution and abundance of species of wildlife, including low and declining populations as each State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's Species of Greatest Conservation Need (SGCN).* The SWAP must identify and focus on the recovery and conservation of SGCNs yet address the full array of wildlife and wildlife-related issues.

A key step in the SWAP revision process is reviewing the species list. In the 2015 North Dakota (ND) SWAP, the list was referred to as Species of Conservation Priority (SCP) and was divided into 3 different levels of priority. In the 2025 ND SWAP, the principal list will be referred to as Species of Greatest Conservation Need or SGCN and no levels will be assigned. A second list has been developed and will be referred to as Species of Greatest Information Need or SGIN. **While SGCNs are known to be at-risk or in decline, SGINs face uncertainty in terms of their status, range, or level of risk.**

Guidance and definitions for identifying the species on the list:

- N.D.C.C. § 20.1-01-02 (59). "Wildlife" means any member of the animal kingdom including any mammal, fish, bird (including any migratory, nonmigratory, or endangered bird for which protection is also afforded by treaty or other international agreement), amphibian, reptile, mollusk, crustacean, or other invertebrate . . . Wildlife does not include domestic animals as defined by section 36-01-00.1 or birds or animals held in private ownership.
- The term "species" includes taxonomic species as well as selected subspecies. If taxonomy is uncertain or scientific knowledge does not exist to identify to species level, an assemblage or species group may be used.
- Species must be fauna, not flora, and may include aquatic species and invertebrates. States have the option of choosing which taxa to include.
- The list may include both hunted and non-hunted species. States have the option of whether to include game species on the list.
- The list may include federally threatened or endangered species but is not mandatory. In previous ND SWAPS, all federally listed species were included. For the 2025 species list revision, federally listed species that are not known to occur, or occur infrequently, may be omitted, or moved to the SGIN list.
- The list is subject to change as new information becomes available. If it is determined that a species is at high or imminent risk, it may be added to the SGCN list prior to the 2035 revision.

LIST REVISION PROCESS

A team of four North Dakota Game and Fish Department Conservation Biologists led the review and development of the 2025 list. The following taxonomic groups were considered: birds, mammals, reptiles, amphibians, fish, terrestrial invertebrates, and aquatic invertebrates. The 2025 list includes a more thorough assessment of terrestrial and aquatic invertebrates compared to previous SWAP efforts. For comparison, the 2015 list only included invertebrates listed as federally threatened or endangered, or under review for listing. Migratory and wintering birds were also evaluated for the 2025 list, whereas previous efforts concentrated mainly on birds that nest in the state.

First, Department staff compiled the information available for species that may be at-risk or declining. For some taxa, such as birds, a tremendous amount of data and expert identified lists of species of concern are available. For many other species evaluated, there is a significant lack of data or even knowledge regarding the presence or distribution of the species in the state. Sources consulted included but was not limited to regional, national, or global watch lists, federal lists, international lists such as COSEWIC, NatureServe, iNaturalist, trend data such as Breeding Bird Survey, or data collected from State Wildlife Grant projects or other recent publications and research.

In January 2023, a preliminary list of potential species was shared internally with all Department staff for their review and feedback. The draft list was also sent to a broad group of partners and experts for review and feedback. The proposed revisions were divided into two tables: 1) species from the 2015 list and the Department's proposed actions for those species, and 2) species that were not on the 2015 list but have been identified as at-risk, declining, or priority species from other efforts or data sources. Proposed actions were: 1) keep (species is on 2015 list, retain on 2025 list); 2) add (add species to 2025 list); 3 remove (species is on 2015 list, do not include on 2025 list); or 4) undetermined (species evaluated but needs further review before making determination to add or exclude from list). After gathering insights from reviewers and engaging in discussions with other states about their strategies for the SGCN list, the Department decided to separate the list into two distinct groups: SGCNs and SGINs. In late 2023 and early 2024, expert focus groups based on taxa were established. There were differing opinions on whether to add or remove a species from the list and the smaller focus groups helped the Department make those determinations, including if the species should be categorized as an SGCN or SGIN. The draft 2025 SGCN and SGIN list was completed in July 2024 and made available on the Department's website (gf.nd.gov).

2025 SGCN and SGIN CRITERA/DEFINITONS

<u>SGCN includes species which are one or more of the following:</u>

a. Regionally or globally imperiled.
b. At-risk or experiencing declines either regionally or globally and North Dakota represents an important portion of their remaining range.
c. At-risk based on expert review or recent regional or global assessments.

<u>SGIN includes species which are one or more of the following:</u>

d. Potentially vulnerable but current scientific knowledge and expert understanding is lacking.
e. Potentially stable in North Dakota but may be experiencing declines in a substantial portion of their range.
f. Potentially stable but uncertainty about life history traits may make them at-risk.
g. Declining regionally or globally but uncertainty regarding the significance of North Dakota to its survival.

Summary of Changes

Table 1. Total number of species by taxa included on the 2025 list compared to the 2015 list.

Taxa	2015 SWAP List	Removed From 2015 List	Added to 2025 SGCN	Moved From 2015 List to 2025 SGIN	Added to 2025 SGIN	Total 2025 SGCN	Total 2025 SGIN	Total SGCN + SGIN
Birds	47	3	16	3	8	57	11	68
Mammals	21	2	3	10	4	12	14	26
Amphibians & Reptiles	11	1	1	5	7	6	12	18
Fishes	22	5	1	2	1	16	3	19
Terrestrial Invertebrates	4	0	19	0	36	23	36	59
Aquatic Invertebrates	10	0	10	0	22	20	22	42
TOTAL	**115**	**11**	**50**	**20**	**78**	**134**	**98**	**232**

The following species were removed from the 2015 list because the species has recovered, or the best available information indicates the species is not at-risk or declining.

Table 2. Species removed from 2015 List.

Taxa	Subtaxon or Group	Common Name	Scientific Name
Birds	Landbird	Bald Eagle	*Haliaeetus leucocephalus*
Birds	Landbird	Swainson's Hawk	*Buteo swainsoni*
Birds	Landbird	Dickcissel	*Spiza americana*
Mammals	Carnivore	American Marten	*Martes americana*
Mammals	Carnivore	River Otter	*Lontra canadensis*
Amphibians	Toad	Canadian Toad	*Anaxyrus hemiophrys*
Fishes	Catfish	Yellow Bullhead	*Ameiurus natalis*
Fishes	Lamprey	Chestnut Lamprey	*Ichthyomyzon castaneus*
Fishes	Lamprey	Silver Lamprey	*Ichthyomyzon unicuspis*
Fishes	Minnow	Logperch	*Percina caprodes*
Fishes	Minnow	River Darter	*Percina shumardi*

Taxonomic name changes from 2015 to 2025:

- McCown’s Longspur to Thick-billed Longspur

Table 3. Species of Greatest Conservation Need (SGCN).

SPECIES OF GREATEST CONSERVATION NEED (SGCN)						
Taxa	**Subtaxon or Group**	**Common Name**	**Scientific Name**	**a. Regionally or globally imperiled**	**b. At-risk, ND important**	**c. At-risk, expert review**
Birds	Landbird	American Kestrel	*Falco sparverius*			X
Birds	Landbird	Baird's Sparrow	*Centronyx bairdii*	X	X	
Birds	Landbird	Black-billed Cuckoo	*Coccyzus erythropthalmus*			X
Birds	Landbird	Bobolink	*Dolichonyx oryzivorus*	X	X	
Birds	Landbird	Brewer's Sparrow	*Spizella breweri*			X
Birds	Landbird	Brown Thrasher	*Toxostoma rufum*			X
Birds	Landbird	Burrowing Owl	*Athene cunicularia*			X
Birds	Landbird	Chestnut-collared Longspur	*Calcarius ornatus*	X	X	
Birds	Landbird	Ferruginous Hawk	*Buteo regalis*		X	
Birds	Landbird	Golden Eagle	*Aquila chrysaetos*			X
Birds	Landbird	Grasshopper Sparrow	*Ammodramus savannarum*	X	X	
Birds	Landbird	Greater Prairie-Chicken	*Tympanuchus cupido*	X		
Birds	Landbird	Greater Sage-Grouse	*Centrocercus urophasianus*	X		
Birds	Landbird	Harris's Sparrow	*Zonotrichia querula*		X	X
Birds	Landbird	Horned Lark	*Eremophila alpestris*			X
Birds	Landbird	Lark Bunting	*Calamospiza melanocorys*	X	X	
Birds	Landbird	LeConte's Sparrow	*Ammospiza leconteii*	X	X	
Birds	Landbird	Loggerhead Shrike	*Lanius ludovicianus*	X		
Birds	Landbird	Nelson’s Sparrow	*Ammospiza nelsoni*		X	
Birds	Landbird	Northern Harrier	*Circus hudsonius*		X	
Birds	Landbird	Prairie Falcon	*Falco mexicanus*			X
Birds	Landbird	Red-headed Woodpecker	*Melanerpes erythrocephalus*			X
Birds	Landbird	Ruffed Grouse	*Bonasa umbellus*			X
Birds	Landbird	Sharp-tailed Grouse	*Tympanuchus phasianellus*		X	
Birds	Landbird	Short-eared Owl	*Asio flammeus*	X		X
Birds	Landbird	Sprague's Pipit	*Anthus spragueii*	X	X	
Birds	Landbird	Thick-billed Longspur	*Rhynchophanes mccownii*	X		
Birds	Landbird	Western Meadowlark	*Sturnella neglecta*		X	
Birds	Shorebird	American Avocet	*Recurvirostra americana*		X	
Birds	Shorebird	American Golden-Plover	*Pluvialis dominica*	X		X
Birds	Shorebird	Buff-breasted Sandpiper	*Calidris subruficollis*	X		X
Birds	Shorebird	Dunlin	*Calidris alpina*	X		X
Birds	Shorebird	Hudsonian Godwit	*Limosa haemastica*	X	X	
Birds	Shorebird	Lesser Yellowlegs	*Tringa flavipes*	X	X	
Birds	Shorebird	Long-billed Curlew	*Numenius americanus*			X

SPECIES OF GREATEST CONSERVATION NEED (SGCN)						
Taxa	**Subtaxon or Group**	**Common Name**	**Scientific Name**	**a. Regionally or globally imperiled**	**b. At-risk, ND important**	**c. At-risk, expert review**
Birds	Shorebird	Long-billed Dowitcher	*Limnodromus scolopaceus*	X	X	
Birds	Shorebird	Marbled Godwit	*Limosa fedoa*	X	X	
Birds	Shorebird	Pectoral Sandpiper	*Calidris melanotos*	X	X	
Birds	Shorebird	Piping Plover	*Charadrius melodus*	X	X	
Birds	Shorebird	Ruddy Turnstone	*Arenaria interpres*	X	X	
Birds	Shorebird	Semipalmated Sandpiper	*Calidris pusilla*	X	X	
Birds	Shorebird	Short-billed Dowitcher	*Limnodromus griseus*	X		
Birds	Shorebird	Stilt Sandpiper	*Calidris himantopus*	X	X	
Birds	Shorebird	Upland Sandpiper	*Bartramia longicauda*		X	
Birds	Shorebird	Willet	*Tringa semipalmata*		X	
Birds	Shorebird	Wilson's Phalarope	*Phalaropus tricolor*		X	X
Birds	Waterbird	American Bittern	*Botaurus lentiginosus*		X	
Birds	Waterbird	Black Tern	*Chlidonias niger*	X	X	
Birds	Waterbird	Franklin's Gull	*Leucophaeus pipixcan*		X	
Birds	Waterbird	Horned Grebe	*Podiceps auritus*	X	X	
Birds	Waterbird	Least Tern (Interior)	*Sternula antillarum*	X		
Birds	Waterbird	Western Grebe	*Aechmophorus occidentalis*		X	
Birds	Waterbird	Whooping Crane	*Grus americana*	X		
Birds	Waterbird	Yellow Rail	*Coturnicops noveboracensis*		X	X
Birds	Waterfowl	Canvasback	*Aythya valisineria*		X	
Birds	Waterfowl	Lesser Scaup	*Aythya affinis*		X	
Birds	Waterfowl	Northern Pintail	*Anas acuta*	X	X	
Mammals	Bat	Big Brown Bat	*Eptesicus fuscus*	X		
Mammals	Bat	Eastern Red Bat	*Lasiurus borealis*			X
Mammals	Bat	Hoary Bat	*Lasiurus cinereus*			X
Mammals	Bat	Little Brown Bat	*Myotis lucifugus*	X		
Mammals	Bat	Northern Long-eared Bat	*Myotis septentrionalis*	X		
Mammals	Bat	Silver-haired Bat	*Lasionycteris noctivagans*			X
Mammals	Carnivore	Black-footed Ferret	*Mustela nigripes*	X		
Mammals	Carnivore	Eastern Spotted Skunk	*Spilogale putorius*	X		
Mammals	Carnivore	Gray Fox	*Urocyon cinereoargenteus*	X		
Mammals	Carnivore	Swift Fox	*Vulpes velox*			X
Mammals	Rodent	Black-tailed Prairie Dog	*Cynomys ludovicianus*	X		
Mammals	Rodent	Richardson's Ground Squirrel	*Urocitellus richardsonii*		X	
Amphibians	Toad	American Toad	*Anaxyrus americanus*			X

SPECIES OF GREATEST CONSERVATION NEED (SGCN)						
Taxa	**Subtaxon or Group**	**Common Name**	**Scientific Name**	**a. Regionally or globally imperiled**	**b. At-risk, ND important**	**c. At-risk, expert review**
Amphibians	Toad	Plains Spadefoot	*Spea bombifrons*			X
Reptile	Lizard	Northern Prairie Skink	*Plestiodon septentrionalis*			X
Reptile	Snake	Plains Hog-nosed Snake	*Heterodon nasicus*			X
Reptile	Snake	Smooth Green Snake	*Opheodrys vernalis*			X
Reptile	Turtle	Snapping Turtle	*Chelydra serpentina*			X
Fishes	Codfish	Burbot	*Lota lota*			X
Fishes	Minnow	Blacknose Shiner	*Notropis heterolepis*			X
Fishes	Minnow	Blue Sucker	*Cycleptus elongatus*		X	
Fishes	Minnow	Carmine Shiner	*Notropis percobromus*			X
Fishes	Minnow	Finescale Dace	*Chrosomus neogaeus*			X
Fishes	Minnow	Flathead Chub	*Platygobio gracilis*			X
Fishes	Minnow	Hornyhead Chub	*Nocomis biguttatus*			X
Fishes	Minnow	Northern Pearl Dace	*Margariscus nachtriebi*			X
Fishes	Minnow	Northern Redbelly Dace	*Chrosomus eos*			X
Fishes	Minnow	Pugnose Shiner	*Notropis anogenus*			X
Fishes	Minnow	Sicklefin Chub	*Macrhybopsis meeki*		X	
Fishes	Minnow	Sturgeon Chub	*Macrhybopsis gelida*		X	
Fishes	Minnow	Trout-perch	*Percopsis omiscomaycus*			X
Fishes	Sturgeon	Lake Sturgeon	*Acipenser fulvescens*	X		
Fishes	Sturgeon	Paddlefish	*Polyodon spathula*		X	
Fishes	Sturgeon	Pallid Sturgeon	*Scaphirhynchus albus*	X		
Terrestrial Invertebrates	Bumble Bee	American Bumble Bee	*Bombus pensylvanicus*	X		X
Terrestrial Invertebrates	Bumble Bee	Indiscriminate Cuckoo Bumble Bee	*Bombus insularis*			X
Terrestrial Invertebrates	Bumble Bee	Yellow-banded Bumble Bee	*Bombus terricola*			X
Terrestrial Invertebrates	Bumble Bee	Western Bumble Bee	*Bombus occidentalis*	X		X
Terrestrial Invertebrates	Bumble Bee	Yellow Bumble Bee	*Bombus fervidus*	X	X	X
Terrestrial Invertebrates	Solitary Bee	Ainslie's Cuckoo Nomad Bee	*Epeolus ainsliei*			X
Terrestrial Invertebrates	Beetle	Badlands Tiger Beetle	*Cicindela decemnotata*			X
Terrestrial Invertebrates	Tiger Beetle	Ghost Tiger Beetle	*Cicindela lepida*			X
Terrestrial Invertebrates	Tiger Beetle	Northern Sandy Tiger Beetle	*Cicindela limbata nympha*			X
Terrestrial Invertebrates	Butterfly	Monarch Butterfly	*Danaus plexippus*			X
Terrestrial Invertebrates	Butterfly	Mulberry Wing	*Poanes massasoit*	X		

SPECIES OF GREATEST CONSERVATION NEED (SGCN)						
Taxa	**Subtaxon or Group**	**Common Name**	**Scientific Name**	**a. Regionally or globally imperiled**	**b. At-risk, ND important**	**c. At-risk, expert review**
Terrestrial Invertebrates	Butterfly	Regal Fritillary	*Argynnis idalia*		X	X
Terrestrial Invertebrates	Butterfly	Tawny Crescent	*Phyciodes batesii*			X
Terrestrial Invertebrates	Moth	Abbreviated Underwing	*Catocala abbreviatella*			X
Terrestrial Invertebrates	Moth	Hera Sheepmoth	*Hemileuca hera*			X
Terrestrial Invertebrates	Moth	Whitney's Underwing	*Catocala whitneyi*	X		X
Terrestrial Invertebrates	Skipper	Broad-winged Skipper	*Poanes viator*	X		X
Terrestrial Invertebrates	Skipper	Dakota Skipper	*Hesperia dacotae*	X	X	X
Terrestrial Invertebrates	Skipper	Dion Skipper	*Euphyes dion*	X		X
Terrestrial Invertebrates	Skipper	Edwards' Hairstreak	*Satyrium edwardsii*			X
Terrestrial Invertebrates	Skipper	Hobomok Skipper	*Lon hobomok*			X
Terrestrial Invertebrates	Skipper	Ottoe Skipper	*Hesperia ottoe*			X
Terrestrial Invertebrates	Skipper	Poweshiek Skipperling	*Oarisma poweshiek*	X		X
Aquatic Invertebrates	Dragonfly	Plains Emerald	*Somatochlora ensigera*			X
Aquatic Invertebrates	Dragonfly	Subarctic Darner	*Aeshna subarctica*			X
Aquatic Invertebrates	Freshwater Mussel	Black Sandshell	*Ligumia recta*	X		
Aquatic Invertebrates	Freshwater Mussel	Creek Heelsplitter	*Lasmigona compressa*		X	
Aquatic Invertebrates	Freshwater Mussel	Creeper	*Strophitus undulatus*			X
Aquatic Invertebrates	Freshwater Mussel	Deertoe	*Truncilla truncata*		X	
Aquatic Invertebrates	Freshwater Mussel	Fragile Papershell	*Leptodea fragilis*			X
Aquatic Invertebrates	Freshwater Mussel	Mapleleaf	*Quadrula quadrula*			X
Aquatic Invertebrates	Freshwater Mussel	Pink Heelsplitter	*Potamilus alatus*			X
Aquatic Invertebrates	Freshwater Mussel	Pink Papershell	*Potamilus ohiensis*		X	
Aquatic Invertebrates	Freshwater Mussel	Threeridge	*Amblema plicata*			X
Aquatic Invertebrates	Freshwater Mussel	Wabash Pigtoe	*Fusconaia flava*	X		
Aquatic Invertebrates	Mayfly	a mayfly	*Raptoheptagenia cruentata*			X
Aquatic Invertebrates	Mayfly	a mayfly	*Apobaetis lakota*			X

SPECIES OF GREATEST CONSERVATION NEED (SGCN)						
Taxa	**Subtaxon or Group**	**Common Name**	**Scientific Name**	**a. Regionally or globally imperiled**	**b. At-risk, ND important**	**c. At-risk, expert review**
Aquatic Invertebrates	Mayfly	a mayfly	*Cercobrachys cree*			X
Aquatic Invertebrates	Mayfly	a mayfly	*Traverella lewisi*			X
Aquatic Invertebrates	Mayfly	a sand-dwelling mayfly	*Lachlania saskatchewanensis*		X	
Aquatic Invertebrates	Stonefly	Dakota Stonefly	*Perlesta dakota*		X	
Aquatic Invertebrates	Stonefly	Pawnee Stonefly	*Perlesta xube*			X
Aquatic Invertebrates	Stonefly	Plains Stripetail	*Isoperla longiseta*			X

Hudsonian Godwit

Monarch Butterfly

American Toad

Lake Sturgeon

Table 4. Species of Greatest Information Need (SGIN).

Species denoted with an asterisk (*) have been moved from the 2015 SCP list to the 2025 SGIN list.

SPECIES OF GREATEST INFORMATION NEED (SGIN)							
Taxa	**Subtaxon or Group**	**Common Name**	**Scientific Name**	**d. Scientific knowledge deficient**	**e. Potentially stable in ND, declining in range**	**f. Potentially stable but life history trait vulnerability**	**g. Declining, ND significance uncertain**
Birds	Landbird	Black-billed Magpie	*Pica hudsonia*		X	X	
Birds	Landbird	Chimney Swift	*Chaetura pelagica*				X
Birds	Landbird	Common Nighthawk	*Chordeiles minor*	X		X	
Birds	Landbird	Eastern Screech-Owl	*Megascops asio*	X			X
Birds	Landbird	Northern Flicker	*Colaptes auratus*				X
Birds	Landbird	Peregrine Falcon*	*Falco peregrinus*			X	
Birds	Landbird	Smith's Longspur	*Calcarius pictus*	X			
Birds	Landbird	Snowy Owl	*Bubo scandiacus*	X			
Birds	Landbird	Western Kingbird	*Tyrannus verticalis*				X
Birds	Shorebird	Red Knot (Rufa)*	*Calidris canutus*				X
Birds	Waterbird	American White Pelican*	*Pelecanus erythrorhynchos*			X	
Mammals	Bat	Fringed Myotis	*Myotis thysanodes*				X
Mammals	Bat	Long-eared Bat*	*Myotis evotis*	X			
Mammals	Bat	Long-legged Bat*	*Myotis volans*	X			
Mammals	Bat	Townsend's Big-eared Bat*	*Corynorhinus townsendii*				X
Mammals	Bat	Western Small-footed Bat*	*Myotis ciliolabrum*	X			
Mammals	Rodent	Franklin's Ground Squirrel	*Poliocitellus franklinii*		X		
Mammals	Rodent	Hispid Pocket Mouse*	*Chaetodipus hispidus*	X			
Mammals	Rodent	Plains Pocket Mouse*	*Perognathus flavescens*	X			
Mammals	Rodent	Sagebrush Vole*	*Lemmiscus curtatus*	X			
Mammals	Rodent	Ord's Kangaroo Rat	*Dipodomys ordii*	X			
Mammals	Shrew	Arctic Shrew*	*Sorex arcticus*	X			
Mammals	Shrew	Merriam's Shrew*	*Sorex merriami*	X			
Mammals	Shrew	Northern Water Shrew	*Sorex palustris*	X			
Mammals	Shrew	Pygmy Shrew*	*Sorex minutus*	X			
Amphibians	Frog	Cope's Gray Treefrog	*Hyla chrysoscelis*	X			

SPECIES OF GREATEST INFORMATION NEED (SGIN)							
Taxa	**Subtaxon or Group**	**Common Name**	**Scientific Name**	**d. Scientific knowledge deficient**	**e. Potentially stable in ND, declining in range**	**f. Potentially stable but life history trait vulnerability**	**g. Declining, ND significance uncertain**
Amphibians	Frog	Eastern Gray Treefrog	*Hyla versicolor*	X			
Amphibians	Frog	Wood Frog	*Lithobates sylvaticus*			X	
Amphibians	Salamander	Common Mudpuppy	*Necturus maculosus*	X			
Reptiles	Lizard	Sagebrush Lizard*	*Sceloporus graciosus*			X	
Reptiles	Lizard	Short-horned Lizard*	*Phrynosoma hernandesi*			X	
Reptiles	Snake	Common Gartersnake	*Thamnophis sirtalis*			X	
Reptiles	Snake	Plains Gartersnake	*Thamnophis radix*			X	
Reptiles	Snake	Red-bellied Snake	*Storeria occipitomaculata*			X	
Reptiles	Turtle	False Map Turtle*	*Graptemys pseudogeographica*			X	
Reptiles	Turtle	Smooth Softshell*	*Apalone mutica*			X	
Reptiles	Turtle	Spiny Softshell*	*Apalone spinifera*			X	
Fishes	Minnow	silvery minnows	*Hybognathus spp.*[1]	X			
Fishes	Minnow	Largescale Stoneroller*	*Campostoma oligolepis*	X			
Fishes	Minnow	Silver Chub*	*Macrhybopsis storeriana*	X			
Terrestrial Invertebrates	Bumble Bee	Ashton's Cuckoo Bumble Bee	*Bombus ashtonii*	X			X
Terrestrial Invertebrates	Bumble Bee	Black-and-gold Bumble Bee	*Bombus auricomus*	X			
Terrestrial Invertebrates	Bumble Bee	Rusty-patched Bumble Bee	*Bombus affinis*				X
Terrestrial Invertebrates	Bumble Bee	Suckley's Cuckoo Bumble Bee	*Bombus suckleyi*				X
Terrestrial Invertebrates	Solitary Bee	a leaf-cutter bee	*Megachile dakotensis*				X
Terrestrial Invertebrates	Solitary Bee	a mason bee	*Osmia illinoensis*				X
Terrestrial Invertebrates	Solitary Bee	a nomia bee	*Nomia universitatis*				X
Terrestrial Invertebrates	Solitary Bee	Nude Yellow Loosestrife Bee	*Macropis nuda*				X
Terrestrial Invertebrates	Solitary Bee	Susanna's Cellophane Bee	*Colletes susannae*	X			

[1] Genus assemblage.

SPECIES OF GREATEST INFORMATION NEED (SGIN)							
Taxa	**Subtaxon or Group**	**Common Name**	**Scientific Name**	**d. Scientific knowledge deficient**	**e. Potentially stable in ND, declining in range**	**f. Potentially stable but life history trait vulnerability**	**g. Declining, ND significance uncertain**
Terrestrial Invertebrates	Beetle	Nine-spotted Lady Beetle	*Coccinella novemnotata*				X
Terrestrial Invertebrates	Tiger Beetle	Great Plains Tiger Beetle	*Amblycheila cylindriformis*	X			
Terrestrial Invertebrates	Tiger Beetle	Splendid Tiger Beetle	*Cicindela splendida*				X
Terrestrial Invertebrates	Butterfly	Baird's Swallowtail	*Papilio machaon bairdii*	X			
Terrestrial Invertebrates	Butterfly	Gray Copper	*Tharsalea dione*		X		
Terrestrial Invertebrates	Butterfly	Greenish Blue	*Icaricia saepiolus*		X		
Terrestrial Invertebrates	Butterfly	Large Marble	*Euchloe ausonides*				X
Terrestrial Invertebrates	Butterfly	Mead's Wood-Nymph	*Cercyonis meadii*	X			
Terrestrial Invertebrates	Butterfly	Mormon Metalmark	*Apodemia mormo*	X			
Terrestrial Invertebrates	Butterfly	Persius Dusky Wing	*Erynnis persius*				X
Terrestrial Invertebrates	Butterfly	Purplish Copper	*Lycaena helloides*		X		
Terrestrial Invertebrates	Butterfly	Ridings' Satyr	*Neominois ridingsii*	X			
Terrestrial Invertebrates	Butterfly	Silvery Blue	*Glaucopsyche lygdamus*		X		
Terrestrial Invertebrates	Moth	a crambid snout moth	*Pyrausta pythialis*	X			
Terrestrial Invertebrates	Moth	Juanita Sphinx Moth	*Proserpina juanita*	X			
Terrestrial Invertebrates	Moth	Leadplant Flower Moth	*Schinia lucens*	X			
Terrestrial Invertebrates	Moth	Manitoba Oakworm Moth	*Anisota manitobensis*				X
Terrestrial Invertebrates	Skipper	Arogos Skipper	*Atrytone arogos*				X
Terrestrial Invertebrates	Skipper	Garita Skipperling	*Oarisma garita*	X			
Terrestrial Invertebrates	Skipper	Leonard's Skipper	*Hesperia leonardus*				X
Terrestrial Invertebrates	Skipper	Pahaska Skipper	*Hesperia pahaska*				X
Terrestrial Invertebrates	Skipper	Plains Branded Skipper	*Hesperia assinboia*	X			
Terrestrial Invertebrates	Skipper	Rhesus Skipper	*Polites rhesus*				X
Terrestrial Invertebrates	Skipper	Strecker's Giant-skipper	*Megathymus streckeri*				X
Terrestrial Invertebrates	Skipper	Uncas Skipper	*Hesperia uncas*				X

SPECIES OF GREATEST INFORMATION NEED (SGIN)							
Taxa	**Subtaxon or Group**	**Common Name**	**Scientific Name**	**d. Scientific knowledge deficient**	**e. Potentially stable in ND, declining in range**	**f. Potentially stable but life history trait vulnerability**	**g. Declining, ND significance uncertain**
Terrestrial Invertebrates	Grasshopper	Greenish-white Grasshopper	*Hypochlora alba*	X			
Terrestrial Invertebrates	Jumping spider	Apache Jumping Spider	*Phidippus apacheanus*				X
Aquatic Invertebrates	Anostroca	Ornate Fairy Shrimp	*Eubranchipus ornatus*		X		
Aquatic Invertebrates	Caddisfly	a giant case maker	*Ptilostomus angustipennis*	X			
Aquatic Invertebrates	Caddisfly	Long-horned Caddisfly	*Oecetis ochracea*	X			
Aquatic Invertebrates	Caddisfly	long-horned case makers	*Ceraclea spp.*[1]	X			
Aquatic Invertebrates	Caddisfly	Footed Micro Caddisfly	*Ochrotrichia tarsalis*	X			
Aquatic Invertebrates	Caddisfly	Net-spinning Caddisfly	*Hydropsyche piatrix*	X			
Aquatic Invertebrates	Caddisfly	Northern Caddisfly	*Anabolia ozburni*	X			
Aquatic Invertebrates	Caddisfly	Northern Case Maker	*Limnephilus perpusillus*	X			
Aquatic Invertebrates	Dragonfly	Boreal Whiteface	*Leucorrhinia borealis*	X			
Aquatic Invertebrates	Dragonfly	clubtails	*Stylurus spp.*[1]	X			
Aquatic Invertebrates	Dragonfly	Paiute Dancer	*Argia alberta*	X			
Aquatic Invertebrates	Dragonfly	spinylegs	*Dromogomphus spp.*[1]	X			
Aquatic Invertebrates	Gastropoda	sprites	*Promenetus spp.*[1]		X		
Aquatic Invertebrates	Hemiptera	Water Scorpion	*Nepa apiculata*	X			
Aquatic Invertebrates	Mayfly	a sand-dwelling mayfly	*Analetris eximia*	X			
Aquatic Invertebrates	Mayfly	small minnow mayflies	*Camelobaetidius spp.*[1]	X			
Aquatic Invertebrates	Mayfly	a small square-gilled mayfly	*Sparbarus lacustris*	X			
Aquatic Invertebrates	Mayfly	a small square-gilled mayfly	*Caenis youngi*	X			
Aquatic Invertebrates	Mayfly	a spiny-headed burrowing mayfly	*Pentagenia vittigera*	X			
Aquatic Invertebrates	Mayfly	Flat-headed Mayfly	*Stenacron minnetonka*	X			
Aquatic Invertebrates	Mayfly	White Sand-river Mayfly	*Pseudiron centralis*	X			

[1] Genus assemblage.

SPECIES OF GREATEST INFORMATION NEED (SGIN)							
Taxa	**Subtaxon or Group**	**Common Name**	**Scientific Name**	**d. Scientific knowledge deficient**	**e. Potentially stable in ND, declining in range**	**f. Potentially stable but life history trait vulnerability**	**g. Declining, ND significance uncertain**
Aquatic Invertebrates	Stonefly	Saskatoon Willowfly (winter stonefly)	*Oemopteryx fosketti*	X			

Boreal Whiteface

Sagebrush Lizard

Ord's Kangaroo Rat

Common Nighthawk

CHAPTER 4
HABITAT AND COMMUNITY TYPES

This chapter outlines how the following element was identified:

Element 2: descriptions of locations and relative condition of key habitats and community types essential to species of greatest conservation need.

OVERVIEW

North Dakota lies within the Great Plains temperate grassland biome. The natural landscape was predominantly tallgrass, mixed-grass and shortgrass prairies and abundant, diverse freshwater wetlands. Over the past 150+ years, the prairie landscape has changed dramatically. It is estimated that more than 70 percent of the native prairie and 60% of the wetlands have been converted to other land uses, primarily annual crops, but also to roads and development. Abundant tree shelterbelts were planted to help reduce erosion and protect farmsteads. Several large reservoirs were constructed including Lake Sakakawea, which altered the natural flooding cycle of the Missouri River, North Dakota's largest riparian system. Roads, urbanization, and energy development are steadily increasing and expanding across North Dakota. There is, however, great potential to protect, conserve, and enhance habitat. Figure 16 provides a breakdown of the major land classes present in North Dakota today.

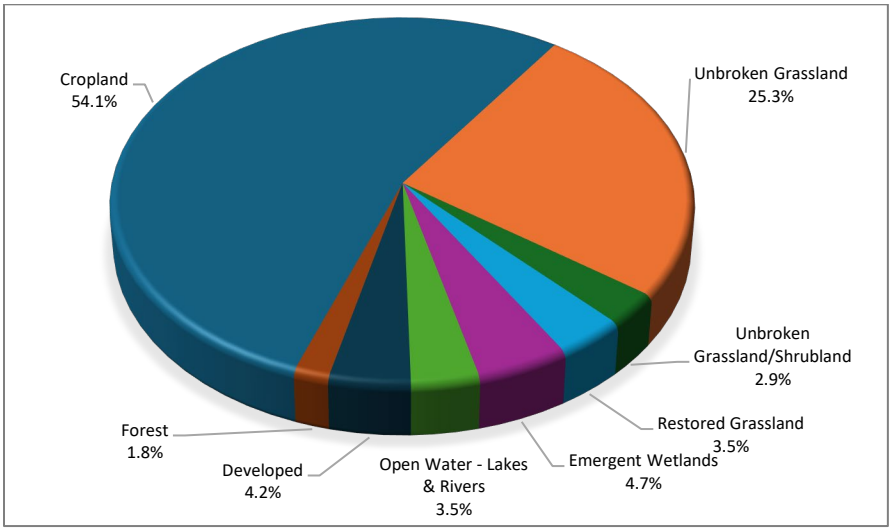


Figure 16. Percentage of North Dakota by land class.

Approximately 24.5 million acres of cropland (annually farmed land, includes alfalfa but excludes practices such as CRP), 11.47 million acres of unbroken grassland (native prairie), 1.3 million acres of unbroken grassland/shrubland (shrub-steppe, western ND primarily), 1.6 million acres of restored grassland, 2.15 million acres of emergent wetlands, 1.58 million acres of open water (lakes and rivers), 815 thousand acres of forest, and 1.89 million acres of developed (urban, transportation, industrial, etc.).

Many species require a variety of habitat types throughout their life cycle. To ensure their long-term survival, it's essential to maintain a diverse landscape, including grasslands, wetlands, forest, rivers, streams, and cropland. This approach goes beyond preserving a few small areas and calls for a broader, landscape-level perspective. Although cropland covers much of

North Dakota today, it was not historically part of the Great Plains' natural habitat. However, agriculture plays an important role in North Dakota's past, present, and future, providing benefits like nesting cover, migration stopovers, and winter food sources.

Adopting a habitat or landscape approach in conservation planning offers several benefits, including the ability to:

- **Link species of greatest conservation need** to key landscapes or habitats, sometimes within specific geographic areas or across multiple landscapes or ecoregions.
- **Assess the relative condition** of the landscape, providing insight into its current health and ecological status.
- **Highlight priority conservation issues** (direct threats) affecting the landscape, enabling targeted action.
- **Determine necessary conservation actions** and identify potential partners who are already involved in, or could contribute to, addressing these issues.
- **Identify research or survey needs** to gather information required to confirm conservation problems and necessary actions.
- **Provide data on ideal habitat and landscape characteristics** for specific areas, helping to define landscape goals to strive toward.
- **Understand the impact of management practices** on species within the area, as these practices can have varying effects depending on geographic context (see species accounts for more details).

This approach enhances the ability to address conservation needs at a broader, landscape level, ensuring that management actions are more effective and aligned with ecological realities.

Approximately 92 percent of North Dakota is privately owned, creating significant opportunities to collaborate with private landowners to conserve fish and wildlife resources. North Dakota farms and ranches are made up of cropland, rangeland, hayland, and other features like wetlands, wooded areas, and grassed waterways. The extent and quality of these elements will significantly impact the success of the SWAP and other conservation efforts aimed at preserving fish and wildlife species in the state. Many landowners have partnered with state, federal and conservation organizations to implement conservation practices.

Compared to other western states, North Dakota has limited public land. Of the state's 45.2 million acres, roughly 3.6 million acres are owned in fee title by state (just under 1 million acres) and federal (~2.66 million acres) land management agencies (Figure 17). Most public land is subject to multiple-use regulations, where fish and wildlife habitat is not the primary focus. However, many of these agencies collaborate with private producers to help manage the land. For instance, the Department leases certain wildlife management areas for grazing, haying, and food plots, while the U.S. Forest Service manages land for multiple purposes, including water, forage, wildlife, recreation, and industries like oil and gas. Although some public lands are vulnerable to conversion into cropland, much of it, such as the ND Department of Trust Lands, remains native vegetation. There is potential for working cooperatively with state and federal landholders to adjust management practices to benefit SGCNs and demonstrate the effectiveness of conservation tools to enhance wildlife habitat and populations.

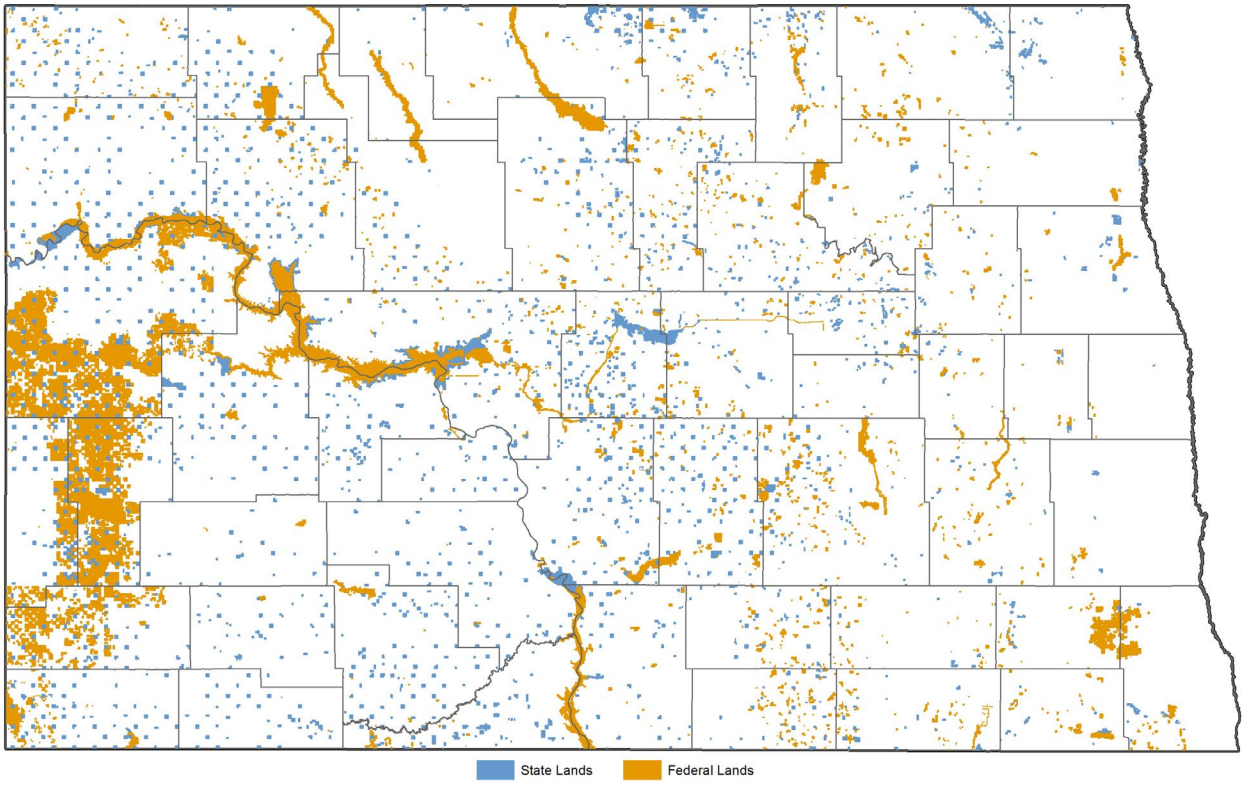


Figure 17. State and federal lands held in fee title.

ND Game and Fish Department Wildlife Management Area

U.S. Fish and Wildlife Service Waterfowl Production Area

SGCN and SGIN HABITAT ASSOCIATIONS

North Dakota is part of the Midwest Association of Fish and Wildlife Agencies (MAFWA). In 2021, MAFWA's Midwest Landscape Initiative spearheaded a project to identify Regional Species of Greatest Conservation Need (RSGCN). This initiative also established 20 habitats to align with the identified species. The tables below connect North Dakota's Species of Greatest Conservation Need (SGCN) and Species of Greatest Information Need (SGIN) to 10 of the 20 MAFWA habitats, plus badlands habitat. Each species was assigned up to four habitat associations.

Table 5. Species of Greatest Conservation Need (SGCN) habitat associations.

Taxon	Subtaxon or Group	Common Name	Scientific Name	Grasslands	Wetlands	Lakes and Reservoirs	Rivers and Streams	Big Rivers	Riparian	Forest	Badlands	Agriculture Cropland	Developed	Soil
Birds	Shorebird	American Avocet	*Recurvirostra americana*		X	X								
Birds	Waterbird	American Bittern	*Botaurus lentiginosus*	X	X	X								
Birds	Shorebird	American Golden-Plover	*Pluvialis dominica*	X	X							X		
Birds	Landbird	American Kestrel	*Falco sparverius*	X					X		X		X	
Birds	Landbird	Baird's Sparrow	*Centronyx bairdii*	X										
Birds	Waterbird	Black Tern	*Chlidonias niger*		X	X								
Birds	Landbird	Black-billed Cuckoo	*Coccyzus erythropthalmus*						X	X				
Birds	Landbird	Bobolink	*Dolichonyx oryzivorus*	X										
Birds	Landbird	Brewer's Sparrow	*Spizella breweri*	X										
Birds	Landbird	Brown Thrasher	*Toxostoma rufum*						X	X	X		X	
Birds	Shorebird	Buff-breasted Sandpiper	*Calidris subruficollis*	X	X							X		
Birds	Landbird	Burrowing Owl	*Athene cunicularia*	X							X			X
Birds	Waterfowl	Canvasback	*Aythya valisineria*		X	X								
Birds	Landbird	Chestnut-collared Longspur	*Calcarius ornatus*	X										
Birds	Shorebird	Dunlin	*Calidris alpina*		X	X								
Birds	Landbird	Ferruginous Hawk	*Buteo regalis*	X										
Birds	Waterbird	Franklin's Gull	*Leucophaeus pipixcan*		X	X						X		
Birds	Landbird	Golden Eagle	*Aquila chrysaetos*	X					X		X			
Birds	Landbird	Grasshopper Sparrow	*Ammodramus savannarum*	X							X			
Birds	Landbird	Greater Prairie-Chicken	*Tympanuchus cupido*	X										
Birds	Landbird	Greater Sage-Grouse	*Centrocercus urophasianus*	X										
Birds	Landbird	Harris's Sparrow	*Zonotrichia querula*						X	X			X	
Birds	Waterbird	Horned Grebe	*Podiceps auritus*		X	X								
Birds	Landbird	Horned Lark	*Eremophila alpestris*	X							X	X		
Birds	Shorebird	Hudsonian Godwit	*Limosa haemastica*		X	X								
Birds	Landbird	Lark Bunting	*Calamospiza melanocorys*	X							X			
Birds	Waterbird	Least Tern (Interior)	*Sternula antillarum*			X		X						
Birds	Landbird	LeConte's Sparrow	*Ammospiza leconteii*	X	X				X					
Birds	Waterfowl	Lesser Scaup	*Aythya affinis*	X	X	X								
Birds	Shorebird	Lesser Yellowlegs	*Tringa flavipes*		X	X	X							
Birds	Landbird	Loggerhead Shrike	*Lanius ludovicianus*	X					X		X		X	
Birds	Shorebird	Long-billed Curlew	*Numenius americanus*	X	X							X		
Birds	Shorebird	Long-billed Dowitcher	*Limnodromus scolopaceus*		X	X								
Birds	Shorebird	Marbled Godwit	*Limosa fedoa*	X	X	X								
Birds	Landbird	Nelson's Sparrow	*Ammospiza nelsoni*	X	X				X					

Taxon	Subtaxon or Group	Common Name	Scientific Name	Grasslands	Wetlands	Lakes and Reservoirs	Rivers and Streams	Big Rivers	Riparian	Forest	Badlands	Agriculture Cropland	Developed	Soil
Birds	Landbird	Northern Harrier	*Circus hudsonius*	X	X									
Birds	Waterfowl	Northern Pintail	*Anas acuta*	X	X							X		
Birds	Shorebird	Pectoral Sandpiper	*Calidris melanotos*		X	X								
Birds	Shorebird	Piping Plover	*Charadrius melodus*			X		X						
Birds	Landbird	Prairie Falcon	*Falco mexicanus*	X							X			
Birds	Landbird	Red-headed Woodpecker	*Melanerpes erythrocephalus*						X	X				
Birds	Shorebird	Ruddy Turnstone	*Arenaria interpres*		X	X								
Birds	Landbird	Ruffed Grouse	*Bonasa umbellus*							X				
Birds	Shorebird	Semipalmated Sandpiper	*Calidris pusilla*		X	X								
Birds	Landbird	Sharp-tailed Grouse	*Tympanuchus phasianellus*	X							X	X		
Birds	Shorebird	Short-billed Dowitcher	*Limnodromus griseus*		X	X								
Birds	Landbird	Short-eared Owl	*Asio flammeus*	X	X									
Birds	Landbird	Sprague's Pipit	*Anthus spragueii*	X										
Birds	Shorebird	Stilt Sandpiper	*Calidris himantopus*		X	X								
Birds	Landbird	Thick-billed Longspur	*Rhynchophanes mccownii*	X										
Birds	Shorebird	Upland Sandpiper	*Bartramia longicauda*	X										
Birds	Waterbird	Western Grebe	*Aechmophorus occidentalis*		X	X								
Birds	Landbird	Western Meadowlark	*Sturnella neglecta*	X							X	X		
Birds	Waterbird	Whooping Crane	*Grus americana*		X			X				X		
Birds	Shorebird	Willet	*Tringa semipalmata*	X	X	X								
Birds	Shorebird	Wilson's Phalarope	*Phalaropus tricolor*	X	X									
Birds	Waterbird	Yellow Rail	*Coturnicops noveboracensis*		X									
Mammals	Bat	Big Brown Bat	*Eptesicus fuscus*						X	X	X		X	
Mammals	Carnivore	Black-footed Ferret	*Mustela nigripes*	X							X			X
Mammals	Rodent	Black-tailed Prairie Dog	*Cynomys ludovicianus*	X							X			X
Mammals	Bat	Eastern Red Bat	*Lasiurus borealis*						X	X	X			
Mammals	Carnivore	Eastern Spotted Skunk	*Spilogale putorius*	X					X					
Mammals	Carnivore	Gray Fox	*Urocyon cinereoargenteus*	X					X					
Mammals	Bat	Hoary Bat	*Lasiurus cinereus*						X	X	X			
Mammals	Bat	Little Brown Bat	*Myotis lucifugus*						X	X	X		X	
Mammals	Bat	Northern Long-eared Bat	*Myotis septentrionalis*						X	X	X			
Mammals	Rodent	Richardson's Ground Squirrel	*Urocitellus richardsonii*	X										X
Mammals	Bat	Silver-haired Bat	*Lasionycteris noctivagans*						X	X	X			
Mammals	Carnivore	Swift Fox	*Vulpes velox*	X							X			X
Amphibians	Toad	American Toad	*Anaxyrus americanus*	X	X					X				X
Amphibians	Toad	Plains Spadefoot	*Spea bombifrons*	X										X
Reptiles	Lizard	Northern Prairie Skink	*Plestiodon septentrionalis*	X										
Reptiles	Snake	Plains Hog-nosed Snake	*Heterodon nasicus*	X										X
Reptiles	Snake	Smooth Green Snake	*Opheodrys vernalis*	X	X				X					
Reptiles	Turtle	Snapping Turtle	*Chelydra serpentina*		X	X	X						X	
Fishes	Minnow	Blacknose Shiner	*Notropis heterolepis*				X							
Fishes	Minnow	Blue Sucker	*Cycleptus elongatus*			X	X	X						
Fishes	Codfish	Burbot	*Lota lota*			X	X	X						
Fishes	Minnow	Carmine Shiner	*Notropis percobromus*				X							
Fishes	Minnow	Finescale Dace	*Chrosomus neogaeus*				X							
Fishes	Minnow	Flathead Chub	*Platygobio gracilis*			X	X	X						

Taxon	Subtaxon or Group	Common Name	Scientific Name	Grasslands	Wetlands	Lakes and Reservoirs	Rivers and Streams	Big Rivers	Riparian	Forest	Badlands	Agriculture Cropland	Developed	Soil
Fishes	Minnow	Hornyhead Chub	*Nocomis biguttatus*				X							
Fishes	Sturgeon	Lake Sturgeon	*Acipenser fulvescens*				X							
Fishes	Minnow	Northern Pearl Dace	*Margariscus nachtriebi*				X							
Fishes	Minnow	Northern Redbelly Dace	*Chrosomus eos*				X							
Fishes	Sturgeon	Paddlefish	*Polyodon spathula*			X		X						
Fishes	Sturgeon	Pallid Sturgeon	*Scaphirhynchus albus*			X		X						
Fishes	Minnow	Pugnose Shiner	*Notropis anogenus*				X							
Fishes	Minnow	Sicklefin Chub	*Macrhybopsis meeki*			X	X	X						
Fishes	Minnow	Sturgeon Chub	*Macrhybopsis gelida*			X	X	X						
Fishes	Minnow	Trout-perch	*Percopsis omiscomaycus*				X							
Terrestrial Invertebrates	Moth	Abbreviated Underwing	*Catocala abbreviatella*	X										
Terrestrial Invertebrates	Solitary Bee	Ainslie's Cuckoo Nomad Bee	*Epeolus ainsliei*	X										
Terrestrial Invertebrates	Bumble Bee	American Bumble Bee	*Bombus pensylvanicus*	X										
Terrestrial Invertebrates	Beetle	Badlands Tiger Beetle	*Cicindela decemnotata*								X			X
Terrestrial Invertebrates	Skipper	Broad-winged Skipper	*Poanes viator*		X				X					
Terrestrial Invertebrates	Skipper	Dakota Skipper	*Hesperia dacotae*	X										
Terrestrial Invertebrates	Skipper	Dion Skipper	*Euphyes dion*		X				X					
Terrestrial Invertebrates	Skipper	Edwards' Hairstreak	*Satyrium edwardsii*	X						X				
Terrestrial Invertebrates	Tiger Beetle	Ghost Tiger Beetle	*Cicindela lepida*			X	X	X	X					X
Terrestrial Invertebrates	Moth	Hera Sheepmoth	*Hemileuca hera*	X							X			
Terrestrial Invertebrates	Skipper	Hobomok Skipper	*Lon hobomok*	X			X		X	X			X	
Terrestrial Invertebrates	Bumble Bee	Indiscriminate Cuckoo Bumble Bee	*Bombus insularis*	X										
Terrestrial Invertebrates	Butterfly	Monarch Butterfly	*Danaus plexippus*	X	X				X				X	
Terrestrial Invertebrates	Butterfly	Mulberry Wing	*Poanes massasoit*	X	X				X					
Terrestrial Invertebrates	Tiger Beetle	Northern Sandy Tiger Beetle	*Cicindela limbata nympha*											X
Terrestrial Invertebrates	Skipper	Ottoe Skipper	*Hesperia ottoe*	X										
Terrestrial Invertebrates	Skipper	Poweshiek Skipperling	*Oarisma poweshiek*	X										
Terrestrial Invertebrates	Butterfly	Regal Fritillary	*Argynnis idalia*	X										
Terrestrial Invertebrates	Butterfly	Tawny Crescent	*Phyciodes batesii*	X					X	X				
Terrestrial Invertebrates	Bumble Bee	Western Bumble Bee	*Bombus occidentalis*	X									X	
Terrestrial Invertebrates	Moth	Whitney's Underwing	*Catocala whitneyi*	X										
Terrestrial Invertebrates	Bumble Bee	Yellow Bumble Bee	*Bombus fervidus*	X						X		X	X	
Terrestrial Invertebrates	Bumble Bee	Yellow-banded Bumble Bee	*Bombus terricola*	X	X				X	X			X	
Aquatic Invertebrates	Mayfly	a mayfly	*Raptoheptagenia cruentata*					X						
Aquatic Invertebrates	Mayfly	a mayfly	*Apobaetis lakota*				X							
Aquatic Invertebrates	Mayfly	a mayfly	*Cercobrachys cree*				X							
Aquatic Invertebrates	Mayfly	a mayfly	*Traverella lewisi*					X						
Aquatic Invertebrates	Mayfly	a sand-dwelling mayfly	*Lachlania saskatchewanensis*					X						
Aquatic Invertebrates	Freshwater Mussel	Black Sandshell	*Ligumia recta*				X							
Aquatic Invertebrates	Freshwater Mussel	Creek Heelsplitter	*Lasmigona compressa*				X							
Aquatic Invertebrates	Freshwater Mussel	Creeper	*Strophitus undulatus*				X							
Aquatic Invertebrates	Stonefly	Dakota Stonefly	*Perlesta dakota*				X							
Aquatic Invertebrates	Freshwater Mussel	Deertoe	*Truncilla truncata*				X							
Aquatic Invertebrates	Freshwater Mussel	Fragile Papershell	*Leptodea fragilis*				X							

Taxon	Subtaxon or Group	Common Name	Scientific Name	Grasslands	Wetlands	Lakes and Reservoirs	Rivers and Streams	Big Rivers	Riparian	Forest	Badlands	Agriculture Cropland	Developed	Soil
Aquatic Invertebrates	Freshwater Mussel	Mapleleaf	*Quadrula quadrula*				X							
Aquatic Invertebrates	Stonefly	Pawnee Stonefly	*Perlesta xube*				X							
Aquatic Invertebrates	Freshwater Mussel	Pink Heelsplitter	*Potamilus alatus*				X							
Aquatic Invertebrates	Freshwater Mussel	Pink Papershell	*Potamilus ohiensis*				X							
Aquatic Invertebrates	Dragonfly	Plains Emerald	*Somatochlora ensigera*				X							
Aquatic Invertebrates	Stonefly	Plains Stripetail	*Isoperla longiseta*				X							
Aquatic Invertebrates	Dragonfly	Subarctic Darner	*Aeshna subarctica*		X									
Aquatic Invertebrates	Freshwater Mussel	Threeridge	*Amblema plicata*				X							

Table 6. Species of Greatest Information Need (SGIN) habitat associations.

Taxon	Subtaxon or Group	Common Name	Scientific Name	Grasslands	Wetlands	Lakes and Reservoirs	Rivers and Streams	Big Rivers	Riparian	Forest	Badlands	Agriculture Cropland	Developed	Soil
Birds	Waterbird	American White Pelican	*Pelecanus erythrorhynchos*		X	X		X						
Birds	Landbird	Black-billed Magpie	*Pica hudsonia*	X					X	X	X			
Birds	Landbird	Chimney Swift	*Chaetura pelagica*										X	
Birds	Landbird	Common Nighthawk	*Chordeiles minor*	X					X		X		X	
Birds	Landbird	Eastern Screech-Owl	*Megascops asio*						X	X				
Birds	Landbird	Northern Flicker	*Colaptes auratus*						X	X			X	
Birds	Landbird	Peregrine Falcon	*Falco peregrinus*	X	X	X								
Birds	Shorebird	Red Knot (Rufa)	*Calidris canutus*			X		X						
Birds	Landbird	Smith's Longspur	*Calcarius pictus*	X										
Birds	Landbird	Snowy Owl	*Bubo scandiacus*	X	X							X		
Birds	Landbird	Western Kingbird	*Tyrannus verticalis*	X						X			X	
Mammals	Bat	Fringed Myotis	*Myotis thysanodes*	X					X	X	X			
Mammals	Bat	Long-eared Bat	*Myotis evotis*						X	X	X			
Mammals	Bat	Long-legged Bat	*Myotis volans*	X					X	X	X			
Mammals	Bat	Townsend's Big-eared bat	*Corynorhinus townsendii*						X	X	X			
Mammals	Bat	Western Small-footed Bat	*Myotis ciliolabrum*						X		X			
Mammals	Rodent	Franklin's Ground Squirrel	*Poliocitellus franklinii*	X										X
Mammals	Rodent	Hispid Pocket Mouse	*Chaetodipus hispidus*	X								X		X
Mammals	Rodent	Plains Pocket Mouse	*Perognathus flavescens*	X								X		X
Mammals	Rodent	Sagebrush Vole	*Lemmiscus curtatus*	X							X			
Mammals	Rodent	Ord's Kangaroo Rat	*Dipodomys ordii*	X								X		X
Mammals	Shrew	Arctic Shrew	*Sorex arcticus*	X	X				X					
Mammals	Shrew	Merriam's Shrew	*Sorex merriami*	X							X			X
Mammals	Shrew	Northern Water Shrew	*Sorex palustris*		X		X		X	X				
Mammals	Shrew	Pygmy Shrew	*Sorex minutus*	X	X					X				
Amphibians	Frog	Cope's Gray Treefrog	*Hyla chrysoscelis*	X	X		X		X					
Amphibians	Frog	Eastern Gray Treefrog	*Hyla versicolor*		X		X		X	X				

Taxon	Subtaxon or Group	Common Name	Scientific Name	Grasslands	Wetlands	Lakes and Reservoirs	Rivers and Streams	Big Rivers	Riparian	Forest	Badlands	Agriculture Cropland	Developed	Soil
Amphibians	Frog	Wood Frog	*Lithobates sylvaticus*		X				X	X				
Amphibians	Salamander	Common Mudpuppy	*Necturus maculosus*			X	X							
Reptiles	Lizard	Sagebrush Lizard	*Sceloporus graciosus*	X							X			
Reptiles	Lizard	Short-horned Lizard	*Phrynosoma hernandesi*	X							X			
Reptiles	Snake	Common Gartersnake	*Thamnophis sirtalis*	X	X								X	
Reptiles	Snake	Plains Gartersnake	*Thamnophis radix*	X	X								X	
Reptiles	Snake	Red-bellied Snake	*Storeria occipitomaculata*	X						X				
Reptiles	Turtle	False Map Turtle	*Graptemys pseudogeographica*				X	X						
Reptiles	Turtle	Smooth Softshell	*Apalone mutica*				X	X						
Reptiles	Turtle	Spiny Softshell	*Apalone spinifera*				X	X						
Fishes	Minnow	silvery minnows	*Hybognathus spp.*					X						
Fishes	Minnow	Largescale Stoneroller	*Campostoma oligolepis*					X						
Fishes	Minnow	Silver Chub	*Macrhybopsis storeriana*					X						
Terrestrial Invertebrates	Moth	a crambid snout moth	*Pyrausta pythialis*	X										
Terrestrial Invertebrates	Solitary Bee	a leaf-cutter bee	*Megachile dakotensis*	X										
Terrestrial Invertebrates	Solitary Bee	a mason bee	*Osmia illinoensis*	X										
Terrestrial Invertebrates	Solitary Bee	a nomia bee	*Nomia universitatis*	X										
Terrestrial Invertebrates	Jumping spider	Apache Jumping Spider	*Phidippus apacheanus*	X							X			
Terrestrial Invertebrates	Skipper	Arogos Skipper	*Atrytone arogos*	X										
Terrestrial Invertebrates	Bumble Bee	Ashton's Cuckoo Bumble Bee	*Bombus ashtoni*	X										
Terrestrial Invertebrates	Butterfly	Baird's Swallowtail	*Papilio machaon bairdii*	X							X			
Terrestrial Invertebrates	Bumble Bee	Black-and-gold Bumble Bee	*Bombus auricomus*	X										
Terrestrial Invertebrates	Skipper	Garita Skipperling	*Oarisma garita*	X						X				
Terrestrial Invertebrates	Butterfly	Gray Copper	*Tharsalea dione*	X	X				X					
Terrestrial Invertebrates	Tiger Beetle	Great Plains Tiger Beetle	*Amblycheila cylindriformis*	X										
Terrestrial Invertebrates	Butterfly	Greenish Blue	*Icaricia saepiolus*	X	X		X		X					
Terrestrial Invertebrates	Grasshopper	Greenish-white Grasshopper	*Hypochlora alba*	X										
Terrestrial Invertebrates	Moth	Juanita Sphinx Moth	*Proserpina juanita*	X						X	X		X	
Terrestrial Invertebrates	Butterfly	Large Marble	*Euchloe ausonides*	X			X		X					
Terrestrial Invertebrates	Moth	Leadplant Flower Moth	*Schinia lucens*	X										
Terrestrial Invertebrates	Skipper	Leonard's Skipper	*Hesperia leonardus*	X										
Terrestrial Invertebrates	Moth	Manitoba Oakworm Moth	*Anisota manitobensis*							X				
Terrestrial Invertebrates	Butterfly	Mead's Wood-Nymph	*Cercyonis meadii*							X				
Terrestrial Invertebrates	Butterfly	Mormon Metalmark	*Apodemia mormo*	X							X		X	
Terrestrial Invertebrates	Beetle	Nine-spotted Lady Beetle	*Coccinella novemnotata*	X						X		X	X	
Terrestrial Invertebrates	Solitary Bee	Nude Yellow Loosestrife Bee	*Macropis nuda*	X	X				X					
Terrestrial Invertebrates	Skipper	Pahaska Skipper	*Hesperia pahaska*	X						X				
Terrestrial Invertebrates	Butterfly	Persius Dusky Wing	*Erynnis persius*	X										
Terrestrial Invertebrates	Skipper	Plains Branded Skipper	*Hesperia assiniboia*	X										
Terrestrial Invertebrates	Butterfly	Purplish Copper	*Lycaena helloides*	X			X		X				X	
Terrestrial Invertebrates	Skipper	Rhesus Skipper	*Polites rhesus*	X										
Terrestrial Invertebrates	Butterfly	Ridings' Satyr	*Neominois ridingsii*	X										
Terrestrial Invertebrates	Bumble Bee	Rusty-patched Bumble Bee	*Bombus affinis*	X									X	
Terrestrial Invertebrates	Butterfly	Silvery Blue	*Glaucopsyche lygdamus*	X						X				
Terrestrial Invertebrates	Tiger Beetle	Splendid Tiger Beetle	*Cicindela splendida*											X

Taxon	Subtaxon or Group	Common Name	Scientific Name	Grasslands	Wetlands	Lakes and Reservoirs	Rivers and Streams	Big Rivers	Riparian	Forest	Badlands	Agriculture Cropland	Developed	Soil
Terrestrial Invertebrates	Skipper	Strecker's Giant-skipper	*Megathymus streckeri*	X							X			
Terrestrial Invertebrates	Bumble Bee	Suckley's Cuckoo Bumble Bee	*Bombus suckleyi*	X										
Terrestrial Invertebrates	Solitary Bee	Susanna's Cellophane Bee	*Colletes susannae*	X										
Terrestrial Invertebrates	Skipper	Uncas Skipper	*Hesperia uncas*	X						X	X			
Aquatic Invertebrates	Anostroca	Ornate Fairy Shrimp	*Eubranchipus ornatus*		X									
Aquatic Invertebrates	Caddisfly	a giant case maker	*Ptilostomis angustipennis*				X							
Aquatic Invertebrates	Caddisfly	Long-horned Caddisfly	*Oecetis ochracea*				X							
Aquatic Invertebrates	Caddisfly	long-horned case makers	*Ceraclea spp.*				X							
Aquatic Invertebrates	Caddisfly	Footed Micro Caddisfly	*Ochrotrichia tarsalis*				X							
Aquatic Invertebrates	Caddisfly	Net-spinning Caddisfly	*Hydropsyche piatrix*				X							
Aquatic Invertebrates	Caddisfly	Northern Caddisfly	*Anabolia ozburni*				X							
Aquatic Invertebrates	Caddisfly	Northern Case Maker	*Limnephilus perpusillus*				X							
Aquatic Invertebrates	Dragonfly	Boreal Whiteface	*Leucorrhinia borealis*		X									
Aquatic Invertebrates	Dragonfly	clubtails	*Stylurus spp.*				X							
Aquatic Invertebrates	Dragonfly	Paiute Dancer	*Argia alberta*		X									
Aquatic Invertebrates	Dragonfly	spinylegs	*Dromogomphus spp.*				X							
Aquatic Invertebrates	Gastropoda	sprites	*Promenetus spp.*		X									
Aquatic Invertebrates	Hemiptera	Water Scorpion	*Nepa apiculata*			X								
Aquatic Invertebrates	Mayfly	Flat-headed Mayfly	*Stenacron minnetonka*				X							
Aquatic Invertebrates	Mayfly	White Sand-river Mayfly	*Pseudiron centralis*					X						
Aquatic Invertebrates	Mayfly	a sand-dwelling mayfly	*Analetris eximia*				X							
Aquatic Invertebrates	Mayfly	small minnow mayflies	*Camelobaetidius spp.*				X							
Aquatic Invertebrates	Mayfly	a small square-gilled mayfly	*Sparbarus lacustris*				X							
Aquatic Invertebrates	Mayfly	a small square-gilled mayfly	*Caenis youngi*				X							
Aquatic Invertebrates	Mayfly	a spiny-headed burrowing mayfly	*Pentagenia vittigera*				X							
Aquatic Invertebrates	Stonefly	Saskatoon Willowfly (winter stonefly)	*Oemopteryx fosketti*				X							

GRASSLANDS

Prairie or grasslands are often classified as tallgrass, mixed-grass, and shortgrass. However, there is a broad spectrum, or combinations of grassland vegetation found across the state. Grasslands are a dynamic ecosystem, with vegetation composition, height, density and ground cover varying greatly from year to year depending on climate conditions and land use. Regardless of the visual quality or the level of invasion of nonnative or noxious species, curbing grassland destruction and fragmentation is essential to sustaining 62 SGCN and 53 SGIN grassland dependent species.

Grasslands may be native prairie or planted grassland, including pastures and rangeland, and all are frequently used for grazing livestock. The SWAP may refer to native prairie or unbroken grassland interchangeably. Definitions and attributes of unbroken grassland and restored grassland are as follows:

1) Unbroken Grassland – also referred to as "native prairie," (Figure 19). This is grassland that, according to best available spatial information, has not been converted to another land type or land cover (e.g. cropland, developed, roads). Other attributes:

- May be composed of native and/or non-native grasses and forbs.
- May be heavily invaded with nonnative species such as Kentucky bluegrass or smooth brome, but it is still considered unbroken/native prairie if there is no cultivation history.
- May be grazed or otherwise "disturbed" with animals, hayed, or burned. Managed grazing, haying and burning can be very beneficial to grasses and forbs.
- May be fenced, contain structures (e.g. old homesteads, water tanks, overhead lines), or two-track roads (i.e. with grass between the tire ruts).
- May contain patches of shrubs (e.g. buffaloberry, chokecherry, silverberry bush) or woody draws.
- May contain natural wetlands or created (e.g. stock dams).
- May be any size or configuration.

2) Restored Grassland – planted or reconstructed grassland (Figure 20). This typically occurs on previously cultivated land (broken prairie that was then used for crop production for several years). The most common type of restored grassland is federal Conservation Reserve Program (CRP), but other natural resource agencies operate grassland restoration programs. Other attributes:

- May be planted with native or non-native grass and/or forb species.
- May be grazed or otherwise "disturbed" with animals, hayed, or burned.
- May contain tree rows.
- May contain natural wetlands or created (e.g. stock dams).
- Enrolled land in restoration programs may remain in a grassland state after the contract has expired.

Tallgrass Prairie (Red River Valley)

The tallgrass prairie once predominantly covered the eastern quarter of North Dakota. The Red River of the North marks the boundary between North Dakota and Minnesota, and today, this area is commonly known as the Red River Valley. Around 10,000 years ago, the region was submerged under a vast glacial lake called Lake Agassiz. The flat terrain and fertile soil left behind by Lake Agassiz make the area ideal for intensive agriculture, producing crops like potatoes, beans, sugar beets, corn, and wheat. By the 20th century, much of the tallgrass prairie had been transformed into farmland, leaving only small patches of native vegetation. Some of these remnants of natural areas are connected to Lake Agassiz's ancient landscape. Diagonal ridges of sand and gravel formed along the shoreline of the lake, which are still visible today through aerial and satellite imagery. These beach ridges are part of the focus area known as Sand Deltas and Beach Ridges, which also includes large fan-shaped sand deltas deposited by the lake. Highly saline areas, where high salt concentrations make farming unsuitable, have remained largely intact. The largest such area lies just west of Grand Forks and is known as the Saline Area

or the Grand Forks County Prairie. Compared to the mixed-grass prairie further west, the Red River Valley has fewer wetlands. The landscape is dominated by farmland with woodlot and shelterbelt plantings, although advancements in farming practices have resulted in the removal of many shelterbelts. Several streams, vital to native fish populations, flow across the Red River Valley from west to east and eventually drain into the Red River.

Eastern Mixed-Grass Prairie (Drift Prairie)

The Eastern mixed-grass prairie, also known as the Drift Prairie, serves as a transition zone between the wetter tallgrass prairie to the east and the drier shortgrass prairie to the west. Before settlement, the Drift Prairie had a high concentration of temporary and seasonal wetlands. Wetlands embedded in cropland are often farmed during dry years. Prominent geographic features within this region include the Pembina Hills, Turtle Mountains, and Devils Lake hills, which are included in the forest landscape. A significant area of untilled land, largely due to sandy, gravelly soil from a glacial lake delta, is found in and around McHenry County and south of the Turtle Mountains. Known as the Glacial Lake Deltas focus area, this region retains much of its native vegetation and wetlands. In recent years, irrigation has enabled previously unsuitable areas to be farmed, with crops such as potatoes now growing in these areas. The Souris River riparian zone divides the Glacial Lake Deltas. Another important focus area is the Devils Lake Basin, formed by glacial ice blockage. This area is characterized by a high concentration of larger wetlands or lakes and slightly less grassland than the Glacial Lake Deltas. It is a critical habitat for migrating waterfowl, waterbirds, and shorebirds. The Drift Prairie is relatively flat and has largely been converted to cropland, producing spring wheat, durum, other small grains, canola, corn, beans, sunflowers, and alfalfa. The Sheyenne and James rivers also wind through this region.

Mixed-Grass Prairie (Missouri Coteau)

The Missouri Coteau forms the western edge of glaciation in North Dakota, characterized by its distinctive hummocky, rolling hills that rise 150 to 500 feet above the Drift Prairie. The region is rich in wetlands, with approximately 800,000 basin acres, and alkaline lakes are more common here. Streams and rivers are scarce but intermittent streams occur in low areas. The northern part of the Coteau contains tracts of aspen parkland, though upland deciduous forests are largely absent. A significant portion of native prairie still exists in this region, and livestock grazing is common. Areas with gentler slopes, particularly along the western edge, have been converted to cropland, producing small grains, sunflowers, corn, and alfalfa hay. The Missouri Coteau is renowned for supporting some of the highest densities of breeding ducks in North America. The large amount of remaining or restored grassland and wetlands makes this area critical for numerous species of wildlife, and designation as the focus area Missouri Coteau.

Western Mixed-Grass/Short-grass Prairie (Missouri Slope)

The Western mixed-grass prairie and short-grass prairie is semiarid, unglaciated with level to rolling plains and occasional sandstone buttes or badlands formations. Natural wetland basins are limited, but small creeks and streams are plentiful. Some consider the Missouri River System/Breaks either part of or a boundary between the Missouri Coteau and Missouri Slope, but herein it's included in the Rivers, Streams and Riparian landscape. Shrub-steppe, an open landscape of sagebrush and perennial grasses, is found in the western one-third of the state, in and around the Badlands. Big sagebrush is found only in the extreme southwest corner of the state, within the Sagebrush Steppe focus area. Land use is primarily dryland farming of crops like spring and winter wheat, barley, sunflowers, and corn, and cattle production. A substantial amount of native vegetation remains in the Missouri Slope.

Restored Grassland (Statewide)

Restored grassland is former cropland that has been converted back to grassland by replanting with tame or native grasses and forbs. One of the leading programs for restoring grasslands is the Conservation Reserve Program (CRP). Established in the 1985 Farm Bill, this program allowed producers to conserve marginal soils by retiring cropland for contracts of typically

10-15 years. The program provides income for producers and creates valuable wildlife habitat while conserving soil and water. In 2007, there were 3.38 million acres enrolled in CRP in North Dakota. In 2022, this had declined 63% to 1.24 million acres. There are, however, many other grassland restoration initiatives that have been established by various state, federal, and conservation organizations. Restored grasslands are also common on public lands throughout the state, including NDGF wildlife management areas and USFWS waterfowl production areas and refuges.

Grassland Classification Relationships

1) The Midwest Landscape Initiative developed *Voluntary Lexicon and Best Practice Recommendations for Midwest State Wildlife Action Plans* (May 2024). In line with recommendation 2.1, the following Macrogroup and Group classifications from the United States National Vegetation Classification System (USNVC) pertain to grassland habitat in North Dakota.

Macrogroup: M054 Central Lowlands Tallgrass Prairie https://www1.usgs.gov/csas/nvcs/unitDetails/860688
- Group: G075 Northern Tallgrass Prairie https://www1.usgs.gov/csas/nvcs/unitDetails/849293

Macrogroup: M051 Great Plains Mixedgrass & Fescue Prairie https://www1.usgs.gov/csas/nvcs/unitDetails/860481
- Group: G141 Northern Great Plains Mesic Mixedgrass Prairie https://www1.usgs.gov/csas/nvcs/unitDetails/856963
- Group: G331 Northern Great Plains Dry Mixedgrass Prairie https://www1.usgs.gov/csas/nvcs/unitDetails/856981
- Group 332: Northern Great Plains Rough Fescue Prairie https://www1.usgs.gov/csas/nvcs/unitDetails/856995

Macrogroup: M052 Great Plains Sand Grassland & Shrubland https://www1.usgs.gov/csas/nvcs/unitDetails/860480
- Group: G889 Northern Great Plains Sand Grassland https://www1.usgs.gov/csas/nvcs/unitDetails/1127110

2) Major Land Resource Areas (MLRA, Figure 18) form the basis for organizing and operating conservation programs, particularly USDA Natural Resources Conservation Service (NRCS) programs. NRCS Ecological Sites are defined by MLRAs and provide a consistent framework for classifying and describing rangeland and forestland soils and vegetation; thereby delineating land units that share similar capabilities to respond to management activities or disturbance. Below are the grassland habitat types that correspond to the MLRAs.

Grassland Region	MLRA
Tallgrass Prairie (Red River Valley)	56 Glacial Lake Agassiz
Eastern Mixed-grass Prairie (Drift Prairie)	53A Northern Dark Brown Glaciated Plains 55A Northern Black Glaciated Plains 55B Central Black Glaciated Plains 102A Rolling Till Prairie
Mixed-grass Prairie (Missouri Coteau)	53B Central Dark Brown Glaciated Plains
Western Mixed-Grass/Short-grass Prairie (Missouri Slope)	54 Rolling Soft Shale Plain 58D Northern Rolling Hills Plains, Eastern Part 60B Pierre Shale Plains, Northern Part 63A Northern Rolling Pierre Shale Plains

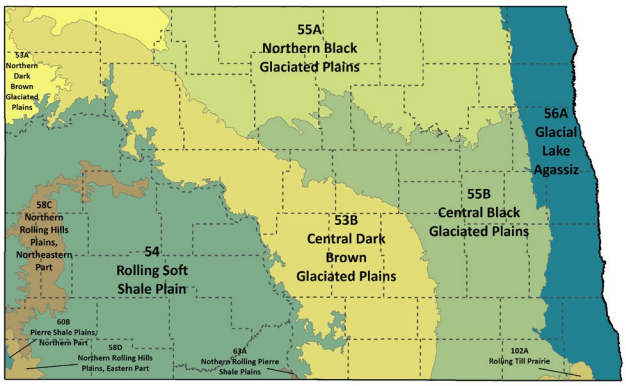


Figure 18. Major Land Resource Areas.

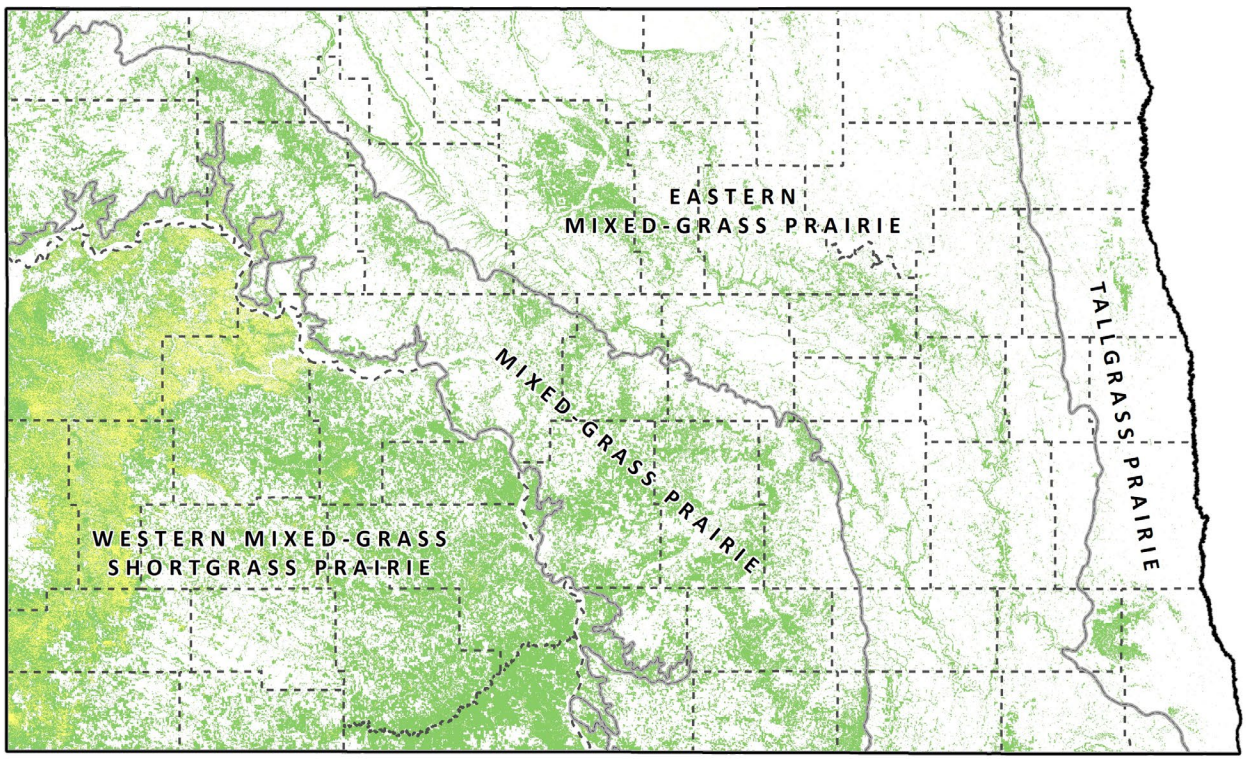


Figure 19. Estimated current extent of unbroken grassland (green) and unbroken grassland/shrubland (yellow).

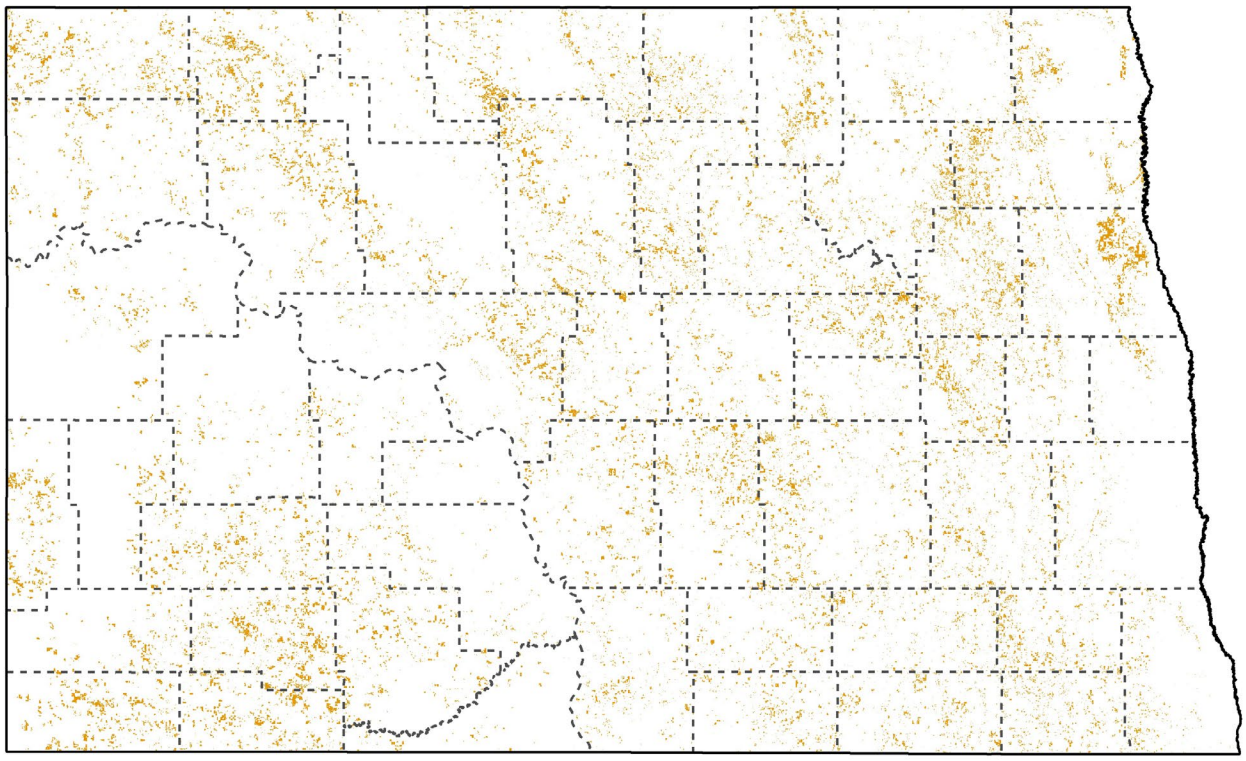


Figure 20. Estimated current extent of intact restored grassland (orange).

Table 7. Grassland dependent SGCN. Total = 62 species: 33 birds, 6 mammals, 2 amphibians, 3 reptiles, and 18 terrestrial invertebrates.

Grassland SGCN – Species of Greatest Conservation Need				
BIRDS		MAMMALS	REPTILES & AMPHIBIANS	TERRESTRIAL INVERTEBRATES
American Bittern	Lesser Scaup	Black-footed Ferret	American Toad	Abbreviated Underwing
American Golden-Plover	Loggerhead Shrike	Black-tailed Prairie Dog	Northern Prairie Skink	Ainslie's Cuckoo Nomad Bee
American Kestrel	Long-billed Curlew	Eastern Spotted Skunk	Plains Hog-nosed Snake	American Bumble Bee
Baird's Sparrow	Marbled Godwit	Gray Fox	Plains Spadefoot	Dakota Skipper
Bobolink	Nelson’s Sparrow	Richardson's Ground Squirrel	Smooth Green Snake	Edwards' Hairstreak
Brewer's Sparrow	Northern Harrier	Swift Fox		Hera Sheepmoth
Buff-breasted Sandpiper	Northern Pintail			Hobomok Skipper
Burrowing Owl	Prairie Falcon			Indiscriminate Cuckoo Bumble Bee
Chestnut-collared Longspur	Sharp-tailed Grouse			Monarch Butterfly
Ferruginous Hawk	Short-eared Owl			Mulberry Wing
Golden Eagle	Sprague's Pipit			Ottoe Skipper
Grasshopper Sparrow	Thick-billed Longspur			Poweshiek Skipperling
Greater Prairie-Chicken	Upland Sandpiper			Regal Fritillary
Greater Sage-Grouse	Western Meadowlark			Tawny Crescent
Horned Lark	Willet			Western Bumble Bee
Lark Bunting	Wilson’s Phalarope			Whitney's Underwing
LeConte's Sparrow				Yellow Bumble Bee
				Yellow-banded Bumble Bee

Tallgrass Prairie – Sheyenne National Grasslands

Shortgrass Prairie – Big Sagebrush

Table 8. Grassland dependent SGIN. Total = 55 species: 6 birds, 10 mammals, 1 amphibian, 5 reptiles, and 33 terrestrial invertebrates.

Grassland SGIN – Species of Greatest Information Need				
BIRDS	MAMMALS	REPTILES & AMPHIBIANS	TERRESTRIAL INVERTEBRATES	
Black-billed Magpie	Arctic Shrew	Common Gartersnake	a crambid snout moth (*Pyrausta pythialis*)	Leonard's Skipper
Common Nighthawk	Franklin's Ground Squirrel	Cope's Gray Treefrog	a leaf-cutter bee (*Megachile dakotensis*)	Mormon Metalmark
Peregrine Falcon	Fringed Myotis	Plains Gartersnake	a mason bee (*Osmia illinoensis*)	Nine-spotted Lady Beetle
Smith's Longspur	Hispid Pocket Mouse	Red-bellied Snake	a nomia bee (*Nomia universitatis*)	Nude Yellow Loosestrife Bee
Snowy Owl	Long-legged Bat	Sagebrush Lizard	Apache Jumping Spider	Pahaska Skipper
Western Kingbird	Merriam's Shrew	Short-horned Lizard	Arogos Skipper	Persius Dusky Wing
	Ord's Kangaroo Rat		Ashton's Cuckoo Bumble Bee	Plains Branded Skipper
	Plains Pocket Mouse		Baird's Swallowtail	Purplish Copper
	Pygmy Shrew		Black-and-gold Bumble Bee	Rhesus Skipper
	Sagebrush Vole		Garita Skipperling	Ridings' Satyr
			Gray Copper	Rusty-patched Bumble Bee
			Great Plains Tiger Beetle	Silvery Blue
			Greenish Blue	Strecker's Giant-skipper
			Greenish-white Grasshopper	Suckley's Cuckoo Bumble Bee
			Juanita Sphinx Moth	Susanna's Cellophane Bee
			Large Marble	Uncas Skipper
			Leadplant Flower Moth	

Mixed-grass Prairie – Missouri Coteau

Mixed-grass Prairie

Short-grass Prairie

Restored Grassland

WETLANDS

A wetland is an area that is inundated or saturated by surface or groundwater long enough to support vegetation typically adapted for life in saturated soil. Wetlands are classified depending on how long water and vegetation are present. These range from temporary wetlands that typically hold water for only a few weeks, to permanent wetlands that hold water year-round. North Dakota has about 2.4 million acres of wetlands remaining from an estimated 5 million acres that once existed (Figure 21). The highest wetland densities are in the Missouri Coteau and Drift Prairie, collectively known as the Prairie Potholes region. Some areas contain more than 150 wetlands per square mile. However, the destruction and alteration of wetlands, particularly shallow temporary basins, is widespread due to draining, filling, burning, farming, and other practices. From 1997 to 2009, over 50,000 basins were lost, representing a 3.3% overall decrease. Wetlands within cropland may lack emergent vegetation, while those in pasture or rangeland often suffer from overuse and degradation due to cattle. Wetlands are highly dynamic, influenced by weather cycles, and may experience periods of drought or flooding. Conservation efforts for many SGCNs and other wetland-associated wildlife depend on maintaining a mosaic of wetlands and grasslands. While no specific focus areas for conservation have been identified, nearly all wetlands are crucial for water filtration, surface water storage, and providing essential wildlife habitat.

Wetland Classification Relationships

1) The Midwest Landscape Initiative developed *Voluntary Lexicon and Best Practice Recommendations for Midwest State Wildlife Action Plans* (May 2024). In line with recommendation 2.1, the following Macrogroup and Group classifications from the United States National Vegetation Classification System (USNVC) pertain to wetland habitat in North Dakota.

Macrogroup: M069 Eastern North American Marsh, Wet Meadow & Shrubland https://www1.usgs.gov/csas/nvcs/unitDetails/860627
- Group: G125 Eastern North American Freshwater Marsh https://www1.usgs.gov/csas/nvcs/unitDetails/837180
- Group: G770 Midwest Wet Prairie, Wet Meadow & Shrub Swamp https://www1.usgs.gov/csas/nvcs/unitDetails/894450

Macrogroup: M071 Great Plains Marsh, Wet Meadow, Shrubland & Playa https://www1.usgs.gov/csas/nvcs/unitDetails/860542
- Group: G35 Great Plains Freshwater Marsh https://www1.usgs.gov/csas/nvcs/unitDetails/857034
- Group: G336 Great Plains Wet Prairie, Wet Meadow & Seepage Fen https://www1.usgs.gov/csas/nvcs/unitDetails/857050
- Group: G337 Great Plains Riparian Wet Meadow & Shrubland https://www1.usgs.gov/csas/nvcs/unitDetails/857066

Macrogroup: M077 Great Plains Saline Wet Meadow & Marsh https://www1.usgs.gov/csas/nvcs/unitDetails/860569
- Group: G324 Great Plains Saline Wet Meadow & Marsh https://www1.usgs.gov/csas/nvcs/unitDetails/848823
- Group: G534 Western Great Plains Saline Wet Meadow https://www1.usgs.gov/csas/nvcs/unitDetails/860851

Macrogroup: M877 North American Boreal & Subboreal Alkaline Fen https://www1.usgs.gov/csas/nvcs/unitDetails/907538
- Group: G183 Midwest Prairie Alkaline Fen https://www1.usgs.gov/csas/nvcs/unitDetails/835830

2) Wetland Types

Permanent - surface water is present throughout the year in all years.

Permanent Wood-bordered - deep surface water is present year-round, and the wetland periphery is predominantly woodland.

Semipermanent - surface water is present year-round in most years. During dry years, however, water may disappear as early as midsummer.

Seasonal - surface water is present for extended periods in spring and early summer but usually disappears during late summer and fall.

Temporary - surface water present for a brief period during early spring following snowmelt and occasionally for several days following heavy rainstorms during the late spring, summer, and fall.

Alkali - highly saline shallow water and alkali salt flats.

Working Wetlands (cropped wetlands) - occur in basins with soils that are frequently cultivated.

Fens - surface water is sometimes lacking but bottom soils saturated by alkaline ground-water seepage.

Slope Wetlands - occur primarily in southwest North Dakota.

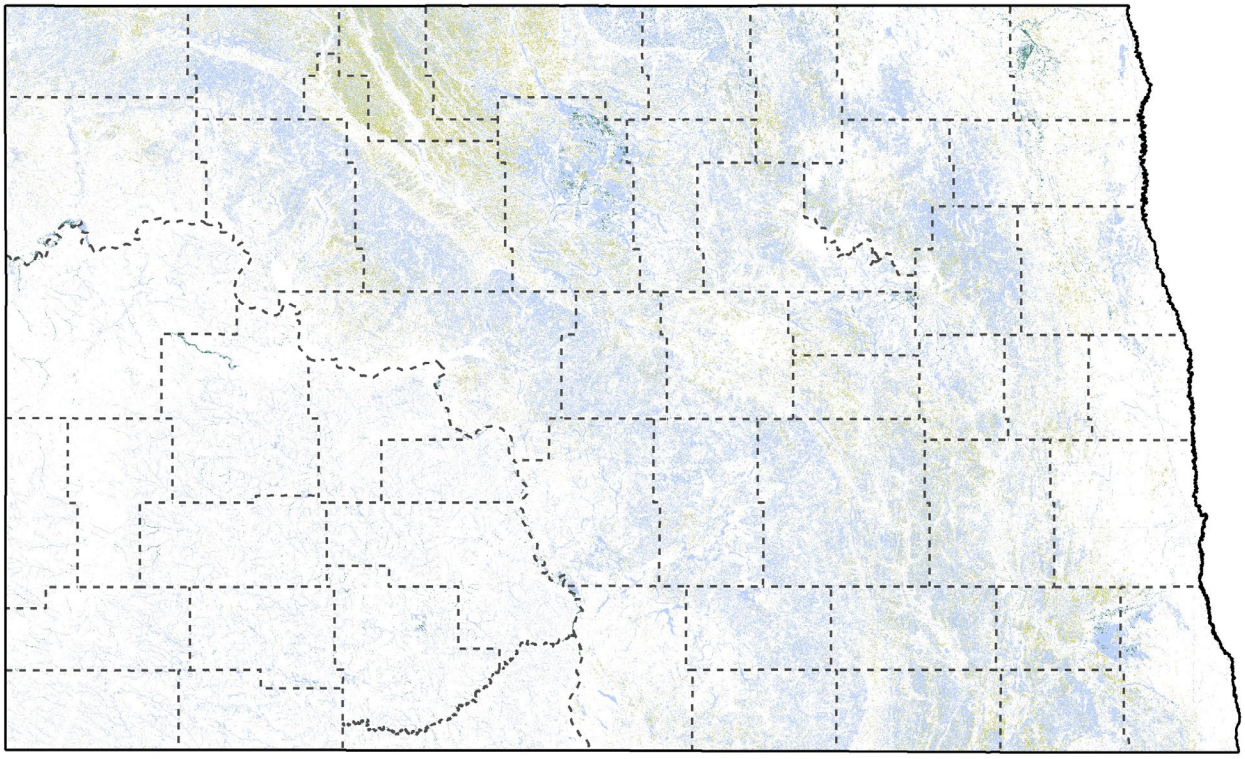


Figure 21. Estimated current extent of emergent wetlands (blue), forested wetlands (dark green), and working or cropped wetlands (tan).

Emergent wetland

Emergent wetland

Working or cropped wetland

Restored wetlands

Table 9. Wetland dependent SGCN. Total = 39 species: 30 birds, 1 amphibian, 2 reptiles, 5 terrestrial invertebrates, and 1 aquatic invertebrate.

Wetland SGCN – Species of Greatest Conservation Need				
BIRDS		REPTILES & AMPHIBIANS	TERRESTRIAL INVERTEBRATES	AQUATIC INVERTEBRATES
American Avocet	Marbled Godwit	American Toad	Broad-winged Skipper	Subarctic Darner
American Bittern	Nelson's Sparrow	Smooth Green Snake	Dion Skipper	
American Golden-Plover	Northern Harrier	Snapping Turtle	Monarch Butterfly	
Black Tern	Northern Pintail		Mulberry Wing	
Buff-breasted Sandpiper	Pectoral Sandpiper		Yellow-banded Bumble Bee	
Canvasback	Ruddy Turnstone			
Dunlin	Semipalmated Sandpiper			
Franklin's Gull	Short-billed Dowitcher			
Horned Grebe	Short-eared Owl			
Hudsonian Godwit	Stilt Sandpiper			
LeConte's Sparrow	Western Grebe			
Lesser Scaup	Whooping Crane			
Lesser Yellowlegs	Willet			
Long-billed Curlew	Wilson's Phalarope			
Long-billed Dowitcher	Yellow Rail			

Table 10. Wetland dependent SGIN. Total = 18 species: 3 birds, 3 mammals, 3 amphibians, 2 reptiles, 3 terrestrial invertebrates, and 4 aquatic invertebrates.

Wetland SGIN – Species of Greatest Information Need				
BIRDS	MAMMALS	REPTILES & AMPHIBIANS	TERRESTRIAL INVERTEBRATES	AQUATIC INVERTEBRATES
American White Pelican	Arctic Shrew	Common Gartersnake	Gray Copper	Boreal Whiteface
Peregrine Falcon	Northern Water Shrew	Cope's Gray Treefrog	Greenish Blue	Ornate Fairy Shrimp
Snowy Owl	Pygmy Shrew	Eastern Gray Treefrog	Nude Yellow Loosestrife Bee	Paiute Dancer
		Plains Gartersnake		sprites (*Promenetus spp*.)
		Wood Frog		

LAKES AND RESERVOIRS

Lakes differ from wetlands due to their shape and size. According to the US Environmental Protection Agency (USEPA), a lake is defined as a standing body of water greater than 2.5 acres and has a depth of at least 3 feet for inclusion into the National Lakes Assessment. In North Dakota, 337 public lakes and reservoirs are recognized by the North Dakota Department of Environmental Quality (NDDEQ 2023). Of those 337 lakes, 151 are man-made reservoirs and 186 are natural lakes. The Department currently manages over 400 fishing waters for public access and some degree of management by regional biologists. Reservoirs, on the other hand, are typically created by damming waterbodies to fulfill a management objective such as flood control or recreation (Figure 22).

Lakes and reservoirs exhibit a wide range of sizes, shapes and depths driven by local climate, precipitation, land-use, geology, and groundwater inputs. Lakes typically contain three major habitat types: littoral (near-shore), pelagic (open-water) and benthic (lake bottom). Most lakes and reservoirs support warmwater fish species composition such as walleye, bass, and bluegill. However, Lake Sakakawea contains a significant cold water habitat due to its size and depth, capable of supporting a viable salmon management program and fishery. Other notable lakes throughout the state include Devils Lake, Lake Oahe, and several productive prairie walleye fisheries, such as Lake Alkaline. Lakes in North Dakota are particularly vulnerable to non-point source pollution, largely due to the extensive agricultural activity in the state.

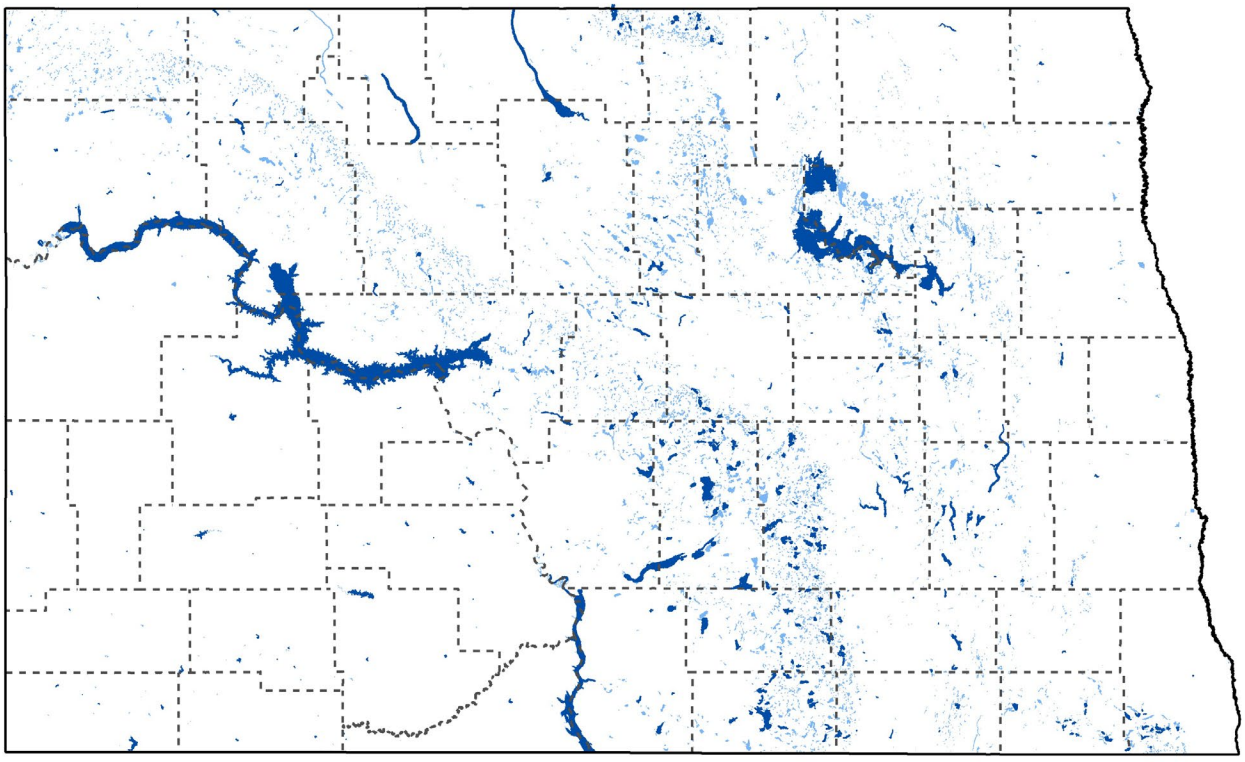


Figure 22. Lakes and reservoirs. Darker blue indicates fishing waters for public access.

Table 11. Lake and reservoir dependent SGCN. Total = 30 species: 21 birds, 1 reptile, 1 terrestrial invertebrate, and 7 fish.

Lake and Reservoir SGCN – Species of Greatest Conservation Need				
BIRDS		REPTILE	TERRESTRIAL INVERTEBRATES	FISHES
American Avocet	Long-billed Dowitcher	Snapping Turtle	Ghost Tiger Beetle	Burbot
American Bittern	Marbled Godwit			Blue Sucker
Black Tern	Pectoral Sandpiper			Flathead Chub
Canvasback	Piping Plover			Sicklefin Chub
Dunlin	Ruddy Turnstone			Sturgeon Chub
Franklin's Gull	Semipalmated Sandpiper			Paddlefish
Horned Grebe	Short-billed Dowitcher			Pallid Sturgeon
Hudsonian Godwit	Stilt Sandpiper			
Least Tern (Interior)	Western Grebe			
Lesser Scaup	Willet			
Lesser Yellowlegs				

Table 12. Lake and reservoir dependent SGIN. Total = 5 species: 3 birds, 1 amphibian, and 1 aquatic invertebrate.

Lake and Reservoir SGIN – Species of Greatest Information Need		
BIRDS	AMPHIBIAN	AQUATIC INVERTEBRATES
American White Pelican	Common Mudpuppy	Water Scorpion
Peregrine Falcon		
Red Knot (Rufa)		

Devils Lake

Chase Lake NWR colonial waterbird nesting island

RIVERS, STREAMS AND RIPARIAN

This landscape component includes all rivers, streams, and their associated riparian areas spread across North Dakota (Figure 23). Rivers and streams are linear, flowing bodies of water that often feature alternating slower pools and faster-moving riffles and runs. These habitats can differ significantly in size, shape, flow speed, gradient, turbidity, nutrient levels, substrate composition, and more. Seasonal changes impact flow, with spring typically being the wettest time of year, and some smaller streams may even dry up completely during the summer, making them ephemeral.

"Big Rivers," operate quite differently from smaller river habitats, supporting distinct faunal communities not typically found in smaller bodies of water. These rivers are more influenced by regional rainfall and runoff than by local conditions. Their flow is generally swift and steady year-round, with fewer seasonal variations compared to smaller rivers and streams. Due to their faster currents, big rivers tend to be more turbid, as sediments remain suspended in the water longer. This also causes frequent shifts in the channel bottom as sand, gravel, and silt are continually moved and redeposited. In the Midwest, the Missouri and Mississippi Rivers are classified as Big Rivers, while other river habitats are categorized as rivers and streams.

A riparian zone is the area between a body of water and the adjacent upland, characterized by unique soil conditions and vegetation that requires abundant water. This zone includes wetlands and portions of the floodplain that support riparian plant life. Typically, it consists of trees, shrubs, and understory vegetation such as various grasses and forbs, though some areas may naturally lack trees. In eastern North Dakota, riparian zones are dominated by green ash and elm trees, while cottonwoods are more common in the western part of the state. Though riparian zones cover a relatively small area, they are crucial habitats for numerous wildlife species and play a vital role in maintaining stream health.

River floodplains and riparian habitats form narrow corridors of unique ecosystems. Overgrazing by cattle in some regions has degraded riparian habitats, contributing to reduced water quality, including impairments from fecal coliform bacteria and Escherichia coli. Development, particularly increased housing along the Missouri River, has disturbed some wildlife species and destroyed riparian habitats. Additionally, many small low-head dams have obstructed fish movement. While larger dams, such as the Garrison Dam, have brought numerous benefits, they have also disrupted natural processes like cottonwood regeneration and fish migration. According to North Dakota's 2020-2022 Integrated Water Quality Report (NDDEQ 2023), 39% of rivers and streams are classified as fully supporting but threatened for aquatic life use, 29% are fully supporting aquatic life, and 32% are not supporting aquatic life use. Non-point source pollution, such as siltation/sedimentation and stream habitat loss, is a leading cause of aquatic life impairment. Dissolved oxygen depletion, caused by organic enrichment, and nuisance algae and plant growth due to excessive nutrient loading are also significant concerns.

Rivers, Streams and Riparian Classification Relationships

1) The Midwest Landscape Initiative developed *Voluntary Lexicon and Best Practice Recommendations for Midwest State Wildlife Action Plans* (May 2024). In line with recommendation 2.1, the following Macrogroup and Group classifications from the United States National Vegetation Classification System (USNVC) pertain to rivers, streams and riparian habitat in North Dakota.

Macrogroup: M029 Central Hardwood Floodplain Forest https://www1.usgs.gov/csas/nvcs/unitDetails/838650
- Group: G652 Midwest Floodplain Forest https://www1.usgs.gov/csas/nvcs/unitDetails/877317

Macrogroup: M028 Great Plains Flooded & Swamp Forest https://www1.usgs.gov/csas/nvcs/unitDetails/860485
- Group: G147 Great Plains Cottonwood – Green Ash Floodplain Forest https://www1.usgs.gov/csas/nvcs/unitDetails/856756

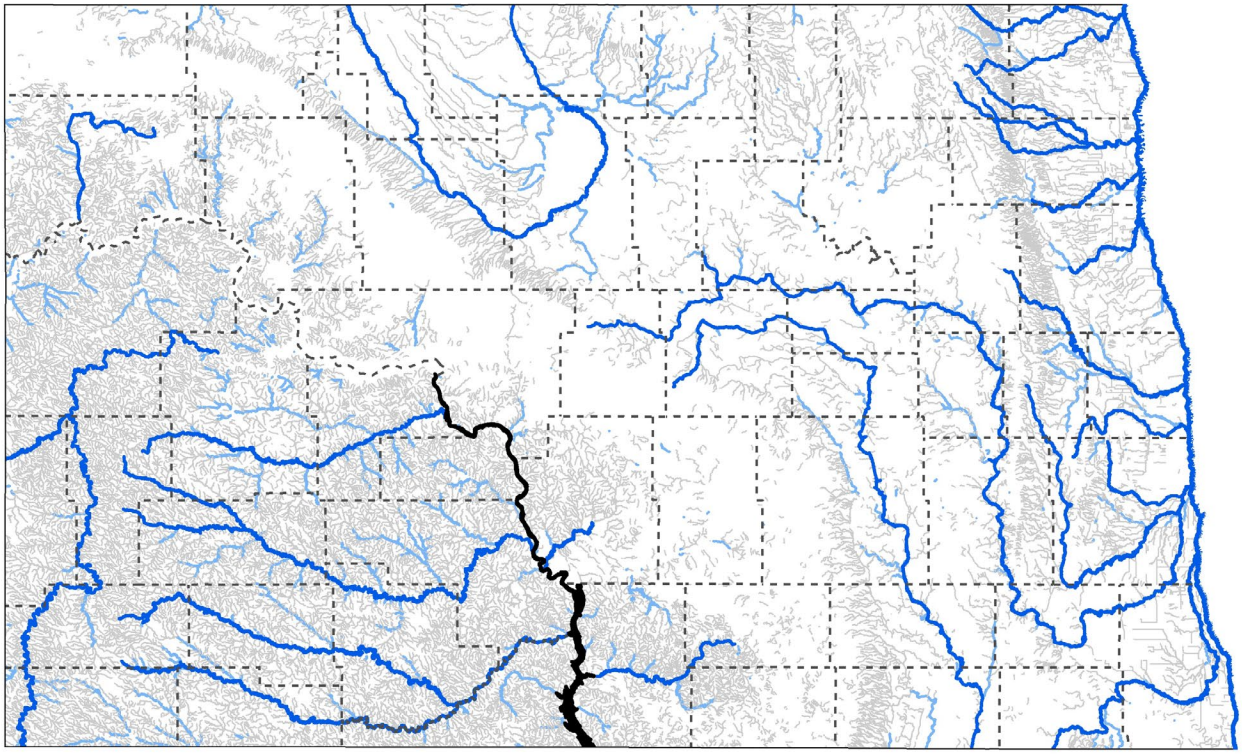


Figure 23. Intermittent streams (gray), perennial rivers (light blue; thicker and darker blue line indicate focus areas), and big rivers (black, Missouri River and Lake Oahe).

Sheyenne River

Little Missouri River

Missouri River/Lake Oahe – Big River

Red River - Drayton Dam modification

Table 13. River and stream dependent SGCN. Total = 34 species: 1 bird, 1 reptile, 2 terrestrial invertebrates, 16 aquatic invertebrates, and 14 fishes.

River and Stream SGCN – Species of Greatest Conservation Need						
BIRDS	REPTILE	TERRESTRIAL INVERTEBRATES	AQUATIC INVERTEBRATES		FISHES	
Lesser Yellowlegs	Snapping Turtle	Ghost Tiger Beetle	a mayfly (*Apobaetis lakota*)	Mapleleaf	Burbot	Northern Pearl Dace
		Hobomok Skipper	a mayfly (*Cercobrachys cree*)	Pawnee Stonefly	Blacknose Shiner	Northern Redbelly Dace
			Black Sandshell	Pink Heelsplitter	Blue Sucker	Pugnose Shiner
			Creek Heelsplitter	Pink Papershell	Carmine Shiner	Sicklefin Chub
			Creeper	Plains Emerald	Finescale Dace	Sturgeon Chub
			Dakota Stonefly	Plains Stripetail	Flathead Chub	Trout-perch
			Deertoe	Threeridge	Hornyhead Chub	Lake Sturgeon
			Fragile Papershell	Wabash Pigtoe		

Table 14. River and stream dependent SGIN. Total = 29 species: 3 amphibians, 3 reptiles, 1 mammal, 3 terrestrial invertebrates, 16 aquatic invertebrates, and 3 fishes.

River and Stream SGIN – Species of Greatest Information Need					
REPTILES & AMPHIBIANS	MAMMAL	TERRESTRIAL INVERTEBRATES	AQUATIC INVERTEBRATES		FISHES
Common Mudpuppy	Northern Water Shrew	Greenish Blue	a giant case maker (*Ptilostomis angustipennis*)	Long-horned Caddisfly	Largescale Stoneroller
Cope's Gray Treefrog		Large Marble	a sand-dwelling mayfly (*Analetris eximia*)	long-horned case makers (*Ceraclea* spp.)	Silver Chub
Eastern Gray Treefrog		Purplish Copper	a small square-gilled mayfly (*Caenis youngi*)	Net-spinning Caddisfly	silvery minnows (*Hybognathus* spp.)
False Map Turtle			a small square-gilled mayfly (*Sparbarus lacustris*)	Northern Caddisfly	
Smooth Softshell			a spiny-headed burrowing mayfly (*Pentagenia vittigera*)	Northern Case Maker	
Spiny Softshell			clubtails (*Stylurus* spp.)	Saskatoon Willowfly (winter stonefly)	
			Flat-headed Mayfly	small minnow mayflies (*Camelobaetidius* spp.)	
			Footed Micro Caddisfly	spinylegs (*Dromogomphus* spp.)	

Table 15. Big river (Missouri River and Lake Oahe) dependent SGCN. Total = 14 species: 3 birds, 1 terrestrial invertebrate, 3 aquatic invertebrates, and 7 fishes.

Big River SGCN – Species of Greatest Conservation Need				
BIRDS	TERRESTRIAL INVERTEBRATE	AQUATIC INVERTEBRATES	FISHES	
Least Tern (Interior)	Ghost Tiger Beetle	a mayfly (*Raptoheptagenia cruentata)*	Burbot	Sturgeon Chub
Piping Plover		a mayfly *(Traverella lewisi)*	Blue Sucker	Paddlefish
Whooping Crane		a sand-dwelling mayfly *(Lachlania saskatchewanensis)*	Flathead Chub	Pallid Sturgeon
			Sicklefin Chub	

Table 16. Big river (Missouri River and Lake Oahe) dependent SGIN. Total = 6 species: 1 bird, 3 reptiles, 1 aquatic invertebrate.

Big River SGIN – Species of Greatest Information Need		
BIRDS	REPTILES	AQUATIC INVERTEBRATE
American White Pelican	False Map Turtle	White Sand-river Mayfly
Red Knot (Rufa)	Smooth Softshell	
	Spiny Softshell	

Table 17. Riparian dependent SGCN. Total = 26 species: 9 birds, 8 mammals, 1 reptile, 8 terrestrial invertebrates.

Riparian SGCN – Species of Greatest Conservation Need			
BIRDS	MAMMALS	REPTILE	TERRESTRIAL INVERTEBRATES
American Kestrel	Big Brown Bat	Smooth Green Snake	Broad-winged Skipper
Black-billed Cuckoo	Eastern Red Bat		Dion Skipper
Brown Thrasher	Eastern Spotted Skunk		Ghost Tiger Beetle
Golden Eagle	Gray Fox		Hobomok Skipper
Harris's Sparrow	Hoary Bat		Monarch Butterfly
LeConte's Sparrow	Little Brown Bat		Mulberry Wing
Loggerhead Shrike	Northern Long-eared Bat		Tawney Crescent
Nelson’s Sparrow	Silver-haired Bat		Yellow-banded Bumble Bee
Red-headed Woodpecker			

Table 18. Riparian dependent SGIN. Total = 19 species: 4 birds, 7 mammals, 3 amphibians, 5 terrestrial invertebrates.

Riparian SGIN – Species of Greatest Information Need			
BIRDS	MAMMALS	AMPHIBIANS	TERRESTRIAL INVERTEBRATES
Black-billed Magpie	Arctic Shrew	Cope's Gray Treefrog	Gray Copper
Common Nighthawk	Fringed Myotis	Eastern Gray Treefrog	Greenish Blue
Eastern Screech-Owl	Long-eared Bat	Wood Frog	Large Marble
Northern Flicker	Long-legged Bat		Nude Yellow Loosestrife Bee
	Northern Water Shrew		Purplish Copper
	Townsend's Big-eared bat		
	Western Small-footed Bat		

FORESTS

This landscape component includes larger tracts of native upland deciduous forest scattered throughout North Dakota, as well as unique stands of natural coniferous forest (Figure 24). Less than 2% of the state is forested, which includes deciduous and coniferous forests, wooded shrubland, and riparian forests. Approximately 72% of the state's forestland is deciduous forest. Larger tracts of deciduous forest, designated as Focus Areas, include the Pembina Gorge, Turtle Mountains, Devils Lake Hills, and Killdeer Mountains. The Ponderosa Pines is a key coniferous forest Focus Area. Smaller, scattered deciduous forest tracts are found along the bluffs of the Sheyenne River and on the north- and east-facing slopes of the Badlands (woody draws). These natural upland forests are a rare and unique community in North Dakota. Most forested areas in the state are privately owned and primarily used for cattle grazing. While over-harvesting for wood products does not appear to be a major issue, the lack of forest regeneration in some areas is a concern. Additionally, clearing of trees for farming or other development continues to impact these forested areas.

Forest Classification Relationships

1) The Midwest Landscape Initiative developed *Voluntary Lexicon and Best Practice Recommendations for Midwest State Wildlife Action Plans* (May 2024). In line with recommendation 2.1, the following Macrogroup and Group classifications from the United States National Vegetation Classification System (USNVC) pertain to forest habitat in North Dakota.

Macrogroup: M012 Central Midwest Oak Forest, Woodland & Savanna https://www1.usgs.gov/csas/nvcs/unitDetails/838459
- Group: G181 Central Midwest Oak Openings & Barrens https://www1.usgs.gov/csas/nvcs/unitDetails/837682

Macrogroup: M501 Central Rocky Mountain Dry Lower Montane-Foothill Forest https://www1.usgs.gov/csas/nvcs/unitDetails/877291
- Group: G209 Rocky Mountain Foothill-Rock Outcrop Limber Pine – Juniper Woodland https://www1.usgs.gov/csas/nvcs/unitDetails/836637
- Group: G213 Central Rocky Mountain Ponderosa Pine Open Woodland https://www1.usgs.gov/csas/nvcs/unitDetails/836566
- Group: G216 Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland https://www1.usgs.gov/csas/nvcs/unitDetails/836663

Macrogroup: M151 Great Plains Forest & Woodland https://www1.usgs.gov/csas/nvcs/unitDetails/860458
- Group: G324 Great Plains Mesic Forest & Woodland https://www1.usgs.gov/csas/nvcs/unitDetails/856641
- Group: G146 Northeastern Great Plains Aspen Woodland https://www1.usgs.gov/csas/nvcs/unitDetails/849192
- Group: G328 Northwestern Great Plains Aspen Woodland https://www1.usgs.gov/csas/nvcs/unitDetails/849198
- Group: G329 Great Plains Bur Oak Forest & Woodland https://www1.usgs.gov/csas/nvcs/unitDetails/849207

Macrogroup: M029 Central Hardwood Floodplain Forest https://www1.usgs.gov/csas/nvcs/unitDetails/838650
- Group: G652 Midwest Floodplain Forest https://www1.usgs.gov/csas/nvcs/unitDetails/877317

Macrogroup: M028 Great Plains Flooded & Swamp Forest https://www1.usgs.gov/csas/nvcs/unitDetails/860485
- Group: G147 Great Plains Cottonwood – Green Ash Floodplain Forest https://www1.usgs.gov/csas/nvcs/unitDetails/856756

Pembina Gorge

Woody draws

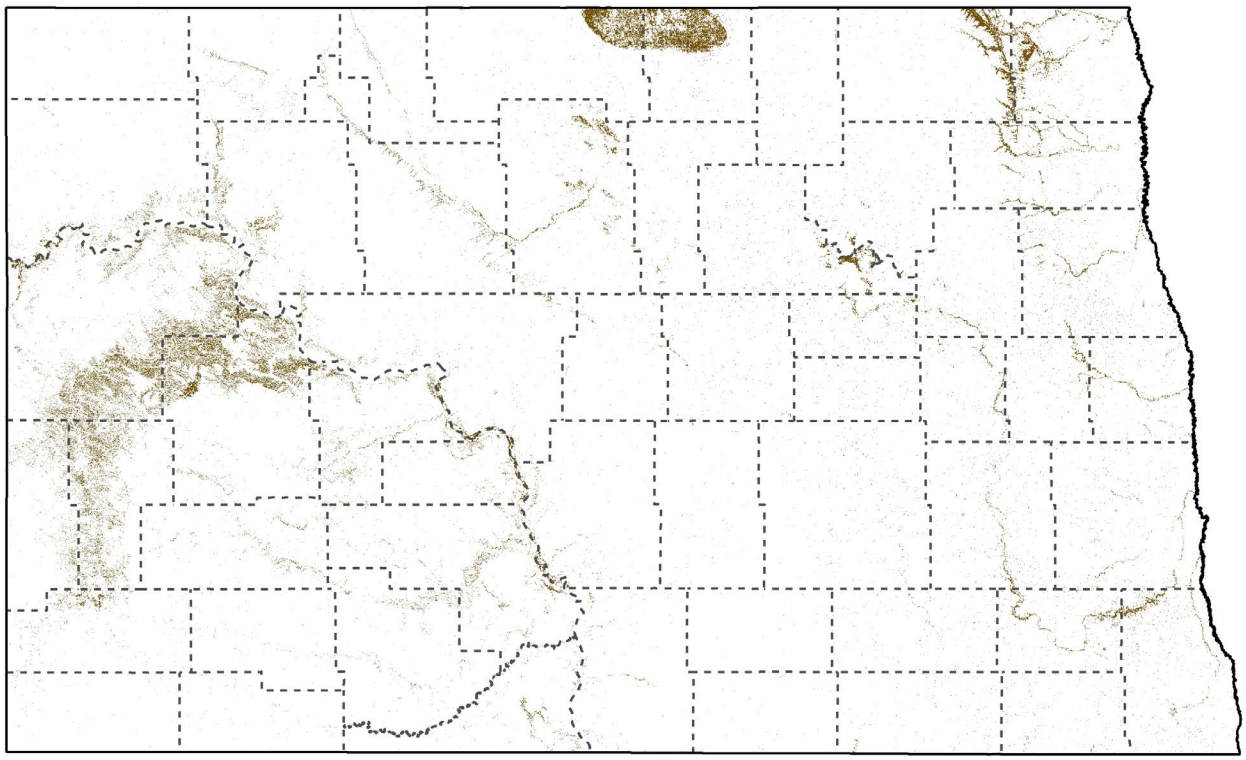


Figure 24. Forest (dark brown).

Table 19. Forest dependent SGCN. Total = 17 species: 5 birds, 6 mammals, 1 amphibian, 5 terrestrial invertebrates.

Forest SGCN – Species of Greatest Conservation Need			
BIRDS	MAMMALS	AMPHIBIAN	TERRESTRIAL INVERTEBRATES
Black-billed Cuckoo	Big Brown Bat	American Toad	Edwards' Hairstreak
Brown Thrasher	Eastern Red Bat		Hobomok Skipper
Harris's Sparrow	Hoary Bat		Tawny Crescent
Red-headed Woodpecker	Little Brown Bat		Yellow Bumble Bee
Ruffed Grouse	Northern Long-eared Bat		Yellow-banded Bumble Bee
	Silver-haired Bat		

Table 20. Forest dependent SGIN. Total = 21 species: 4 birds, 6 mammals, 1 reptile, 2 amphibians, 8 terrestrial invertebrates.

Forest SGIN - Species of Greatest Information Need				
BIRDS	MAMMALS	REPTILES & AMPHIBIANS	TERRESTRIAL INVERTEBRATES	
Black-billed Magpie	Fringed Myotis	Eastern Gray Treefrog	Garita Skipperling	Nine-spotted Lady Beetle
Eastern Screech-Owl	Long-eared Bat	Red-bellied Snake	Juanita Sphinx Moth	Pahaska Skipper
Northern Flicker	Long-legged Bat	Wood Frog	Manitoba Oakworm Moth	Silvery Blue
Western Kingbird	Northern Water Shrew		Mead's Wood-Nymph	Uncas Skipper
	Pygmy Shrew			
	Townsend's Big-eared bat			

BADLANDS

This landscape encompasses the area associated with the Little Missouri River drainage, commonly known as the Badlands (Figure 25). This highly dissected terrain was shaped by water erosion of soft silt or clay soils and the collapse following lignite coal bed fires. Badly eroded clay-scoria slopes, buttes, and steep canyons are prevalent throughout the region. Thickets of small trees and shrubs, or woody draws of cottonwood and green ash, naturally occur on north- or east-facing escarpments. Bare hills, scattered with Rocky Mountain juniper, and shortgrass prairie dominate the bottomlands and tops of buttes. A few small, unique stands of native coniferous forest are found, specifically in Billings, Golden Valley, Slope, and Bowman counties. The absence of fire has allowed juniper to expand and encroach upon some areas. Ephemeral or intermittent streams are common in steep valleys, while natural wetlands are rare; however, water impoundments are abundant. Cattle grazing is the most prevalent land use, but the area is a popular destination for outdoor recreation such as hunting, hiking and biking. Oil and gas development has occurred in this region since the 1950s but has intensified since around 2009. The Killdeer Mountains and Ponderosa Pines Focus Areas lie within the Badlands' exterior boundaries but are categorized under Upland Forest.

The Badlands has abundant caves or crevices, or naturally occurring cavities formed underground or in the face of a cliff or hillside. In North Dakota, caves are usually not large enough for a human to enter. However, they may be very important hibernacula and overwintering areas for bats.

Badlands Classification Relationships

1) The Midwest Landscape Initiative developed *Voluntary Lexicon and Best Practice Recommendations for Midwest State Wildlife Action Plans* (May 2024). In line with recommendation 2.1, the following Macrogroup and Group classifications from the United States National Vegetation Classification System (USNVC) pertain to Badlands habitat in North Dakota.

Macrogroup: M501 Central Rocky Mountain Dry Lower Montane-Foothill Forest https://www1.usgs.gov/csas/nvcs/unitDetails/877291
- Group: G209 Rocky Mountain Foothill-Rock Outcrop Limber Pine – Juniper Woodland https://www1.usgs.gov/csas/nvcs/unitDetails/836637
- Group: G213 Central Rocky Mountain Ponderosa Pine Open Woodland https://www1.usgs.gov/csas/nvcs/unitDetails/836566
- Group: G216 Black Hills-Northwestern Great Plains Ponderosa Pine Forest & Woodland https://www1.usgs.gov/csas/nvcs/unitDetails/836663

Macrogroup: M052 Great Plains Sand Grassland & Shrubland https://www1.usgs.gov/csas/nvcs/unitDetails/860480
- Group: G889 Northern Great Plains Sand Grassland https://www1.usgs.gov/csas/nvcs/unitDetails/1127110

Macrogroup: M115 Great Plains Badlands Vegetation https://www1.usgs.gov/csas/nvcs/unitDetails/860626
- Group: G566 Great Plains Badlands Vegetation https://www1.usgs.gov/csas/nvcs/unitDetails/857182

Macrogroup: M116 Great Plains Cliff, Scree & Rock Vegetation https://www1.usgs.gov/csas/nvcs/unitDetails/860694
- Group: G567 Great Plains Cliff, Scree & Rock Vegetation https://www1.usgs.gov/csas/nvcs/unitDetails/857191

Badlands topography.

Badlands cattle crazing and woody draws.

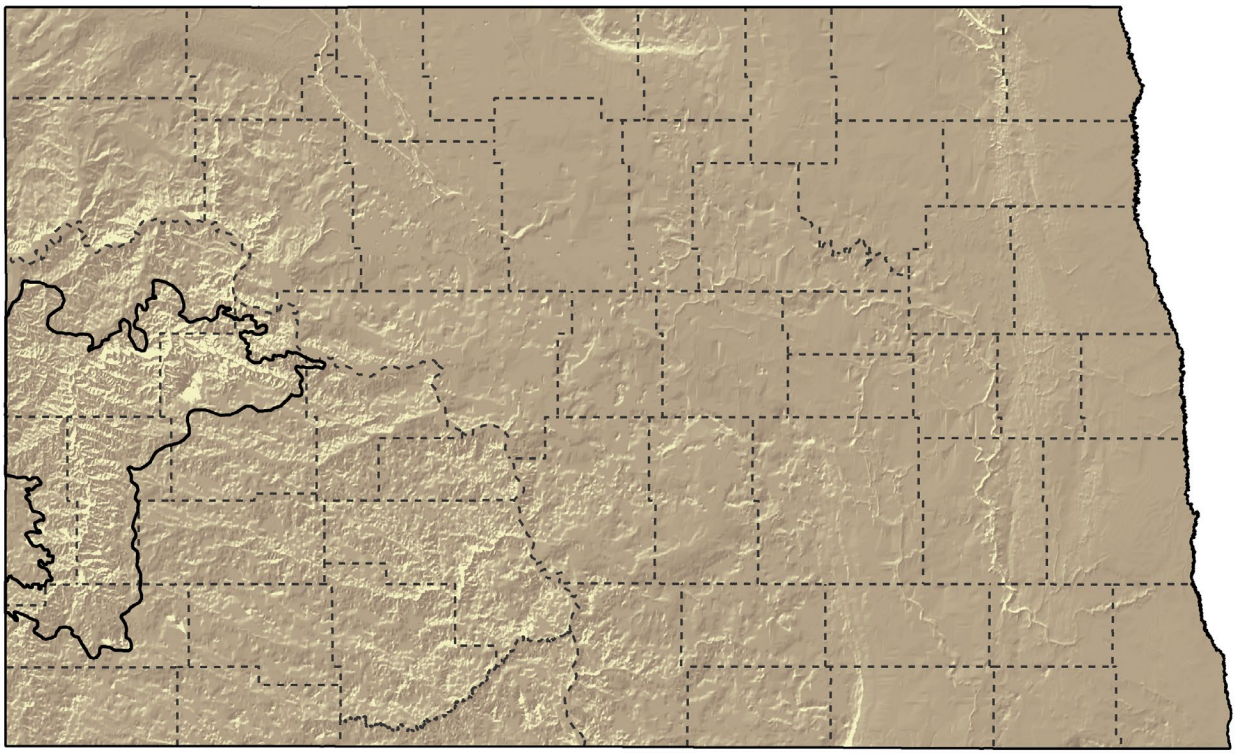


Figure 25. The badlands region (black outline) and shaded relief.

Table 21. Badlands use by SGCN. Total = 22 species: 11 birds, 9 mammals, 2 terrestrial invertebrates.
An asterisk (*) indicates species that utilize caves and crevices.

Badlands SGCN – Species of Greatest Conservation Need				
BIRDS		MAMMALS		TERRESTRIAL INVERTEBRATES
American Kestrel	Lark Bunting	Big Brown Bat*	Little Brown Bat*	Badlands Tiger Beetle
Brown Thrasher	Loggerhead Shrike	Black-footed Ferret	Northern Long-eared Bat	Hera Sheepmoth
Burrowing Owl	Prairie Falcon	Black-tailed Prairie Dog	Silver-haired Bat	
Golden Eagle	Sharp-tailed Grouse	Eastern Red Bat	Swift Fox	
Grasshopper Sparrow	Western Meadowlark	Hoary Bat		
Horned Lark				

Table 22. Badlands use by SGIN. Total = 17 species: 2 birds, 7 mammals, 2 reptiles, 6 terrestrial invertebrates.
An asterisk (*) indicates species that utilize caves and crevices.

Badlands SGIN – Species of Greatest Information Need				
BIRDS	MAMMALS		REPTILES	TERRESTRIAL INVERTEBRATES
Black-billed Magpie	Fringed Myotis*	Sagebrush Vole	Sagebrush Lizard	Apache Jumping Spider
Common Nighthawk	Long-eared Bat*	Townsend's Big-eared bat*	Short-horned Lizard	Baird's Swallowtail
	Long-legged Bat*	Western Small-footed Bat*		Juanita Sphinx Moth
	Merriam's Shrew			Mormon Metalmark
				Strecker's Giant-skipper
				Uncas Skipper

OTHER

Agriculture Cropland

North Dakota is home to over 25,000 farms, with more than 38 million acres classified as farmland. Of this, over 26 million acres are dedicated to cropland, which includes hayland and perennial grass cover (2022 Census of Agriculture). This habitat category focuses on cultivated agriculture cropland areas used for the annual production of adapted crops for harvest, including grains and row crops (Figure 26). The state leads the nation in producing soybeans, wheat, canola, and dry edible beans. However, much of the land now used for crops was established at the expense of losing grassland, wetlands, or other natural habitats. Cropland provides certain advantages for wildlife by providing food, cover, and potential nesting sites. Additionally, many farms participate in conservation programs and adopt practices that benefit local wildlife.

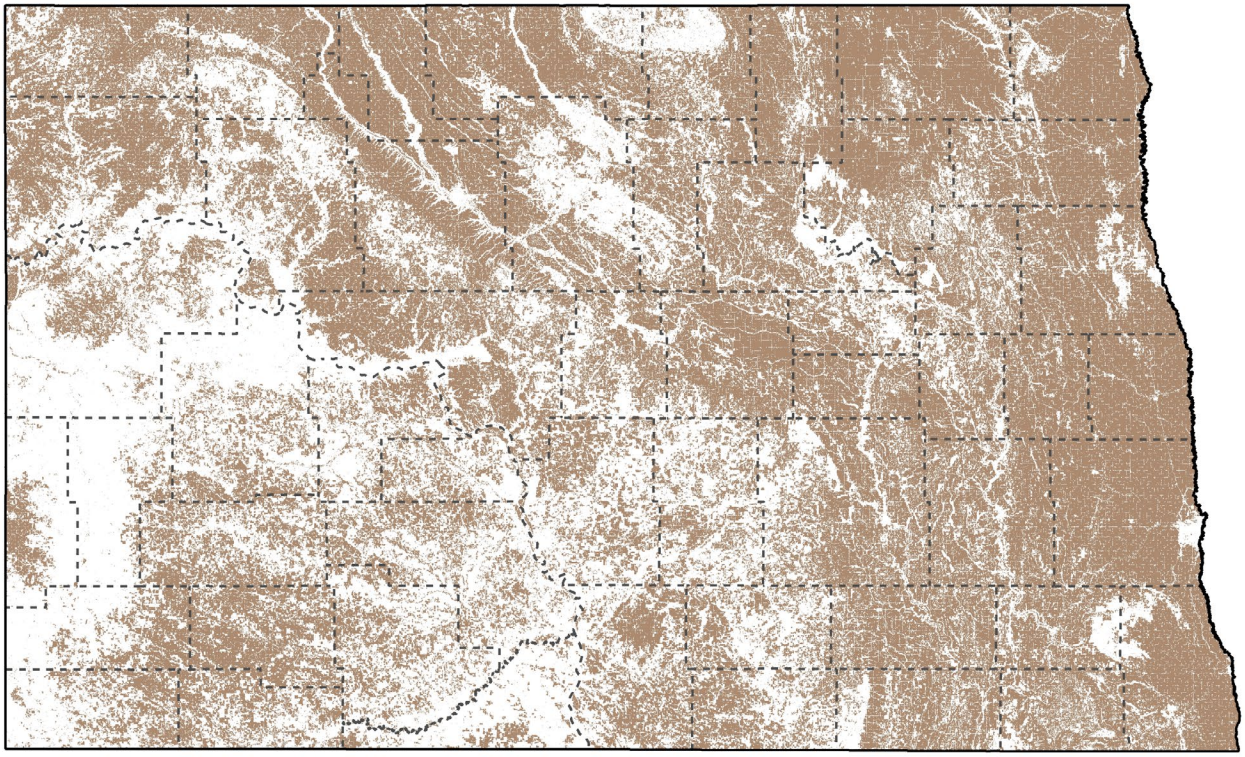


Figure 26. Cultivated agriculture cropland (brown).

Table 23. Agriculture cropland use by SGCN. Total = 10 species: 9 birds, 1 terrestrial invertebrate.

Agriculture Cropland SGCN – Species of Greatest Conservation Need		
BIRDS		TERRESTRIAL INVERTEBRATE
American Golden-Plover	Northern Pintail	Yellow-banded Bumble Bee
Buff-breasted Sandpiper	Sharp-tailed Grouse	
Franklin's Gull	Western Meadowlark	
Horned Lark	Whooping Crane	
Long-billed Curlew		

Table 24. Agriculture cropland use by SGIN. Total = 5 species: 1 bird, 3 mammals, 1 terrestrial invertebrate.

Agriculture Cropland SGIN – Species of Greatest Information Need		
BIRDS	MAMMALS	TERRESTRIAL INVERTEBRATE
Snowy Owl	Hispid Pocket Mouse	Nine-spotted Lady Beetle
	Ord's Kangaroo Rat	
	Plains Pocket Mouse	

Agriculture landscape southwest North Dakota.

Agriculture land is utilized by big game species.

Whooping Cranes foraging in corn stubble.

Long-billed Curlews often forage in cropland or hayland.

Developed Areas

Developed areas are dominated by constructed materials such as buildings and roads, residential areas, commercial or industrial centers, transportation and utility corridors, and may include intensively modified open areas such as golf courses and parks (Figure 27). While some vegetation may be present, these areas are typically dominated by man-made structures. North Dakota's population was estimated at 796,568 in 2024, with more than half living in urban areas. There are about 107,000 miles of roads, including paved, gravel and unsurfaced roads. While the actual road surfaces do not function as habitat, the adjacent ditches or roadsides can play a key role in providing habitat for some species, especially in areas where natural habitat is limited. Developed land totals nearly 1.9 million acres and covers 4.2% of the state.

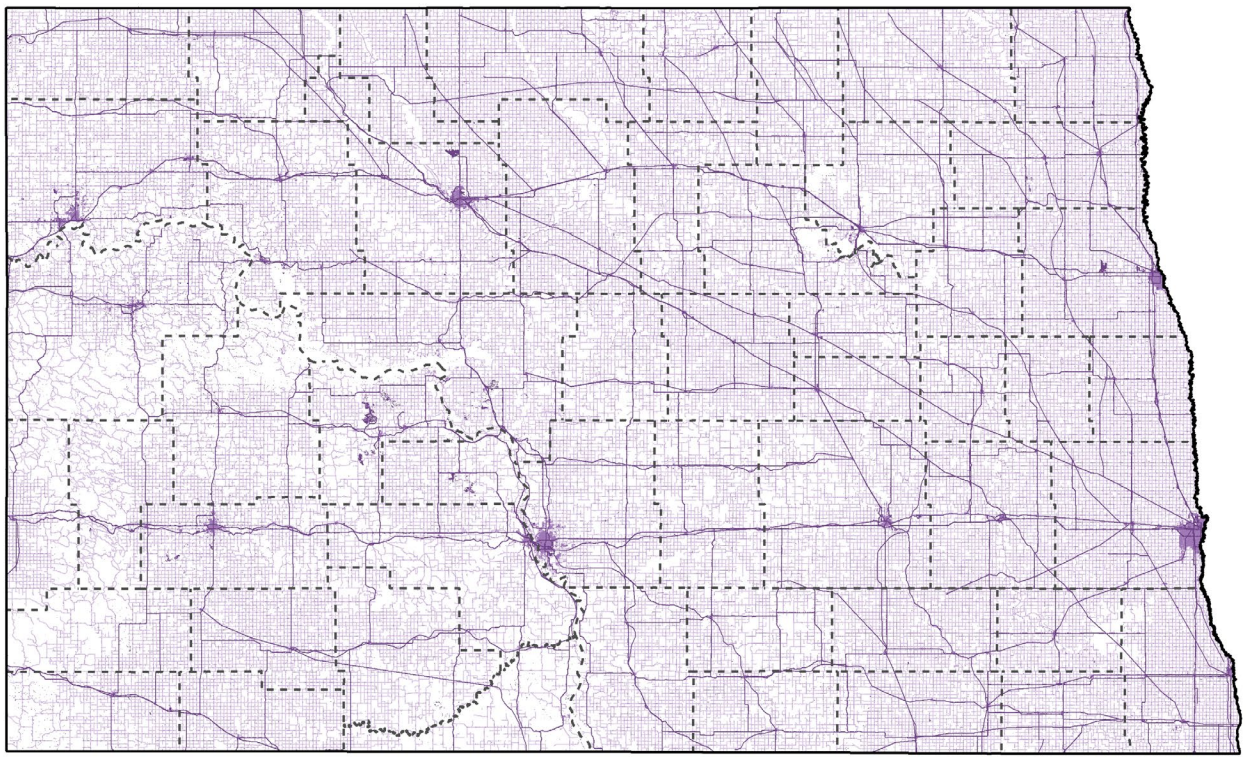


Figure 27. Developed land (purple), including towns and cities, roads, railroads, industrial and energy facilities.

Table 25. Developed area use SGCN. Total = 12 species: 4 birds, 2 mammals, 1 reptile, 5 terrestrial invertebrates.

Developed Areas SGCN – Species of Greatest Conservation Need				
BIRDS	MAMMALS	REPTILE	TERRESTRIAL INVERTEBRATES	
American Kestrel	Big Brown Bat	Snapping Turtle	Hobomok Skipper	Yellow Bumble Bee
Brown Thrasher	Little Brown Bat		Monarch Butterfly	Yellow-banded Bumble Bee
Harris's Sparrow			Western Bumble Bee	
Loggerhead Shrike				

Table 26. Developed area use SGIN. Total = 11 species: 4 birds, 2 reptiles, 5 terrestrial invertebrates.

Developed Areas SGIN – Species of Greatest Information Need			
BIRDS	REPTILES	TERRESTRIAL INVERTEBRATES	
Chimney Swift	Common Gartersnake	Juanita Sphinx Moth	Purplish Copper
Common Nighthawk	Plains Gartersnake	Mormon Metalmark	Rusty-patched Bumble Bee
Northern Flicker		Nine-spotted Lady Beetle	
Western Kingbird			

Pollinator garden in developed urban area.

Upland game birds using roadsides.

Soil

This habitat type is distinct because it can coexist with any other habitat. It includes any underground habitat formed entirely within mineral soil. Soil habitats are dug by burrowing species rather than created by geological forces. As a result, they are often small and temporary, filling in due to erosion and soil settling. Many species use underground burrows for various purposes, such as resting, raising young, or storing food. These species may dig the burrows themselves, take over burrows from other species, or inhabit abandoned ones. For this discussion, a species was classified as using soil habitats only if it spends most of its time in subterranean spaces.

Table 27. Soil use by SGCN. Total = 11 species: 1 bird, 4 mammals, 1 reptile, 2 amphibians, 3 terrestrial invertebrates.

Soil SGCN – Species of Greatest Conservation Need				
BIRD	MAMMALS		REPTILE & AMPHIBIAN	TERRESTRIAL INVERTEBRATES
Burrowing Owl	Black-footed Ferret	Richardson's Ground Squirrel	Plains Hog-nosed Snake	Badlands Tiger Beetle
	Black-tailed Prairie Dog	Swift Fox	American Toad	Ghost Tiger Beetle
			Plains Spadefoot	Northern Sandy Tiger Beetle

Table 28. Soil use by SGIN. Total = 6 species: 5 mammals, 1 terrestrial invertebrate.

Soil SGIN – Species of Greatest Information Need		
MAMMALS		TERRESTRIAL INVERTEBRATES
Franklin's Ground Squirrel	Ord's Kangaroo Rat	Splendid Tiger Beetle
Hispid Pocket Mouse	Plains Pocket Mouse	
Merriam's Shrew		

Burrowing Owl

Franklin's Ground Squirrel

FOCUS AREAS

In certain instances, there was enough information or justification to designate Focus Areas within specific landscapes. The EPA's Level IV ecoregions served as the foundation for identifying these Focus Areas in the 2015 SWAP. Using Geographic Information Systems, Level IV ecoregions were analyzed alongside various land cover data, the Department's extant native prairie/unbroken grassland and native forest, and spatial biological planning tools, including key sites for Species of Greatest Conservation Need (SGCN). The boundaries of specific Level IV ecoregions were selected and adjusted (digitized) based on existing native vegetation and key biological data, highlighting areas where the highest concentration of SGCN may occur.

Focus Areas typically displayed distinct or easily identifiable differences in vegetation, soils, topography, hydrology, or land use. These areas are highly variable in size and often represent rare types of native vegetation or natural communities within North Dakota. Twenty-one Focus Areas were developed for the 2015 SWAP. Conservation Reserve Program (CRP) grasslands have been removed as a specific focus area in the 2025 SWAP, but restored/planted grassland remains an important component of the grassland landscape. Therefore, a total of 20 Focus Areas are identified in the 2025 SWAP (Figure 28). Wetlands are considered a key component within these Focus Areas where they are present. The Badlands, a unique land feature, also contains designated Focus Areas, though these are categorized under other landscapes (for example, the Ponderosa Pines Focus Area is included within the Upland Forest landscape).

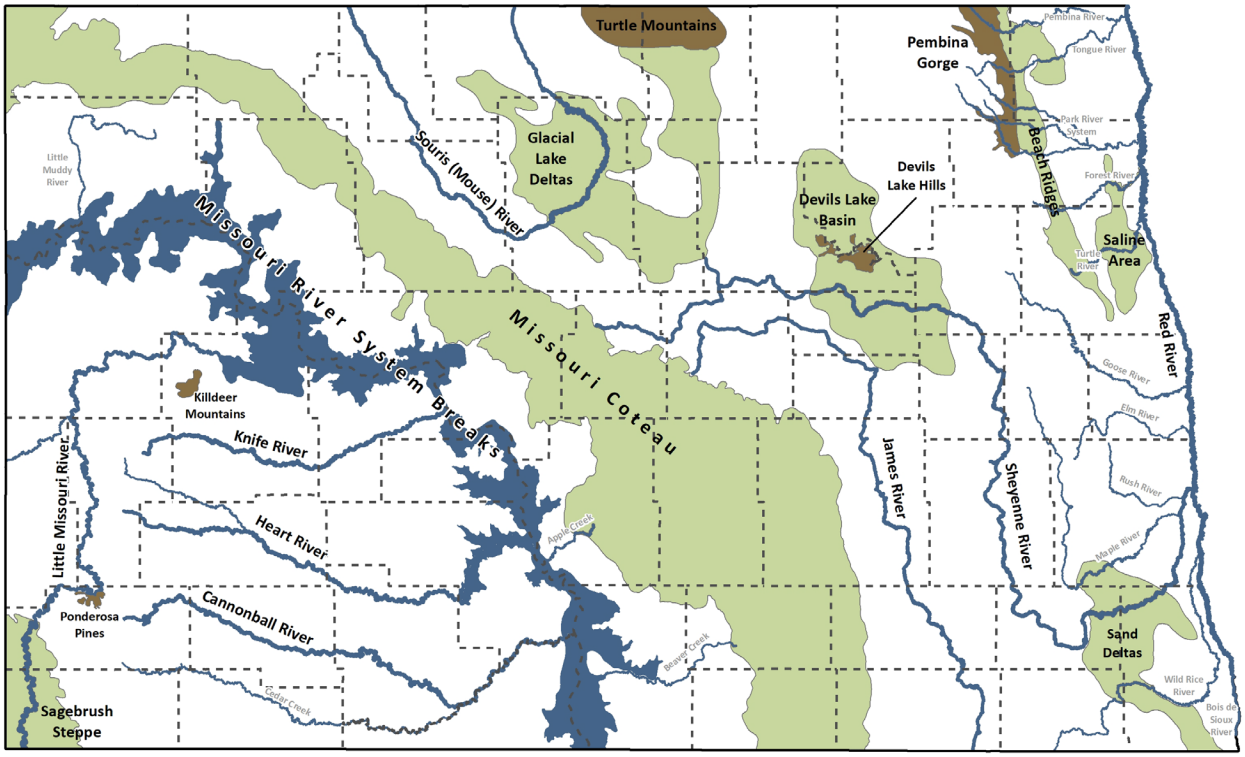


Figure 28. SWAP Focus Areas. Rivers labeled in light gray are tributaries of focus areas.

Saline Area

This region is characterized by saline soils, caused by salty groundwater rising to the surface from underlying sandstone. As a result, much of the land is unsuitable for crop farming, with grazing taking place in most uncultivated areas. Salt-tolerant plants thrive here, and many of the wetlands are brackish. The area contains several large tracts of native tallgrass prairie, each over 640 acres, but most of it remains unprotected. Grand Forks County Prairie Partners advocate for its preservation, though urban expansion poses a threat, as much of the area lies within 15 miles of Grand Forks.

Key SGCNs: Greater Prairie-Chicken, LeConte's Sparrow, Short-eared Owl, Yellow Rail, Regal Fritillary

Key SGINs: Arctic Shrew

Sand Deltas and Beach Ridges

Thick sand deposits, formed from river sediments carried to glacial Lake Agassiz, have created windblown sand dunes, with the largest being the Sheyenne Delta in the southern Red River Valley. The Beach Ridges run in parallel lines of sand and gravel, along with a smaller delta east of the Pembina Gorge. Some agricultural activities, including irrigation, occur in the deltas and around the beach ridges. The Sand Deltas focus area encompasses the Sheyenne National Grasslands, managed by the US Forest Service, making it the largest publicly owned tallgrass prairie preserve in the United States. Oak savannahs thrive in the delta areas, with the Sheyenne River flowing through them. Privately owned native tallgrass prairie stands are also located adjacent to the Sheyenne National Grasslands.

Key SGCNs: American Kestrel, Greater Prairie-Chicken, Northern Prairie Skink, Plains Hog-nosed Snake, Dakota Skipper, Poweshiek Skipperling

Key SGINs: Plains Pocket Mouse

Glacial Lake Deltas

This area, characterized by glaciated flat sheets of sand and gravel or rolling sand dunes, is largely unsuitable for cropland. The drought-prone soils are mainly used for cattle grazing, although some cropland exists, with irrigation making previously unsuitable land farmable. Wet conditions will flood portions of grassland and hayland. Tallgrass prairie communities are also present within this focus area, where the vegetative cover is sparse and dominated by species such as Little Bluestem, Indiangrass, Prairie Sandreed, Switchgrass, and Sand Bluestem.

Key SGCNs: American Kestrel, LeConte's Sparrow, Richardson's Ground Squirrel, Dakota Skipper

Devils Lake Basin

Extensive wetland drainage and intensive farming dominate the northern part of the focus area due to its rich soils and relatively flat terrain. Larger wetlands and lakes are more common here, partly due to the drainage of smaller, temporary, and seasonal wetlands for agricultural purposes. Since 1993, the water levels of Devils Lake have been rising at unprecedented rates, climbing 31.68 feet to a record elevation of 1,454.3 feet above mean sea level in June 2011. This rise has flooded 167,070 acres (261 square miles) of land since 1993. The Sheyenne River meanders through the southern part of the basin, with many adjacent non-wooded uplands remaining intact.

Key SGCNs: American Bittern, Lesser Scaup, Ruddy Turnstone, Eastern Spotted Skunk

Key SGINs: Franklins Ground Squirrel, Arctic Shrew

Missouri Coteau

The rolling, steep topography of this area has largely prevented it from being farmed, allowing a significant portion of native prairie to remain intact. However, conversion to agriculture and industrial development is ongoing. Cattle grazing is the most common land use, and numerous wetlands of various types are scattered throughout the region. Considerable conservation efforts, particularly focused on grassland preservation, have been directed toward the Coteau.

Key SGCNs: American Bittern, Baird's Sparrow, Bobolink, Chestnut-collared Longspur, Ferruginous Hawk, Grasshopper Sparrow, Hudsonian Godwit, LeConte's Sparrow, Lesser Yellowlegs, Long-billed Dowitcher, Marbled Godwit, Nelson's Sparrow, Northern Harrier, Northern Pintail, Pectoral Sandpiper, Semipalmated Sandpiper, Sharp-tailed Grouse, Short-billed Dowitcher, Short-eared Owl, Sprague's Pipit, Stilt Sandpiper, Upland Sandpiper, Western Meadowlark, Willet, Wilson's Phalarope, Richardson's Ground Squirrel, Dakota Skipper, Monarch Butterfly, Regal Fritillary

Key SGINs: Franklin's Ground Squirrel

Sagebrush Steppe

Eroded buttes, scoria mounds, and salt pans give this area a landscape similar to the badlands. The characteristic big sagebrush ecosystem has been significantly altered by livestock grazing, conversion to cropland, and oil and gas development. Despite this, extensive

conservation efforts over the past decade have focused on improving Greater Sage-Grouse habitat. However, the remaining fragile habitat is highly fragmented and continues to face ongoing threats.
Key SGCNs: Brewer's Sparrow, Greater Sage-Grouse, Long-billed Curlew, Thick-billed Longspur, Swift Fox, Hera Sheepmoth
Key SGINs: Sagebrush Lizard, Ord's Kangaroo Rat, Merriam's Shrew, Sagebrush Vole

Missouri River System/Breaks

The Missouri River, the longest river in the United States, begins in the Rocky Mountains of Montana and flows southeast to join the Mississippi River in Missouri. It forms the largest river system in North Dakota. The system is divided into sections: the Upper Missouri River/Yellowstone River, Lake Sakakawea, the Missouri River below Garrison Dam, and Lake Oahe, which starts just south of Bismarck/Mandan. Secondary rivers in the Missouri River System/Breaks Focus Area include the Yellowstone River, Little Muddy Creek, Apple Creek, and Beaver Creek (at Lake Oahe). Other major tributaries, such as the Little Missouri River, Knife River, Heart River, and Cannonball River, are separate Focus Areas. The damming of the Missouri River in the 1950s significantly altered its natural flow. The River Breaks feature steep, dissected topography with woody draws, riparian forests, and upland shortgrass prairie. The loss of natural flooding, which stimulates cottonwood growth, has inhibited cottonwood regeneration. Human development and urban expansion are increasing, particularly around the Bismarck/Mandan and Williston areas.
Key SGCNs: Least Tern, Piping Plover, Red-headed Woodpecker, Little Brown Bat, Northern Long-eared Bat, Blue Sucker, Burbot, Flathead Chub, Northern Redbelly Dace, Paddlefish, Pallid Sturgeon, Sicklefin Chub, Sturgeon Chub, Dakota Stonefly, Plains Stripetail
Key SGINs: Red Knot, Common Gartersnake, False Map Turtle, Smooth Softshell, Spiny Softshell, Paiute Dancer

Little Missouri River

The Little Missouri River originates in eastern Wyoming and flows north through the badlands of western North Dakota. In North Dakota, Beaver Creek is a secondary Focus Area, flowing into the Little Missouri River before it eventually empties into Lake Sakakawea at Little Missouri Bay. While areas of plains cottonwood forest still occur along the riverbanks, their extent has been significantly reduced from historic levels. Juniper tree encroachment is becoming more prevalent in these cottonwood forests. Cattle grazing and unrestricted use along much of the river pose potential threats in North Dakota.
Key SGCNs: Golden Eagle, Red-headed Woodpecker, Little Brown Bat, Northern Long-eared Bat, Flathead Chub, Northern Redbelly Dace, Sicklefin Chub, Sturgeon Chub, Plains Stripetail
Key SGINs: Short-horned Lizard, Fringed Myotis, Long-eared Bat, Long-legged Bat, Townsend's Big-eared Bat, Western Small-footed Bat, Winter Stonefly

Knife River

The Knife River originates in the badlands of west-central North Dakota and flows eastward for 200 miles before joining the Missouri River. The watershed faces threats from poor land use practices, leading to increased erosion and higher sediment loads. Runoff from surrounding lands contributes to water quality impairment in the watershed.
Key SGCNs: Blue Sucker, Flathead Chub, Northern Redbelly Dace, Fragile Papershell
Key SGINs: False Map Turtle, Spiny Softshell, Small Square-gilled Mayfly

Heart River

The Heart River flows across approximately 180 miles of western North Dakota, beginning in Billings County within the Little Missouri National Grasslands. It flows eastward, passing through the Patterson Reservoir near Dickinson, and is joined by the Green River at Gladstone, which is a secondary focus area included with the Heart River. The river continues through Lake Tschida, formed by the Heart Butte Dam, before turning northeast and flowing into the Missouri River south of Mandan. The Heart River is threatened by several land use practices, including reduced riparian width, loss of native riparian plant diversity, overgrazing of the riparian zone, stream bank erosion, and channel filling with sediments. Increased runoff from the watershed further contributes to impairment.
Key SGCNs: Flathead Chub, Northern Redbelly Dace, Dakota Stonefly
Key SGINs: False Map Turtle, Spiny Softshell, spinylegs

Cannonball River

The Cannonball River flows 135 miles from west to east across southwestern North Dakota before emptying into Lake Oahe. Instream flow can vary greatly, ranging from nearly none during dry years to 95,000 cubic feet per second during wet years. Both the upper and lower portions of the Cannonball River and its tributaries are threatened by high nutrient levels and increased sedimentation, likely resulting

from land use practices within the watershed. Pathogens have also been identified as impairments to the river system. Cedar Creek is a secondary river included in this focus area.
Key SGCNs: Blue Sucker, Flathead Chub, Northern Redbelly Dace, Dakota Stonefly
Key SGINs: False Map Turtle, Smooth Softshell, Spiny Softshell, spinylegs

Red River and Tributaries
The Red River basin drains 39,300 square miles across a three-state region, including 21,000 acres of eastern North Dakota. Its largest North Dakota tributary is the Sheyenne River, while secondary rivers include the Bois de Sioux, Wild Rice, Elm, Goose, Turtle, Forest, Park River System, and the Tongue and Pembina Rivers. Many of these rivers are impacted by channelization and flood control impoundments, which were implemented to manage land drainage for agriculture. The region also features extensive drainage ditch systems that alter the natural hydrology of the basin. Agricultural runoff and wastewater inputs contribute further to impairing the system.
Key SGCNs: American Toad, Gray Fox, Burbot, Blacknose Shiner, Carmine Shiner, Finescale Dace, Hornyhead Chub, Northern Pearl Dace, Northern Redbelly Dace, Pugnose Shiner, Silver Chub, Trout-perch, Dakota Stonefly, Plains Stripetail, sand-dwelling mayfly
Key SGINs: Common Mudpuppy, Cope's Gray Treefrog, Eastern Gray Treefrog, Wood Frog

Sheyenne River
The Sheyenne River basin spans nearly 900,000 acres, making it the largest contributing tributary to the Red River in terms of area. It originates in the mixed grass region of central North Dakota and flows southeast toward its confluence with the Red River. Agricultural and ranching practices throughout the region, along with wastewater discharge, have impacted water quality in this drainage. The construction of an outlet from Devils Lake into the Sheyenne River has altered the flow, elevation, and water quality. The Maple and Rush Rivers are secondary Focus Areas, entering the Sheyenne River near its confluence with the Red River.
Key SGCNs: Black-billed Cuckoo, Gray Fox, Little Brown Bat, Blacknose Shiner, Carmine Shiner, Northern Pearl Dace, Northern Redbelly Dace, Pugnose Shiner, Trout-perch, Black Sandshell, Creek Heelsplitter, Creeper, Mapleleaf, Pink Heelsplitter, Threeridge, Wabash Pigtoe, Dakota Stonefly, Plains Stripetail
Key SGINs: Common Gartersnake, Red-bellied Snake

James River
The James River begins in the Drift Prairie of central North Dakota and flows south into South Dakota. The area is primarily used for agriculture. A large reservoir north of Jamestown serves flood control and municipal needs. Land use practices and water withdrawal have been identified as threats to this river system. Many stretches of the river are impaired by high nutrient loads and sedimentation.
Key SGCNs: Blacknose Shiner, Carmine Shiner, Pugnose Shiner, Black Sandshell, Creeper, Deertoe, Fragile Papershell, Plains Emerald

Souris (Mouse) River
The Souris (Mouse) River originates in eastern Saskatchewan, flowing south into northern North Dakota before returning north into Canada. Water flow is regulated by two large reservoirs in Saskatchewan and several smaller dams in North Dakota. The primary land use in this drainage is agriculture. Many stretches of the river are impaired by high nutrient content and sedimentation, with wastewater discharge further affecting water quality. The region also experienced major flooding in 2011.
Key SGCNs: Northern Pearl Dace, Trout-perch
Key SGINs: Long-horned Casemaker, Northern case maker

Pembina Gorge
The Pembina Gorge is a small but steep and dissected escarpment located on the edge of the Drift Prairie, bordering the Red River Valley and Canada. The area is dominated by deciduous forests, including Bur Oak, Quaking Aspen, Green Ash, Cottonwood, and American Elm. The steep slopes help preserve the natural woodland community, while the flatter areas have been cleared for cropland, including small grains, sunflowers, and flax. Off-road vehicle trail systems have been developed, and there is ongoing advocacy for more trails through the Gorge. The Pembina Gorge on the North Dakota side is likely a key migration corridor, as high numbers of raptors have been documented migrating through the Canadian side of the Pembina Valley. The Pembina River, Tongue River, and Park River System run east-west through the Gorge, while Upland Forest on flat land lies to the east in the Beach Ridges focus area.
Key SGCNs: Black-billed Cuckoo, Ruffed Grouse, Eastern Red Bat, Gray Fox, Hoary Bat, Silver-haired Bat
Key SGINs: Copes Gray Treefrog, Eastern Gray Treefrog, Wood Frog, Arctic Shrew, Boreal Whiteface, Giant Case Maker

Turtle Mountains

Set in the northern Drift Prairie, the rolling topography and an additional 10 inches of precipitation per year support deciduous forest cover, including Bur Oak, Aspen, Green Ash, Paper Birch, Boxelder, Sumac, Serviceberry, and Snowberry. The Turtle Mountains rise 600 to 800 feet above the surrounding prairie and wetland landscape. The soil in this region is erodible and poorly suited for farming, although some agricultural activity does occur. Native woodland clearings have been converted into pastureland. The area is dotted with hundreds of large, deep ponds and lakes.

Key SGCNs: Ruffed Grouse, Eastern Red Bat, Hoary Bat, Silver-haired Bat, Subarctic Darner

Key SGINs: Red-bellied Snake, Wood Frog, Arctic Shrew, Northern Water Shrew, Pygmy Shrew, Boreal Whiteface

Devils Lake Hills

The deciduous forest bordering Devils Lake is similar to that of the Pembina Hills, featuring Bur Oak, Quaking Aspen, and Birch. However, much of the natural forest along the shorelines of the lake has been submerged due to the recent rise in water levels.

Key SGCNs: Eastern Red Bat, Hoary Bat, Little Brown Bat, Silver-haired Bat, Subarctic Darner

Key SGINs: Wood Frog, Arctic Shrew, Boreal Whiteface

Killdeer Mountains

Separated from the main stem of the badlands, the Killdeer Mountains rise 700 to 1,000 feet above the surrounding prairie landscape, with the highest point reaching 3,314 feet—about 200 feet lower than the state's highest peak, White Butte. The dominant deciduous vegetation includes Bur Oak, Quaking Aspen, Green Ash, Paper Birch, Western Black Birch, and American Elm. Grazing occurs on private land, while the Killdeer Wildlife Management Area spans the Killdeer Mountains.

Key SGCNs: Golden Eagle, Little Brown Bat

Ponderosa Pines

Coniferous forest is rare in North Dakota, and this stand of Ponderosa Pine in the southwestern part of the state is located at the northeastern most edge of its overall range. It may be an outlier of the pines from the Black Hills of South Dakota. In the summer of 2004, a fire swept through the region, burning several hundred acres of pine. Occasional management may be necessary to prevent the encroachment of pines into native prairie.

Key SGCNs: Little Brown Bat

Key SGINs: Fringed Myotis, Long-eared Bat, Long-legged Bat, Townsend’s Big-eared Bat, Western Small-footed Bat

KEY NATIVE WILDLIFE AND HABITAT AREAS

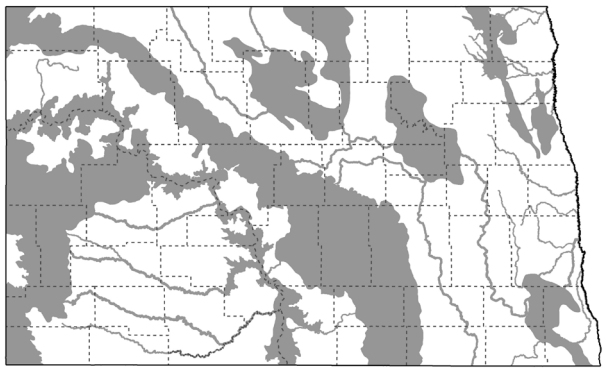
The Key Native Wildlife and Habitat Areas (KNWHA) spatial layer was developed using the ND State Wildlife Action Plan Focus Areas, landscapes where unbroken grassland is ≥ 40% within a 4 square mile area, and landscapes where the accessibility for breeding duck pairs per square mile is greater than 60 ("Thunderstorm Map"). The original KNWHA was developed in 2021 as a planning tool for wind energy development (see Wind Energy Development in North Dakota Best Management Practices, June 2021). However, the KNWHA has become an important tool for not only minimizing impacts to native species and habitat during development such as wind energy, but can also serve as a tool for landscapes to prioritize conservation actions. **The KNWHA is meant to enhance the SWAP Focus Areas by recognizing other landscapes which are vital for SGCNs that rely on larger tracts or complexes of essential native habitat** (Figure 29).

High represents a mostly intact and undisturbed landscape. These areas contain large tracts of land that have not been converted from their native state to other uses, such as cropland and developed areas, and therefore a less fragmented landscape. The KNWHA categorizes all SWAP Focus Areas, plus the Badlands region, as High.

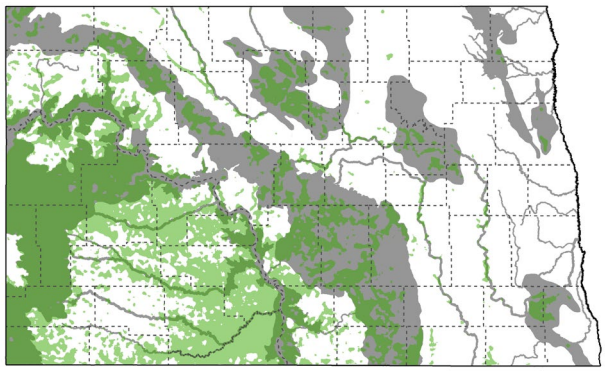
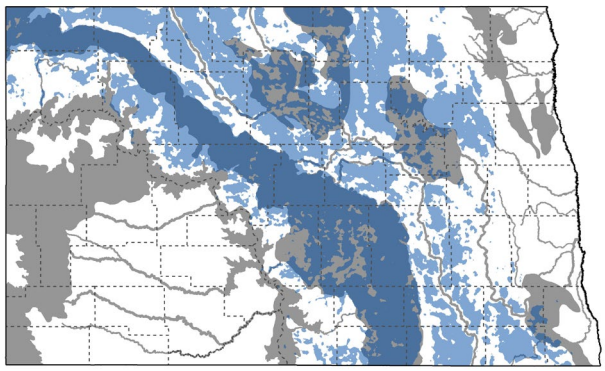
Medium includes areas not identified as High but where unbroken grassland is ≥ 40% within a 4 square mile area, and areas where the accessibility for breeding duck pairs per square mile is greater than 60. Medium areas represent lands that are partially broken or a disturbed landscape. These areas may contain medium to large tracts of land that have not been converted from their native state to other uses, such as cropland and developed areas, and therefore a more fragmented landscape.

Low represents a highly fragmented landscape and much of the land has been converted from its native state to other uses, such as cropland and developed areas.

The KNWHA spatial layer was updated for the 2025 SWAP with the latest assesment of extent unbroken grassland/shrubland (NDGF 2024) and the Waterfowl Breeding Pair Survey 2022 spatial layer. Similar to the original 2021 KNWHA, the updated 2025 KNWHA spatial layer was developed using the SWAP Focus Areas, areas where unbroken grassland/shrubland is ≥ 40% within a 4 square mile area, and areas where the accessibility for breeding duck pairs per square mile is greater than 60.



All SWAP Focus Areas, plus the Badlands region, are categorized as High.

	Green indicates where unbroken grassland/shrubland is ≥ 40% within a 4 square mile area. These are categorized as Medium, if outside the High areas.
	Blue indicates where accessibility for breeding duck pairs per square mile is greater than 60. This spatially explicit model was developd to target waterfowl populations that prioritize habitats (i.e. wetland complexes) to benefit upland nesting waterfowl. This model effectively charactizes areas important to many of the wetland dependent SGCNs and SGINs beyond just waterfowl. These are categorized as Medium, if outside the High areas.

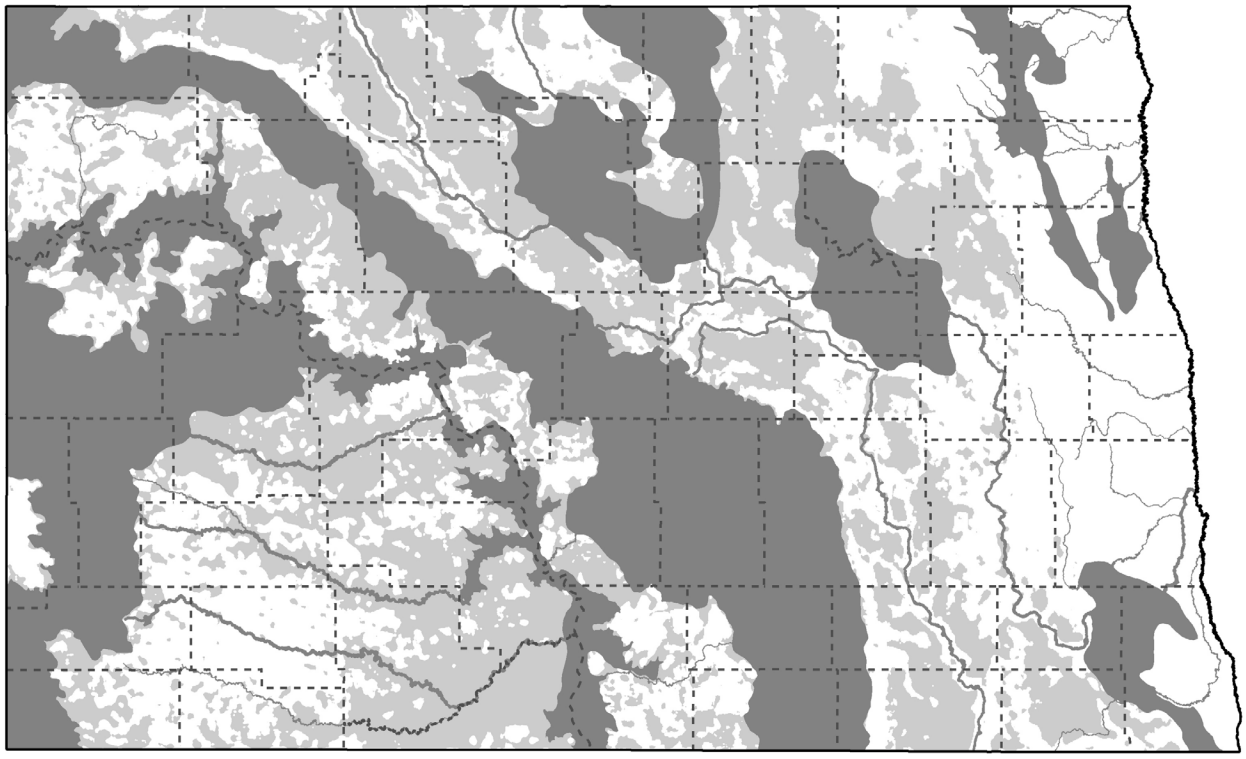


Figure 29. 2025 Key Native Wildlife and Habitat Areas. Dark gray = High; medium gray = Medium; white = Low.

CHAPTER 5
THREATS AND ACTIONS

This chapter includes information on the required elements:

Element 3: descriptions of problems which may adversely affect species of greatest conservation need or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of those species and habitats.

Element 4: descriptions of conservation actions determined to be necessary to conserve the species of greatest conservation need and habitats and priorities for implementing such actions.

IDENTIFYING AND HIGHLIGHTING THREATS AND ACTIONS

North Dakota State Wildlife Action Plan Summits

For the 2015 and 2025 State Wildlife Action Plan revision, North Dakota followed *Best Practices for State Wildlife Action Plans Voluntary Guidance to States for Revision and Implementation* produced by the Association of Fish and Wildlife Agencies (2012). This report's best practices recommendation for creating consistency across SWAPs for classifying threats and conservation actions was to follow definitions and classifications in *A Standard Lexicon for Biodiversity Conservation: United Classifications of Threats and Actions* (Salafsky et al. 2008). The Conservation Measures Partnership (CMP), in collaboration with the IUCN Species Survival Commission, developed the unified classifications as a standard language for terms used by the conservation community. The classification has been revised several times, with revisions made available in 2015 (Version 2.0) and in late 2024 (Version 4.0). Note, the ND SWAP uses only the direct threats classifications from the CMP. The conservation actions identified in Tables 29 to 33 are either proven to be effective in North Dakota or represent practical solutions to help address the identified threats.

In 2014, during the revision of the 2015 SWAP, the NDGF hosted the first State Wildlife Action Plan Summit. The summit was held to inform/update interested agencies, groups, and individuals on the status of the SWAP review and to gather additional input on important issues. In total, 62 people attended the summit from 23 agencies/groups. The summit began with background information of the SWAP, a history of the State Wildlife Grant (SWG) program in North Dakota, and the process used to revise the Species of Conservation Priority list. The afternoon session was divided into five breakout habitat groups: Grasslands; Badlands; Woodlands; Rivers and Streams; and Wetlands and Lakes. Participants were instructed to join the habitat group for which they have the most expertise. The standard lexicon (Salafsky et al. 2008) was used to categorize direct threats for the habitat type. The unified direct-threats classification is structured in a hierarchical fashion, with first and second levels being comprehensive, consistent and exclusive. Some direct threats are not applicable to North Dakota (e.g. volcanoes) and those were excluded. Thirty-five direct threats were included. Conservation actions were identified to address the specific threats. A moderator of each group led the participants in a discussion and recorded all responses. At the conclusion of the afternoon session, participants were each given five "dot stickers" to place what they consider the greatest threats among the various habitat types.

On September 11, 2024, the NDGF hosted a second State Wildlife Action Plan Summit. The meeting was attended by 62 participants from 30 different state and federal agencies and NGOs, in addition to 14 NDGF staff members who were either running the event or participating in the sessions. Similar to 2014, the summit began with a SWAP overview, the process used to revise the species of greatest conservation need list, ideas for improving the SWAP for useability, and a presentation

from the North Central Climate Adaptation Science Center on incorporating climate change in the SWAP. The afternoon session was divided into five breakout habitat groups: Grasslands; Badlands; Forest; Rivers, Streams and Riparian; and Wetlands and Lakes. Participants were instructed to join the habitat group for which they have the most expertise. The direct threats and conservation action tables from the 2015 SWAP were used as a baseline for adding, removing, or modifying threats and conservation actions. The CMP 2.0 revision was used (note: version 4.0 was not made available until after the summit). Each group's moderator facilitated a discussion and recorded all responses. The voting process took place in two stages. First, at the end of the breakout session, group members were asked to vote on the greatest threats and conservation actions for the habitat group they had joined. Then, participants gathered as a large group to vote on the greatest threats and conservation actions among all habitats. The results of the voting are shown in Figures 30 to 34 and summarize participants' perceptions of the most significant habitat threats and their recommendations for focusing conservation efforts to address those threats. Tables 29 to 33 include all threats and actions identified by the habitat breakout groups. Note the threats and actions are not listed in order of priority in the tables.

The approach of using the CMP in a habitat-based approach versus species specific approach may differ from other state's SWAPs. Since many SGCNs share the same habitat, the North Dakota SWAP focuses on threats and conservation actions at the habitat level. Species specific threats and management recommendations are identified in the Species Accounts (see Appendix A to F).

Participants at the September 11, 2024 North Dakota State Wildlife Action Plan Summit.

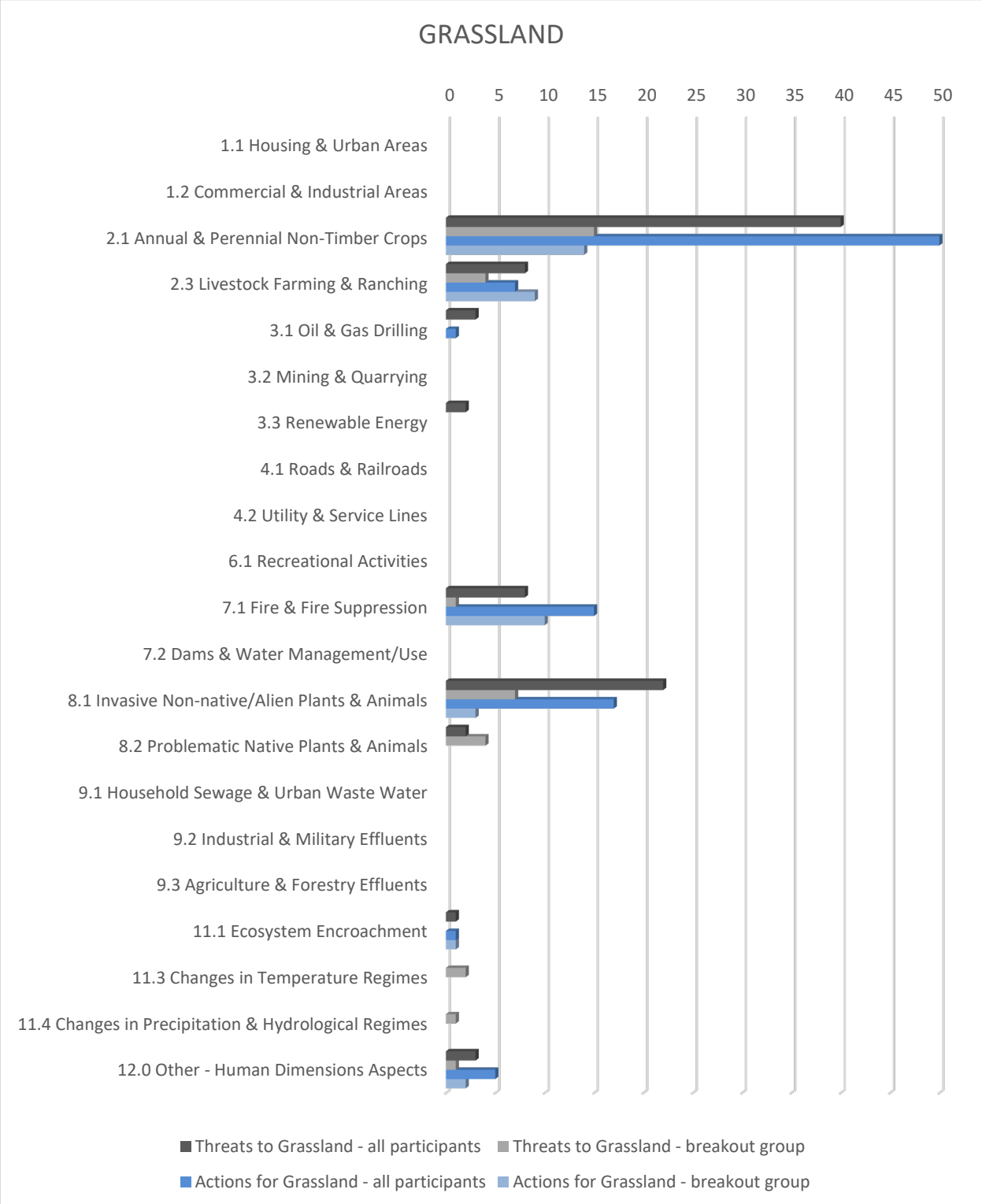


Figure 30. Responses from SWAP Summit participants on threats to grasslands and the areas to focus conservation actions.

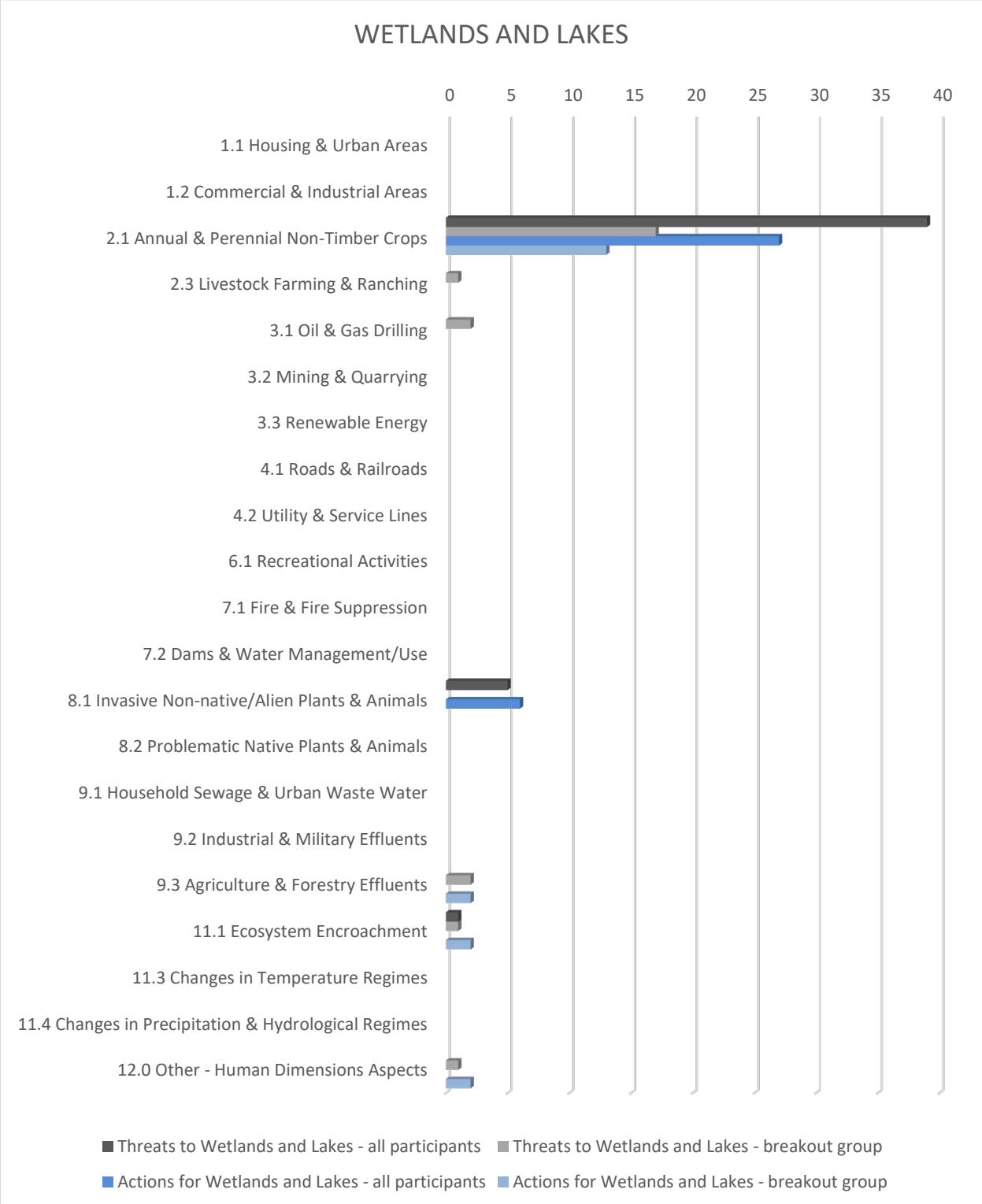


Figure 31. Responses from SWAP Summit participants on threats to wetlands and lakes and the areas to focus conservation actions.

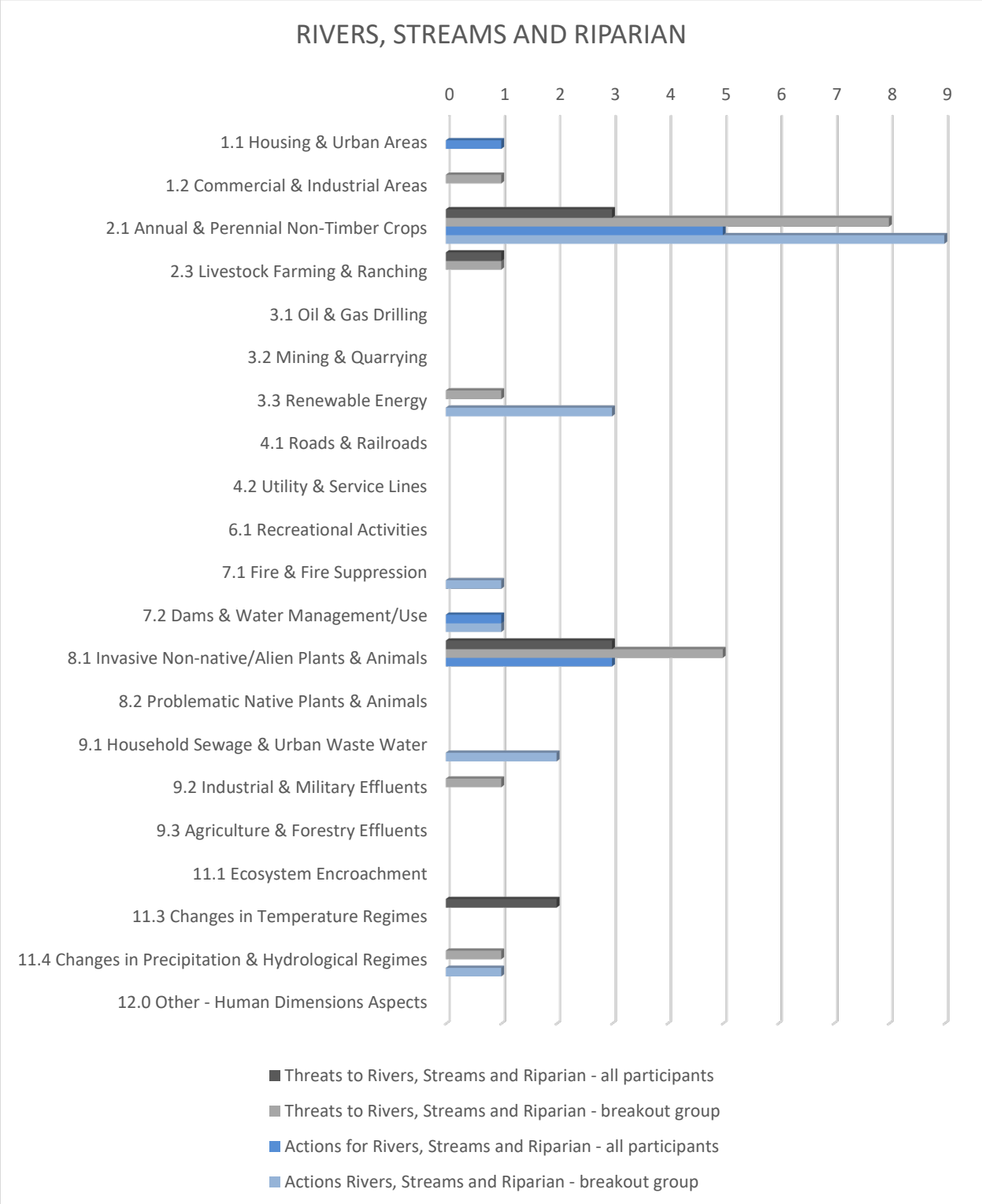


Figure 32. Responses from SWAP Summit participants on threats to rivers, streams and riparian and the areas to focus conservation actions.

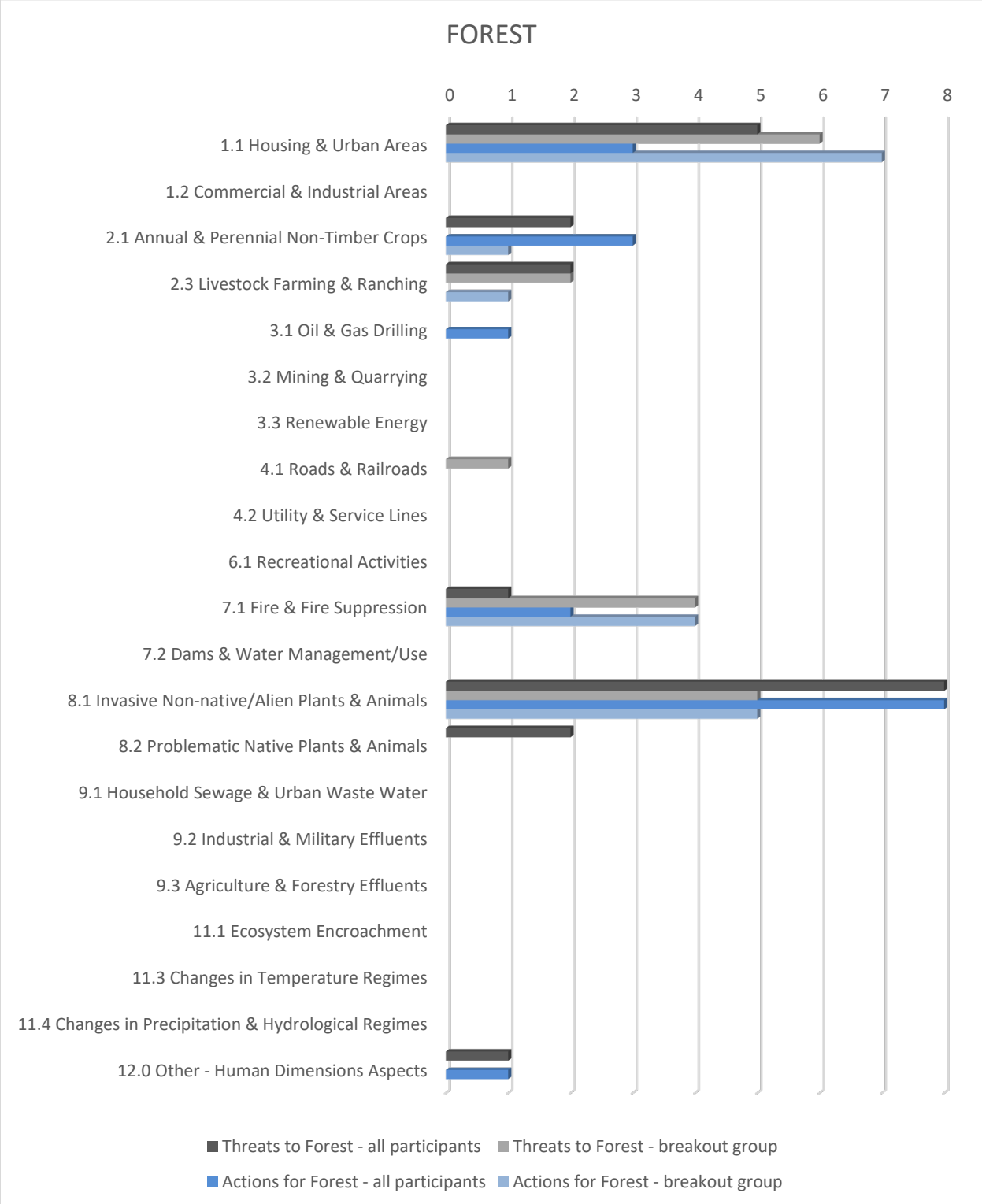


Figure 33. Responses from SWAP Summit participants on threats to forest and the areas to focus conservation actions.

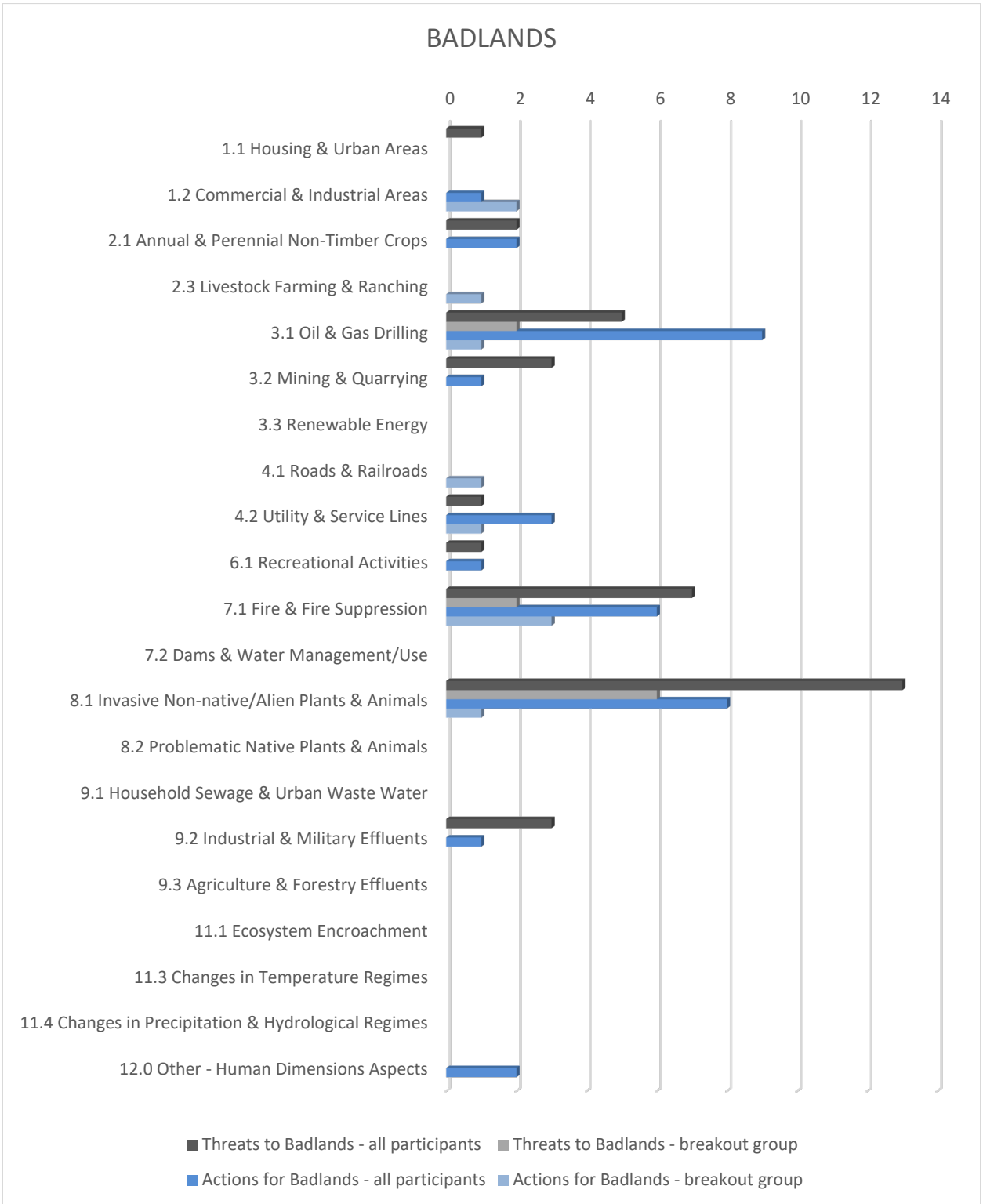


Figure 34. Responses from SWAP Summit participants on threats to badlands and the areas to focus conservation actions.

GRASSLAND THREATS AND ACTIONS

Table 29. Direct threats and conservation actions for grasslands.
Threats and actions are not listed in order of priority.

CLASSIFICATION	THREAT TO GRASSLAND	CONSERVATION ACTION
1. RESIDENTIAL & COMMERCIAL DEVELOPMENT		
1.1 Housing & Urban Areas	a) conversion of grassland to urban development b) fragmentation of grassland from urban development c) disturbance associated with urban development can disperse noxious/invasive weeds d) vegetation planted for ornamental purposes can invade adjacent native prairies e) mowing of adjacent native and/or tame grasslands for ornamental grooming f) pesticide/herbicide application and drift impacts adjacent plant/wildlife species composition g) loss of grazing and burning of grasslands near urban and recreational areas h) predation of grassland wildlife by domestic animals near urban areas i) direct mortality to wildlife species, particularly birds, from collisions with glass on buildings	i. offer incentives and programs to protect, enhance, and restore grasslands ii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iii. urge ecologically responsible urban planning and zoning iv. urge ecologically responsible urban and county policies v. public education and outreach for native landscaping and management vi. increase awareness, understanding, and appreciation of the grassland ecosystem vii. bird-friendly building designs viii. promote responsible and conscientious use of pesticides
1.2 Commercial & Industrial Areas	a) conversion and disturbance of grassland associated with industrial development b) increased garbage load, illegal dumping c) disturbance associated with development can proliferate noxious/invasive weeds d) direct mortality to wildlife species, particularly birds, from collisions with glass on buildings e) increasing demand for data center capacity	i. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures ii. urge ecologically responsible ordinances and suitable reclamation standards iii. bird-friendly building designs iv. education and outreach for native landscaping and management
1.3 Tourism & Recreational Areas	a) disturbance associated with recreational development can disperse noxious/invasive weeds b) pesticide/herbicide application and drift impacts adjacent plant/wildlife species composition c) unrestrained domestic animals can harass wildlife d) introducing woody plant species to native grasslands e) improper management of grasslands within recreational areas	i. promote “Keep It Native” campaign for greenways, trails, recreational areas, and minimize project footprint ii. public education and outreach for native landscaping and management iii. promote ecotourism iv. urge ecologically responsible ordinances v. encourage active management of grasslands, including grazing vi. promote responsible and conscientious use of pesticides vii. review policies to allow flexibility in proper management of grasslands
2. AGRICULTURE		

CLASSIFICATION	THREAT TO GRASSLAND	CONSERVATION ACTION
2.1 Annual & Perennial Non-Timber Crops	a) conversion of grassland to cropland development b) fragmentation of grassland due to cropland development c) displacement of grassland wildlife during conversion process d) pesticide application and drift impacts on adjacent plant/wildlife species composition, effect on pollinators e) increase in soil erosion from wind and water resulting in deposition in grasslands f) decline in soil health g) impacts to water table and water infiltration rates h) changing farm demographics resulting in shift from livestock ranching to crop production, loss of connection to the land, and loss of rural community lifestyle i) salinization of land that has been converted to cropland j) increase of noxious weeds and invasive plants when grassland is converted	i. offer incentives and programs to protect, enhance, and restore grasslands ii. use a targeted approach to protect, enhance, and restore the most vulnerable grasslands and/or those of high ecological value and connectivity iii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iv. offer midterm conservation agreements for grassland management and protection v. promote working lands conservation agreements vi. strengthen Farm Bill regulatory provisions (i.e. sodbuster, sodsaver) vii. offer incentives for wildlife friendly farming, tax-based or direct payments viii. promote and support regenerative grazing management, collaborate with grassland based agricultural groups ix. support demo projects and best management practices x. promotion of cover crops and soil health xi. promote equal risk management for grassland-based agriculture xii. promote responsible and conscientious use of pesticides
2.3 Livestock Farming & Ranching	a) absence of grazing b) underutilization of grazing or over-rest c) overutilization of grazing or overgrazing d) shift from ranching (pro-grass) lifestyle to confined animal feeding operations e) disturbance, erosion, and decline in soil health in high livestock traffic areas f) opposing attitude of using prescribed fire as co-management tool g) non-traditional livestock farms may proliferate disease transmission, genetic mixing, escapees, to wild populations h) inappropriate fencing (i.e. not wildlife-friendly) i) incentives to convert grassland to cropland j) public perception that livestock are bad for the climate and lack of knowledge on the importance of grasslands for carbon sequestration and storage k) increase of noxious weeds and invasive plants from poor grazing management practices l) changing farm demographics resulting in shift from livestock ranching to crop production, loss of connection to the land, and loss of rural community lifestyle	i. encourage grazing as a grassland management tool for high resistance and resilience ii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iii. develop provisions for Farm Bill disaster assistance for livestock producers iv. promote equal risk management for grassland-based agriculture v. establish grassbanks between state/federal/non-governmental land and private ranches vi. incentivize good grazing management vii. promote and support regenerative grazing management, use best management practices or ecological site descriptions viii. build market and corporate support of grass-based livestock ix. support grazing lands coalitions and work with grass-based agriculture groups x. use best management practices or ecological site descriptions xi. assessment of economic and ecological values of grasslands and associated wildlife, ecosystem services xii. promote carbon credits, biodiversity credits

CLASSIFICATION	THREAT TO GRASSLAND	CONSERVATION ACTION
		xiii. encourage smooth wire, at least for bottom wire, and apply visibility markers (wildlife-friendly fencing) xiv. encourage temporary or virtual fencing when possible xv. promote responsible livestock practices that minimize disease spread (i.e. double fences, appropriate removal of carcasses, etc.) xvi. educate the public on the benefits of working grasslands xvii. support prescribed fire, including training and education
3. ENERGY PRODUCTION & MINING		
3.1 Oil & Gas Drilling	a) conversion of grassland to well pads, field or production facilities, access roads b) fragmentation of grassland to well pads, field or production facilities, access roads c) disturbance associated with oil and gas development can proliferate noxious/invasive weeds d) inadequate or improper reclamation e) illegal dumping of materials and waste f) loss of grazing due to disturbance to livestock g) increased wildfire risk from drilling and operational activities h) anthropogenic disturbance to grassland associated wildlife, e.g. dust, light and noise pollution i) diminished forage quality and plant communities due to increased road dust j) social apathy to negative ecological impacts of oil and gas drilling k) governance apathy to negative ecological impacts of oil and gas drilling	i. well pad and facility consolidation, minimize footprint of development ii. engage in early consultation with the siting of well pads iii. develop crucial habitat maps or species avoidance areas iv. follow/implement best management practices v. incentivize companies for implementing ecologically sound development vi. urge ecologically responsible ordinances and suitable reclamation standards and foster relationships with oil companies to stimulate ecologically sound development vii. urge requirements to promptly reclaim dry or abandoned wells viii. enforce regulatory compliance and close loopholes which are used to delay or avoid reclamation ix. public education and outreach x. public disclosure of impacts/footprint xi. research the impacts of oil and gas drilling on grassland habitat and wildlife xii. explore novel alternatives to offset impacts of oil and gas development
3.2 Mining & Quarrying	a) conversion of grassland to mines or quarries b) anthropogenic disturbance to grassland associated wildlife c) inadequate or improper reclamation d) increase of noxious weeds and invasive plants when grassland is mined	i. minimize footprint of development ii. suitable reclamation standards iii. promote or develop local and state ordinances iv. delay or halt mining/quarrying for new metals or minerals until local ordinances have been approved
3.3 Renewable Energy	a) conversion of grassland to alternative fuel crops b) fragmentation of grassland by wind or solar facilities c) promotion of non-native, monotypic alternative fuel crops d) direct or indirect mortality of wildlife species from structures e) altered wildlife migrations	i. offer incentives and programs to protect, enhance, and restore grasslands ii. incentivize companies for implementing ecologically sound development alongside carbon incentives iii. urge ecologically responsible ordinances and suitable reclamation standards iv. urge accountability for ecological impacts

CLASSIFICATION	THREAT TO GRASSLAND	CONSERVATION ACTION
	f) anthropogenic disturbance to grassland associated wildlife, e.g. dust, noise and light pollution g) displacement of wildlife	v. minimize footprint of development vi. research to determine the best areas for placement to minimize impacts to wildlife vii. use livestock to control weeds viii. establish pollinator-friendly plantings under solar arrays
4. TRANSPORTATION & SERVICE CORRIDORS		
4.1 Roads & Railroads	a) conversion of grassland to roads and railroads b) fragmentation of grassland by roads and railroads c) anthropogenic disturbance to grassland associated wildlife, e.g. noise, dust d) direct mortality and displacement of wildlife species with vehicles or trains e) roads acting as migration barriers for terrestrial wildlife f) proliferate noxious/invasive weeds g) road and railway incident secondary effects, e.g. spills and explosions h) improper herbicide uses in railroad rights-of-way i) potential for wildfires, either accidental or from negligent actions j) road salt impacts to roadside plants and rights-of way	i. urge ecologically responsible ordinances and suitable reclamation standards ii. appropriate mitigation, e.g. native grassland ecosystems iii. appropriate road restrictions, including speed limits iv. timing restrictions for construction v. maintain natural corridors or construct wildlife crossings vi. use pipelines versus trucking liquids and gas vii. use native local ecotype seed, including pollinator-friendly, when seeding road rights-of-way viii. promote adjustments in the timing and frequency of mowing along rights-of-way to minimize impacts to wildlife
4.2 Utility & Service Lines	a) fragmentation of grassland by utility and service lines b) disturbance associated with development of utility and service lines can proliferate noxious/invasive weeds c) inadequate reclamation d) intensification and accumulation of infrastructure e) reduced management and flexibility in easement rights-of-way f) direct mortality of wildlife species, particularly birds, by collision or electrocution g) wildlife displacement from tall structures	i. consolidation corridors ii. encourage buried lines when feasible iii. urge ecologically responsible ordinances and suitable reclamation standards iv. engage in early consultation with the siting of utility and service lines v. timing restrictions for construction vi. require line marking devices vii. use avian protection plans or guidance documents to minimize bird/powerline interactions viii. use native local ecotype seed, including pollinator-friendly, when reseeding easement rights-of-way
5. BIOLOGICAL RESOURCE USE		
5.1 Hunting & Collecting Terrestrial Animals	a) anthropogenic disturbance to grassland associated wildlife, e.g. off-road travel, dog training during nesting season and brood rearing period b) disturbance/movement can proliferate noxious/invasive weeds c) wildlife value or changing public attitudes towards wildlife, promoting the introduction of nonnative species for hunting d) insufficient regulations for collection or harvest of certain wildlife, e.g. reptiles and amphibians e) poaching	i. urge ecologically responsible ordinances ii. increase enforcement and deterrents iii. reevaluate or develop regulations pertaining to collection or harvest of certain wildlife, e.g. reptiles and amphibians iv. public education and outreach v. encourage appropriate management of native grasslands vi. amend dog training laws and regulations to minimize impacts to wildlife during sensitive life cycle periods

CLASSIFICATION	THREAT TO GRASSLAND	CONSERVATION ACTION
	f) supplemental feeding g) conversion of native grassland to facilitate hunting desires, e.g. converting native to dense nesting cover, trees, food plots, and improper herbicide use h) lead ammunition impacts to non-target wildlife	vii. encourage non-toxic ammunition use
5.2 Gathering Terrestrial Plants	a) unregulated collection of edible/medicinal plants for commercial use/sale b) spreading invasive species	i. increase enforcement and deterrents ii. public education and outreach
5.3 Logging & Wood Harvest	a) not a threat	i. use as management tool to restore grassland
5.4 Fishing & Harvesting Aquatic Resources	a) anthropogenic disturbance to grassland associated wildlife, e.g. off-road travel b) disturbance/movement can proliferate noxious/invasive weeds c) poaching	i. urge ecologically responsible ordinances ii. increase enforcement and deterrents iii. public education and outreach
6. HUMAN INTRUSIONS & DISTURBANCE		
6.1 Recreational Activities	a) damage to grassland habitat from off-road vehicles and trail establishment/fragmentation b) anthropogenic disturbance to grassland associated wildlife, e.g. off-road travel, geocaching, paintball, unauthorized camping c) littering d) proliferate noxious/invasive weeds e) potential for wildfires, either accidental or from negligent actions f) discouraging proper management of grasslands	i. restrict or eliminate off-road vehicle use in environmentally sensitive areas ii. engage in early consultation with the siting of recreational areas iii. urge ecologically responsible ordinances iv. increase enforcement, deterrents and fines v. public education and outreach vi. promote equipment and off-road vehicle hygiene to prevent the spread of noxious weeds
6.2 Military Exercises	a) anthropogenic disturbance to grassland associated wildlife	i. support responsible processes
6.3 Work & Other Activities	a) anthropogenic disturbance to grassland associated wildlife	i. urge ecologically responsible ordinances
7. NATURAL SYSTEMS MODIFICATIONS		
7.1 Fire & Fire Suppression	a) fire suppression results in woody encroachment, succession, loss of native diversity, and increase in wildfire risk or severity due to increased fuel loads b) lack of funding for fire management c) public resistance to use of prescribed fire/controlled burns d) insufficient awareness regarding the advantages of prescribed fire/controlled burns	i. offer incentives and programs to implement prescribed fire/controlled burns ii. support fire coalitions and cooperative ventures iii. obtain funding for fire management programs, staff and training iv. involve and educate rural or local fire departments v. develop fire management plans vi. public education and outreach vii. support pro-prescribed fire strategies viii. encourage post-fire reclamation
7.2 Dams & Water Management/ Use	a) conversion of grassland to impoundment b) may proliferate concentration of salts, heavy metals, etc.	i. offer incentives and programs for alternative water sources, e.g. wells, portable water ii. reclaim deteriorating dams and dugouts

CLASSIFICATION	THREAT TO GRASSLAND	CONSERVATION ACTION
	c) addition of water may proliferate the spread of West Nile virus and other diseases to grassland associated wildlife d) inappropriate movement of water as water management e) change in water infiltration rates f) tile and surface drainage g) hydrological impacts from irrigation and ditching h) degradation of grasslands from livestock congregation at dams and impoundments	iii. education about dynamic water systems and water management iv. incentivize buffers/exclusion zones
7.3 Other Ecosystem Modification	a) loss of pollinators b) loss of native plant diversity c) diminishing soil health, e.g. compaction and loss of water infiltration d) changes in water systems e) loss of genetics for both plants and wildlife f) noxious weeds and invasive plants g) improper use of herbicides h) improper placement of woody vegetation	i. promote diversity ii. plant diverse grass and forb mixes and pollinator plantings iii. promote soil health iv. ecosystem education and awareness v. follow/implement best management practices for timing and frequency of mowing vi. follow/implement best management practices for windbreaks or woody plantings
7.4 Removing / Reducing Human Maintenance	a) loss of indigenous peoples management regimes, e.g. loss of fires set by indigenous peoples	i. include indigenous peoples culture and values
8. INVASIVE & PROBLEMATIC SPECIES, PATHOGENS & GENES		
8.1 Invasive Non-Native / Alien Plants & Animals	a) spread and proliferation of invasive or detrimental plants, e.g. Kentucky bluegrass, smooth brome b) spread and proliferation of noxious weeds c) spread and proliferation of invasive woody vegetation d) feral and free-roaming domestic animals e) hybridization concern	i. removal or reduction of invasive or detrimental plants using grazing, fire, chemical and mechanical treatments ii. removal or reduction of noxious weeds using grazing, fire, chemical, mechanical and biological treatments iii. prohibit or disincentive new seeding of invasive or detrimental plants, particularly Kentucky bluegrass and smooth brome iv. incentivize native plant seeding v. develop recommended plant lists and sources of local ecotype seed vi. engage the horticultural industry to educate and promote recommended plants and reduce the use of problematic invasive or detrimental plants vii. public education and outreach viii. support programs and initiatives to reduce or remove feral animals from native habitat ix. encourage pet owners to keep animals indoors, in an outdoor enclosure, or on a leash, to protect both the welfare of the animal and wildlife x. research control or reduction of invasive plants xi. incentivize and promote adaptive management or climate informed approach xii. engage in climate adaptation strategies

CLASSIFICATION	THREAT TO GRASSLAND	CONSERVATION ACTION
8.2 Problematic Native Species	a) spread and proliferation of native woody vegetation, e.g. Eastern red cedar, Rocky Mountain juniper, aspen and Western snowberry b) grasshoppers	i. removal or reduction of undesirable native plants using grazing, fire, chemical and mechanical treatments ii. develop programs and incentives for woody invasive management, including outreach and education programs iii. promote natural control iv. public education and outreach v. consider climate adaptation in woody species management
8.3 Introduced Genetic Material	a) genetically modified plants enable the use of a broad range of pesticides and herbicides b) increase of herbicide resistant plants c) risk of loss of genetics with plants and wildlife d) neonicotinoid effects on non-target organisms	i. promote pragmatic use of herbicides and pesticides
8.4 Pathogens & Microbes		
9. POLLUTION		
9.1 Domestic & Urban Waste Water	a) pipeline leaks b) inappropriate disposal of untreated sewage c) non-point runoff from housing and urban areas, e.g. fertilizer and pesticides from lawns and golf courses	i. require pipeline warning system for leak detection ii. improve reporting and disclosure of incidents iii. increase enforcement and deterrents iv. public education and outreach
9.2 Industrial & Military Effluents	a) pipeline leaks, e.g. oil and brine water b) oil and brine water spills at production or exploration facilities c) oil and brine water spills during transportation d) inappropriate disposal of brine water e) inappropriate disposal of radioactive waste f) coal mining and coal-fired power plant waste seepages	i. require pipeline warning system for leak detection ii. require check valves to contain oil in pipeline in the event of a pipeline rupture iii. improve reporting and disclosure of incidents iv. quantify the magnitude of incidents, full disclosure of environmental impact v. increase enforcement, deterrents and fines vi. support policies to update deteriorating infrastructure
9.3 Agriculture & Forestry Effluents	a) fertilizer and pesticide runoff from cropland b) runoff from improperly designed or sited feedlots	i. require warning system for waste leakage detection ii. require full containment feedlot runoff control system iii. improve reporting and disclosure of incidents iv. quantify the magnitude of incidents, full disclosure of environmental impact v. increase enforcement, deterrents and fines
9.4 Garbage & Solid Waste	a) illegal waste sites b) litter	i. improve reporting and disclosure of incidents ii. increase enforcement, deterrents and fines
9.5 Air-borne Pollutants	a) dust, e.g. from increased traffic on gravel roads, mines or quarries, coal-fired power plants, b) pesticide or herbicide drift c) hydrogen sulfide d) excess carbon dioxide e) wind dispersion of nutrients, pollution, or sediments f) wildfire smoke	i. require warning system for air-borne pollutant detection ii. quantify the magnitude of incidents, full disclosure of environmental impact iii. increase enforcement, deterrents and fines iv. promote carbon credits

CLASSIFICATION	THREAT TO GRASSLAND	CONSERVATION ACTION
9.6 Excess Energy	a) light and thermal pollution causing disturbance to grassland associated wildlife, e.g. from natural gas flaring or urban areas b) noise pollution, e.g. from increased traffic, work sites c) data center disturbance to wildlife, e.g., noise, heat	i. improve reporting and disclosure of incidents ii. quantify the magnitude of incidents, full disclosure of environmental impact iii. increase enforcement, deterrents and fines
10. GEOLOGICAL EVENTS		
10.3 Avalanches / Landslides	a) land sloughing	i. offer incentives or programs for sensitive or susceptible land
11. CLIMATE CHANGE		
11.1 Ecosystem Encroachment	a) changes in species composition b) changes in phenology c) changes in species life cycle requirements d) timing and intensity of weather events	i. alter management plans to adapt to predicted changes ii. provide habitat connectivity to ease species shifts iii. research predicted changes and potential impacts iv. monitor effect of changes v. some change is natural, dynamic landscape
11.2 Changes Geochemical Regimes		
11.3 Changes Temperature Regimes	a) proliferates invasive plants b) limits management actions c) loss of wildlife or plant production d) increased mortality of wildlife	i. establish grassbanks between state/federal/non-governmental land and private ranches ii. promotion of cover crops and soil health
11.4 Changes Precipitation & Hydrological Regimes	a) proliferates invasive plants b) limits management actions c) loss of wildlife or plant production	i. establish grassbanks between state/federal/non-governmental land and private ranches ii. promotion of cover crops and soil health
11.5 Severe / Extreme Weather Events	a) siltation, sedimentation and erosion b) proliferate invasive plants	i. offer incentives and programs to protect, enhance, and restore grasslands ii. incentivize buffers
12. OTHER		
12.1 Human Dimensions	a) social apathy of the value of healthy grasslands and ecosystem services they provide b) lack of knowledge of grassland ecosystem c) view of grasslands as being of no significance, e.g. “wasteland” d) public misconception that livestock are bad for the environment	i. increase awareness, understanding, and appreciation of the grassland ecosystem and ecosystem services ii. public education and outreach iii. support grassland coalitions iv. provide demonstration sites v. incorporate grassland education into K-12 classrooms vi. human dimension research/surveys

WETLANDS AND LAKES THREATS AND ACTIONS

Table 30. Direct threats and conservation actions for wetlands and lakes.
Threats and actions are not listed in order of priority.

CLASSIFICATION	THREAT TO WETLANDS AND LAKES	CONSERVATION ACTION
1. RESIDENTIAL & COMMERCIAL DEVELOPMENT		
1.1 Housing & Urban Areas	a) conversion of wetlands to urban development b) loss of federal jurisdiction of wetlands (i.e. Section 404) c) vegetation planted for ornamental purposes can invade adjacent wetlands d) mowing of adjacent wetland vegetation for ornamental grooming e) pesticide/herbicide application and drift impacts adjacent plant/wildlife species composition f) loss of grazing and burning of grasslands near urban and recreational areas g) predation of wetland wildlife by domestic animals near urban areas h) modification of wetland basins within urban areas to create lakes	i. offer incentives and programs to protect, enhance, and restore wetlands ii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iii. avoid and minimize impacts to wetlands; mitigate unavoidable impacts iv. work with partners to develop ecologically responsible urban planning and zoning v. work with partners to develop ecologically responsible urban and county policies vi. public education and outreach for native landscaping and management vii. increase awareness, understanding, and appreciation of the wetland ecosystem viii. promote responsible and conscientious use of pesticides
1.2 Commercial & Industrial Areas	a) conversion of wetlands to commercial and industrial development b) loss of federal jurisdiction of wetlands (i.e. Section 404) c) disturbance associated with development can proliferate noxious/invasive weeds	i. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures ii. avoid and minimize impacts to wetlands; mitigate unavoidable impacts iii. work with partners to develop ecologically responsible urban planning and zoning iv. work with partners to develop ecologically responsible ordinances and suitable reclamation standards v. education and outreach for native landscaping and management
1.3 Tourism & Recreational Areas	a) expanding lake cabin developments b) disturbance associated with recreation development can disperse noxious/invasive weeds c) pesticide application and drift impacts adjacent plant/wildlife species composition d) unrestrained domestic animals can harass wildlife e) improper management of wetlands within recreational areas	i. urge ecologically responsible ordinances ii. public education and outreach for native landscaping and management iii. encourage appropriate management of wetlands iv. promote responsible and conscientious use of pesticides
2. AGRICULTURE		
2.1 Annual & Perennial Non-Timber Crops	a) conversion of wetlands to cropland development b) tile and surface drainage of wetlands	i. offer incentives and programs to protect, enhance, and restore wetlands

CLASSIFICATION	THREAT TO WETLANDS AND LAKES	CONSERVATION ACTION
	c) inappropriate drainage of wetlands onto neighboring properties d) displacement of wetland wildlife during conversion process e) pesticide application and drift impacts on adjacent plant/wildlife species composition f) increase in soil erosion and sedimentation into wetlands from lack of residual cover on cropland g) impacts to water table and water infiltration rates h) salinization of land that has been converted to cropland i) increase of pesticides and herbicides with new crop development j) increase of noxious weeds and invasive plants when wetlands are disturbed k) regulations or incentives that support the conversion of wetlands to cropland development	ii. use a targeted approach to protect, enhance, and restore the most vulnerable wetlands and/or those of high ecological value and connectivity iii. development of offsets for marginal cropland/wetlands iv. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures v. maintain and enforce Farm Bill regulatory provisions (i.e. swampbuster) vi. include isolated wetlands in Section 404 and offer incentives and programs to maintain, restore or enhance, including grassland buffers vii. offer incentives for wildlife friendly farming, tax-based or direct payments (e.g. cropped wetlands program) viii. flowage easements for downstream drainage ix. offer midterm conservation agreement for wetland management and protection x. support demo projects and best management practices, public outreach and education for wetlands xi. explore new techniques to address impacts to water table xii. promotion of cover crops and soil health xiii. promote responsible and conscientious use of pesticides xiv. promote equal risk management for grassland-based agriculture, to keep grassland and wetland complexes intact xv. reduce bottlenecks to public participation in compliance (regional rules)
2.3 Livestock Farming & Ranching	a) heavy grazing in and around wetlands resulting in total loss of aquatic plants b) disturbance, erosion, and decline in soil health in high livestock traffic areas c) shift from ranching (pro-grass) lifestyle to confined animal feeding operations d) inappropriate fencing (i.e. not wildlife-friendly) e) regulations or incentives that support the conversion of wetlands f) public perception that livestock are bad for the climate and lack of knowledge on the importance of grasslands and wetlands for carbon sequestration and storage g) increase of noxious weeds and invasive plants from poor grazing management practices h) changing farm demographics resulting in shift from livestock ranching to crop production, loss of connection to the land, and loss of rural community lifestyle	i. offer incentives and programs to protect, enhance, and restore wetlands ii. encourage grazing as a grassland management tool for high resistance and resilience iii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iv. incentivize good grazing management v. promote and support regenerative grazing management, use best management practices or ecological site descriptions vi. support grazing lands coalitions and work with grass-based agriculture groups vii. promote equal risk management for grassland-based agriculture viii. use best management practices or ecological site descriptions ix. assessment of economic and ecological values of grasslands and associated wildlife, ecosystem services

CLASSIFICATION	THREAT TO WETLANDS AND LAKES	CONSERVATION ACTION
		x. promote carbon credits, biodiversity credits xi. encourage temporary or virtual fencing when possible, discourage fencing through wetlands xii. promote off-site watering systems for cattle xiii. promote responsible livestock practices that minimize disease spread (i.e. double fences, appropriate removal of carcasses, etc.) xiv. educate the public on the benefits of working grasslands and wetlands
3. ENERGY PRODUCTION & MINING		
3.1 Oil & Gas Drilling	a) conversion of wetlands to well pads, field or production facilities b) fragmentation of wetlands from well pads, field or production facilities, access roads c) dewatering wetlands and lakes for frack water d) disturbance associated with oil and gas development can proliferate noxious/invasive weeds e) loss of federal jurisdiction of wetlands (i.e. Section 404) f) inadequate or improper reclamation g) illegal dumping of materials and waste h) illegal filling of wetlands i) anthropogenic disturbance to wetland associated wildlife, e.g. dust, light and noise pollution j) social apathy to negative ecological impacts of oil and gas drilling k) governance apathy to negative ecological impacts of oil and gas drilling	i. well pad and facility consolidation, minimize footprint of development ii. engage in early consultation with the siting of well pads iii. avoid and minimize impacts to wetlands; mitigate unavoidable impacts iv. follow/implement best management practices v. incentivize companies for implementing ecologically sound development vi. urge ecologically responsible ordinances and suitable reclamation standards and foster relationships with oil companies to stimulate ecologically sound development vii. urge requirements to promptly reclaim dry or abandoned wells viii. enforce regulatory compliance and close loopholes which are used to delay or avoid reclamation ix. public education and outreach x. public disclosure of impacts/footprint xi. research the impacts of oil and gas drilling on wetlands and wildlife xii. explore novel alternatives to offset impacts of oil and gas development
3.2 Mining & Quarrying	a) conversion of wetlands to mines or quarries b) anthropogenic disturbance to wetland associated wildlife c) unregulated gravel pit management d) inadequate or improper reclamation e) creates wetlands that act as ecological sinks f) increase of noxious weeds and invasive plants when land is mined	i. minimize footprint of development ii. avoid and minimize impacts to wetlands; mitigate unavoidable impacts iii. suitable reclamation standards iv. promote or develop local and state ordinances v. delay or halt mining/quarrying for new metals or minerals until local ordinances have been approved
3.3 Renewable Energy	a) conversion of wetlands to alternative fuel crops b) fragmentation of wetland complexes by wind or solar facilities c) loss of federal jurisdiction of wetlands (i.e. Section 404) d) direct or indirect mortality of wildlife species from structures	i. offer incentives and programs to protect, enhance, and restore wetlands ii. incentivize companies for implementing ecologically sound development alongside carbon incentives iii. avoid and minimize impacts to wetlands; mitigate unavoidable impacts

CLASSIFICATION	THREAT TO WETLANDS AND LAKES	CONSERVATION ACTION
	e) altered wildlife migrations f) anthropogenic disturbance to grassland associated wildlife, e.g. dust, noise and light pollution displacement of wildlife	iv. urge ecologically responsible ordinances and suitable reclamation standards v. urge accountability for ecological impacts vi. minimize footprint of development vii. research and model to determine best areas for placement to minimize impacts to wildlife viii. use livestock to control weeds ix. establish pollinator-friendly plantings under solar arrays
4. TRANSPORTATION & SERVICE CORRIDORS		
4.1 Roads & Railroads	a) conversion of wetlands to roads and railroads b) fragmentation of wetland complexes by roads and railroads c) roads acting as dams d) anthropogenic disturbance to wetland associated wildlife, e.g. noise, dust e) proliferate noxious/invasive weeds f) road and railway incident secondary effects, e.g. spills and explosions, run-off g) improper herbicide uses in railroad rights-of-way h) road salt impacts to roadside plants and rights-of way	i. urge ecologically responsible ordinances and suitable reclamation standards ii. avoid and minimize impacts to wetlands; mitigate unavoidable impacts iii. appropriate road restrictions, including speed limits iv. timing restrictions for construction v. use pipelines versus trucking liquids and gas vi. use native local ecotype seed, including pollinator-friendly, when seeding road rights-of-way vii. promote wetland restoration and creation to minimize flooding impacts to roads/infrastructure
4.2 Utility & Service Lines	a) fragmentation of wetland complexes by utility and service lines b) disturbance associated with development of utility and service lines can proliferate noxious/invasive weeds c) inadequate reclamation d) intensification and accumulation of infrastructure e) direct mortality of wildlife species, particularly birds, by collision or electrocution	i. consolidate corridors ii. encourage buried lines when feasible iii. urge ecologically responsible ordinances and suitable reclamation standards iv. engage in early consultation with the siting of utility and service lines v. avoid and minimize impacts to wetlands; mitigate unavoidable impacts vi. timing restrictions for construction vii. require line marking devices viii. use avian protection plans or guidance documents to minimize bird/powerline interactions ix. use native local ecotype seed, including pollinator-friendly, when reseeding easement rights-of-way
5. BIOLOGICAL RESOURCE USE		
5.1 Hunting & Collecting Terrestrial Animals	a) anthropogenic disturbance to wetland associated wildlife, e.g. off-road travel, dog training during nesting season and brood rearing period b) disturbance/movement can proliferate noxious/invasive weeds c) insufficient regulations for collection or harvest of certain wildlife, e.g. reptiles and amphibians d) poaching e) lead ammunition impacts to non-target wildlife	i. urge ecologically responsible ordinances ii. increase enforcement and deterrents iii. public education and outreach iv. reevaluate or develop regulations pertaining to collection or harvest of certain wildlife, e.g. reptiles and amphibians v. amend dog training laws and regulations to minimize impacts to wildlife during sensitive life cycle periods vi. encourage non-toxic ammunition use

CLASSIFICATION	THREAT TO WETLANDS AND LAKES	CONSERVATION ACTION
5.4 Fishing & Harvesting Aquatic Resources	a) anthropogenic disturbance to wetland associated wildlife, e.g. off-road travel b) disturbance/movement can proliferate noxious/invasive weeds c) wildlife value orientations or changing public attitudes towards wildlife, e.g. stimulate illegal fishing/collection of aquatic species, or promote the introduction of nonnative species for fishing d) insufficient regulations for collection or harvest of certain wildlife, e.g. amphibians e) spread of aquatic nuisance species f) unregulated commercial take of aquatic resources g) poaching	i. urge ecologically responsible ordinances ii. increase enforcement, deterrents and fines iii. reevaluate laws pertaining to wetland associated wildlife iv. public education and outreach v. reevaluate or develop regulations pertaining to collection or harvest of certain wildlife, e.g. amphibians vi. follow aquatic nuisance species regulations and recommendations
6. HUMAN INTRUSIONS & DISTURBANCE		
6.1 Recreational Activities	a) damage to wetland habitat from off-road vehicles b) anthropogenic disturbance to wetland or lake associated wildlife, e.g. boating c) impacts to shoreline and submerged vegetation from wake boating d) littering e) spread of aquatic nuisance species	i. restrict or eliminate off-road vehicle use in environmentally sensitive areas ii. increase enforcement, deterrents and fines iii. public education and outreach iv. develop regulations for wake boat use v. follow aquatic nuisance species regulations and recommendations
6.2 Military Exercises	a) anthropogenic disturbance to wetland associated wildlife	i. support responsible processes
6.3 Work & Other Activities	a) anthropogenic disturbance to wetland associated wildlife	i. urge ecologically responsible ordinances
7. NATURAL SYSTEMS MODIFICATIONS		
7.1 Fire & Fire Suppression	a) fire suppression results in woody encroachment or cattail invasion b) public resistance to use of prescribed fire/controlled burns c) insufficient awareness regarding the advantages of prescribed fire/controlled burns d) improper timing or use of fire, e.g. burning wetlands in the fall for spring crop development e) insufficient awareness regarding the advantages of prescribed fire/controlled burns	i. offer incentives and programs to implement prescribed fire/controlled burns ii. public education and outreach iii. support pro-prescribed fire strategies i. research the effects of fire management ii. develop fire management plans iii. proper timing of prescribed fire/controlled burns
7.2 Dams & Water Management/ Use	a) conversion of natural wetland or other existing habitat to impoundment b) wetland consolidation c) impoundments may proliferate concentration of salts, heavy metals, etc. d) inappropriate movement of water as water management e) change in water infiltration rates f) hydrological impacts from irrigation and ditching	i. offer incentives and programs to protect, enhance, and restore wetlands ii. offer incentives and programs for alternative water sources, e.g. wells, portable water iii. reclaim deteriorating dams and dugouts iv. education about dynamic water systems and water management v. incentivize buffers/exclusion zones vi. exclude impoundments in ecologically sensitive or inappropriate areas

CLASSIFICATION	THREAT TO WETLANDS AND LAKES	CONSERVATION ACTION
	g) degradation of grasslands from livestock congregation at dams and impoundments	vii. monitor and research water quality viii. construct fish passages on existing dams
7.3 Other Ecosystem Modification	a) loss of hygrophyte diversity b) diminishing soil health, e.g. compaction and loss of water infiltration c) changes in water systems d) tile and surface drainage e) amplification of run-off events f) modification of watersheds g) channelization	i. promote wetland plant diversity ii. promote soil health iii. ecosystem education and awareness iv. research impacts of tile drainage on wetland ecosystems v. research and inventory aquatic invertebrates within diverse wetlands (stage and health)
7.4 Removing / Reducing Human Maintenance	a) loss of indigenous peoples management regimes	i. include indigenous peoples culture and values
8. INVASIVE & PROBLEMATIC SPECIES, PATHOGENS & GENES		
8.1 Invasive Non-Native / Alien Plants & Animals	a) spread and proliferation of invasive or detrimental plants, e.g. hybrid cattail b) spread and proliferation of noxious weeds c) spread and proliferation of invasive woody vegetation d) aquatic nuisance species e) feral and free-roaming domestic animals f) fish stocking	i. removal or reduction of invasive or detrimental plants using grazing, fire, chemical and mechanical treatments ii. removal or reduction of noxious weeds using grazing, fire, chemical, mechanical and biological treatments iii. develop recommended plant lists and sources of local ecotype seed iv. engage the horticultural industry to educate and promote recommended plants and reduce the use of problematic invasive or detrimental plants v. public education and outreach vi. support programs and initiatives to reduce or remove feral animals from native habitat vii. encourage pet owners to keep animals indoors, in an outdoor enclosure, or on a leash, to protect both the welfare of the animal and wildlife viii. research control or reduction of invasive plants ix. evaluate impacts of fish stocking, decrease rates or do not stock fish in ecologically sensitive wetlands x. follow aquatic nuisance species regulations and recommendations
8.2 Problematic Native Species	a) Spread and proliferation of reed canarygrass	i. removal or reduction of undesirable native plants using grazing, fire, chemical and mechanical treatments
8.3 Introduced Genetic Material	a) genetically modified plants enable the use of a broad range of pesticides and herbicides b) increase of herbicide resistant plants c) neonicotinoid effects on non-target organisms	i. promote pragmatic use of herbicides and pesticides
8.4 Pathogens & Microbes		
9. POLLUTION		

CLASSIFICATION	THREAT TO WETLANDS AND LAKES	CONSERVATION ACTION
9.1 Domestic & Urban Waste Water	a) pipeline leaks b) inappropriate disposal of untreated sewage c) septic system drainage into wetlands and lakes d) non-point runoff from housing and urban areas, e.g. fertilizer and pesticides from lawns and golf courses	i. require pipeline warning system for leak detection ii. improve reporting and disclosure of incidents iii. increase enforcement and deterrents iv. encourage building setback, no structures within 100 feet (minimum) of wetland or lake v. require septic setback, or lagoon septic systems vi. incentivize wetland buffers vii. discourage fertilizer use
9.2 Industrial & Military Effluents	a) pipeline leaks, e.g. oil and brine water b) oil and brine water spills at production or exploration facilities c) oil and brine water spills during transportation d) inappropriate disposal of brine water e) inappropriate disposal of radioactive waste f) coal mining and coal-fired power plant waste seepages g) nonpoint runoff from military bases	i. require pipeline warning system for leak detection ii. require check valves to contain oil in pipeline in the event of a pipeline rupture iii. improve reporting and disclosure of incidents iv. quantify the magnitude of incidents, full disclosure of environmental impact v. increase enforcement, deterrents and fines
9.3 Agriculture & Forestry Effluents	a) fertilizer and pesticide runoff from cropland b) runoff from improperly designed or sited feedlots c) livestock excrement and urine, point source pollution d) tile drainage, nonpoint source pollution	i. require warning system for waste leakage detection ii. require full containment feedlot runoff control system iii. improve reporting and disclosure of incidents iv. quantify the magnitude of incidents, full disclosure of environmental impact v. promote and support regenerative grazing vi. increase enforcement, deterrents and fines vii. follow/implement best management practices
9.4 Garbage & Solid Waste	a) illegal waste sites b) litter	i. improve reporting and disclosure of incidents ii. increase enforcement, deterrents and fines
9.5 Air-borne Pollutants	a) dust, e.g. from increased traffic on gravel roads, mines or quarries, coal-fired power plants, b) pesticide or herbicide drift c) hydrogen sulfide d) excess carbon dioxide, released during wetland tillage e) wind dispersion of nutrients, pollution, or sediments f) mercury contamination from wildfire smoke	i. require warning system for air-borne pollutant detection ii. quantify the magnitude of incidents, full disclosure of environmental impact iii. increase enforcement, deterrents and fines iv. promote carbon credits
9.6 Excess Energy	a) light and thermal pollution causing disturbance to grassland associated wildlife, e.g. from natural gas flaring or urban areas b) noise pollution, e.g. from increased traffic, work sites c) data center disturbance to wildlife, e.g., noise, heat	i. improve reporting and disclosure of incidents ii. quantify the magnitude of incidents, full disclosure of environmental impact iii. increase enforcement, deterrents and fines
10. GEOLOGICAL EVENTS		
10.3 Avalanches / Landslides	a) land sloughing	i. offer incentives or programs for sensitive or susceptible land ii. incentive wetland buffers

CLASSIFICATION	THREAT TO WETLANDS AND LAKES	CONSERVATION ACTION
11. CLIMATE CHANGE		
11.1 Ecosystem Encroachment	a) changes in species composition b) changes in phenology c) changes in species life cycle requirements d) timing and intensity of weather events	i. alter management plans to adapt to predicted changes ii. provide habitat connectivity to ease species shifts iii. research predicted changes and potential impacts iv. monitor effect of changes v. some change is natural, dynamic landscape
11.2 Changes Geochemical Regimes		
11.3 Changes Temperature Regimes	a) proliferates invasive plants b) limits management actions c) loss of wildlife or plant production d) increased mortality of wildlife	i. offer incentives and programs to protect, enhance, and restore wetlands
11.4 Changes Precipitation & Hydrological Regimes	a) proliferates invasive plants b) increase duration and frequency c) changes to wet/dry cycle	i. alter management plans
11.5 Severe / Extreme Weather Events	a) siltation, sedimentation and erosion b) proliferate invasive plants c) consolidation of wetlands from flooding or prolonged wet periods	i. offer incentives and programs to protect, enhance, and restore wetlands ii. incentivize buffers
12. OTHER		
12.1 Human Dimensions	a) social apathy of the value of healthy wetlands and ecosystem services b) lack of knowledge of wetlands ecosystem c) view of wetlands as being of no significance, e.g. “wasteland” d) public misconception that livestock are bad for the environment	i. increase awareness, understanding, and appreciation of the wetland ecosystem and ecosystem services ii. public education and outreach iii. provide demonstration sites iv. incorporate wetland education into K-12 classrooms v. human dimension research/surveys

RIVERS, STREAMS AND RIPARIAN THREATS AND ACTIONS

Table 31. Direct threats and conservation actions for rivers, streams and riparian.

Threats and actions are not listed in order of priority.

CLASSIFICATION	THREAT TO RIVERS, STREAMS & RIPARIAN	CONSERVATION ACTION
1. RESIDENTIAL & COMMERCIAL DEVELOPMENT		
1.1 Housing & Urban Areas	a) conversion of riparian to urban development b) streambank and shoreline stabilization c) channelization d) vegetation planted for ornamental purposes can invade adjacent wetlands e) mowing of aquatic or riparian vegetation for ornamental grooming f) pesticide/herbicide application and drift impacts adjacent plant/wildlife species composition g) predation of wetland wildlife by domestic animals near urban areas h) increased or altered runoff due to non-porous surface increases	i. offer incentives and programs to protect, enhance, and restore rivers, streams and riparian ii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iii. avoid and minimize impacts to aquatic systems; mitigate unavoidable impacts iv. implement soil bioengineering for streambank and shoreline stabilization v. work with partners to develop ecologically responsible urban planning and zoning policies vi. public education and outreach for native landscaping and management vii. increase awareness, understanding, and appreciation of the river or stream ecosystem viii. promote responsible and conscientious use of pesticides
1.2 Commercial & Industrial Areas	a) conversion of riparian to commercial and industrial development b) streambank and shoreline stabilization c) channelization d) water withdrawal and entrapment and impingement e) potential for spills	i. avoid and minimize impacts to aquatic systems; mitigate unavoidable impacts ii. implement soil bioengineering for streambank and shoreline stabilization iii. protection of instream flows iv. implement entrainment and impingement reduction recommendations, best management practices v. work with partners to develop ecologically responsible urban planning and zoning vi. work with partners to develop ecologically responsible ordinances and suitable reclamation standards vii. maintain appropriate water management
1.3 Tourism & Recreational Areas	a) expanding cabin developments b) dock/marina development c) disturbance associated with recreation development can disperse noxious/invasive weeds d) increased chemical or pesticide application and drift impacts adjacent plant/wildlife species composition e) unrestrained domestic animals can harass wildlife	i. urge ecologically responsible ordinances ii. promote responsible and conscientious use of pesticides
2. AGRICULTURE		

CLASSIFICATION	THREAT TO RIVERS, STREAMS & RIPARIAN	CONSERVATION ACTION
2.1 Annual & Perennial Non-Timber Crops	a) conversion of riparian to cropland development b) displacement of riparian associated wildlife during conversion process c) channelization and dredging d) pesticide application and drift impacts on adjacent plant/wildlife species composition e) increase in soil erosion and sedimentation into wetlands from lack of residual cover on cropland f) impacts to water table and water infiltration rates g) water withdrawal for irrigation and entrapment and impingement h) tile drainage, wetland loss and altered hydrology i) increase of noxious weeds and invasive plants when riparian areas are disturbed	i. offer incentives and programs to protect, enhance, and restore rivers, streams and riparian, and uplands, i.e. grasslands and wetlands ii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iii. protection of instream flows iv. maintain and enforce Farm Bill regulatory provisions v. offer incentives for aquatic friendly farming, tax-based or direct payments vi. offer midterm conservation agreements for riparian management and protection vii. support demo projects and best management practices, including public outreach and education on ecosystem services that riparian systems provide viii. explore new techniques to address impacts to water table ix. promotion of cover crops and soil health x. implement entrainment and impingement reduction recommendations, best management practices xi. develop and implement watershed plans xii. use forestry best management practices for wooded riparian xiii. integrated pest management xiv. promote responsible and conscientious use of pesticides
2.3 Livestock Farming & Ranching	a) heavy grazing in and around rivers and streams resulting in total loss of aquatic or riparian vegetation b) disturbance, erosion, and decline in soil health in high livestock traffic areas c) shift from ranching (pro-grass) lifestyle to confined animal feeding operations d) pesticide runoff e) waste runoff f) inappropriate fencing (i.e. not wildlife-friendly) g) increase of noxious weeds and invasive plants from poor grazing management practices	i. offer incentives and programs to protect, enhance, and restore rivers, streams and riparian ii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iii. incentivize good grazing management iv. fence livestock out of waterways and shorelines v. offer incentives and programs for alternative water sources, e.g. wells, portable water vi. promote and support regenerative grazing management, use best management practices or ecological site descriptions vii. support grazing lands coalitions, work with grass-based agriculture groups, and associated outreach activities viii. use best management practices or ecological site descriptions ix. feedlot setbacks x. develop crucial habitat maps or species avoidance areas xi. develop watershed plans

CLASSIFICATION	THREAT TO RIVERS, STREAMS & RIPARIAN	CONSERVATION ACTION
		xii. encourage temporary or virtual fencing when possible, discourage fencing across rivers and streams xiii. promote off-site watering systems for cattle xiv. promote responsible livestock practices that minimize disease spread (i.e. double fences, appropriate removal of carcasses, etc.)
2.4 Freshwater Aquaculture	a) illegal introductions	i. increase enforcement, deterrents and fines
3. ENERGY PRODUCTION & MINING		
3.1 Oil & Gas Drilling	a) conversion of riparian to well pads, field or production facilities b) fragmentation of riparian from well pads, field or production facilities, access roads c) illegal dewatering rivers and streams for frack water d) disturbance associated with oil and gas development can proliferate noxious/invasive weeds e) inadequate or improper reclamation f) illegal dumping of materials and waste or incidental spill g) anthropogenic disturbance to aquatic system associated wildlife, e.g. dust, light and noise pollution h) social apathy to negative ecological impacts of oil and gas drilling i) governance apathy to negative ecological impacts of oil and gas drilling	i. well pad and facility consolidation, minimize footprint of development ii. increase deterrents and fines iii. foster relationships with oil companies to stimulate ecologically sound development iv. engage in early consultation with the siting of well pads v. avoid and minimize impacts to aquatic systems; mitigate unavoidable impacts vi. follow/implement best management practices vii. incentivize companies for implementing ecologically sound development viii. urge ecologically responsible ordinances and suitable reclamation standards and foster relationships with oil companies to stimulate ecologically sound development ix. urge requirements to promptly reclaim dry or abandoned wells x. enforce regulatory compliance and close loopholes which are used to delay or avoid reclamation xi. public education and outreach xii. public disclosure of impacts/footprint xiii. research the impacts of oil and gas drilling on streams, rivers and riparian, and wildlife xiv. maintain appropriate water management
3.2 Mining & Quarrying	a) conversion of streams or riparian to mines or quarries b) conversion of non-jurisdictional stream beds c) sand and gravel washing in stream d) anthropogenic disturbance to aquatic system associated wildlife e) inadequate or improper reclamation, abandonment f) increase of noxious weeds and invasive plants when land is mined	i. minimize footprint of development ii. avoid and minimize impacts to aquatic systems; mitigate unavoidable impacts iii. protection of instream flows iv. best management practices, e.g. gabion-lined channel v. follow suitable reclamation standards vi. proper setback vii. promote or develop local and state ordinances viii. delay or halt mining/quarrying for new metals or minerals until local ordinances have been approved
3.3 Renewable Energy	a) conversion of riparian to energy facility b) fragmentation of aquatic complexes by wind or solar facilities	i. offer incentives and programs to protect, enhance, and restore rivers, streams and riparian

CLASSIFICATION	THREAT TO RIVERS, STREAMS & RIPARIAN	CONSERVATION ACTION
	c) hydropower interrupts the river continuum d) direct or indirect mortality of wildlife species from structures e) altered wildlife migrations f) anthropogenic disturbance to aquatic or riparian associated wildlife, e.g. dust, noise and light pollution displacement of wildlife	ii. incentivize companies for implementing ecologically sound development alongside carbon incentives iii. avoid and minimize impacts to aquatic systems; mitigate unavoidable impacts iv. urge ecologically responsible ordinances and suitable reclamation standards v. urge accountability for ecological impacts vi. minimize footprint of development vii. dam removal or modification viii. research and model to determine best areas for placement to minimize impacts to wildlife ix. use livestock to control weeds x. establish pollinator-friendly plantings under solar arrays
4. TRANSPORTATION & SERVICE CORRIDORS		
4.1 Roads & Railroads	a) conversion of riparian to roads and railroads b) fragmentation of aquatic complexes by roads and railroads c) roads functioning as dams d) culverts, alter natural water movement or promote unnatural movement e) erosion and sedimentation f) anthropogenic disturbance to aquatic system associated wildlife, e.g. noise, dust g) direct mortality of wildlife species with vehicles or trains h) proliferate noxious/invasive weeds i) road and railway incidents secondary effects, e.g. spills and explosions, run-off j) inadequate reclamation k) improper herbicide uses in railroad rights-of-way l) road salt impacts to roadside plants and rights-of way	i. urge ecologically responsible ordinances and suitable reclamation standards ii. avoid and minimize impacts to aquatic systems; mitigate unavoidable impacts iii. use best management practices for erosion and sediment control iv. appropriate road restrictions, including speed limits v. seasonal restrictions for construction vi. use pipelines versus trucking liquids and gas vii. maintain natural corridors or construct wildlife crossings viii. considerations for fish passage at bridge/railroad crossings ix. use native local ecotype seed, including pollinator-friendly, when seeding road rights-of-way x. promote wetland restoration and creation to minimize flooding impacts to roads/infrastructure
4.2 Utility & Service Lines	a) fragmentation of aquatic complexes by utility and service lines b) disturbance associated with development of utility and service lines can proliferate noxious/invasive weeds c) inadequate reclamation d) intensification and accumulation of infrastructure e) direct mortality of wildlife species, particularly birds, by collision or electrocution f) altered predator/prey dynamics	i. consolidate corridors ii. encourage buried lines when feasible iii. urge ecologically responsible ordinances and suitable reclamation standards iv. engage in early consultation with the siting of utility and service lines v. avoid and minimize impacts to aquatic systems; mitigate unavoidable impacts vi. seasonal restrictions for construction vii. require line marking devices ix. use avian protection plans or guidance documents to minimize bird/powerline interactions

CLASSIFICATION	THREAT TO RIVERS, STREAMS & RIPARIAN	CONSERVATION ACTION
		viii. use native local ecotype seed, including pollinator-friendly, when reseeding easement rights-of-way
5. BIOLOGICAL RESOURCE USE		
5.1 Hunting & Collecting Terrestrial Animals	a) anthropogenic disturbance to aquatic or riparian associated wildlife, e.g. off-road travel, dog training during nesting season and brood rearing period b) disturbance/movement can proliferate noxious/invasive weeds c) insufficient regulations for collection or harvest of certain wildlife, e.g. reptiles and amphibians d) poaching e) lead ammunition impacts to non-target wildlife	i. urge ecologically responsible ordinances ii. increase enforcement and deterrents iii. reevaluate or develop regulations pertaining to collection or harvest of certain wildlife, e.g. reptiles and amphibians iv. increase public education and outreach efforts v. amend dog training laws and regulations to minimize impacts to wildlife during sensitive life cycle periods vi. encourage non-toxic ammunition use
5.3 Logging & Wood Harvesting	a) firewood transportation b) inadequate laws	i. increase public education and outreach efforts ii. evaluate current laws and regulations iii. follow firewood cutting and movement regulations
5.4 Fishing & Harvesting Aquatic Resources	a) anthropogenic disturbance to aquatic or riparian associated wildlife, e.g. off-road travel b) disturbance/movement can proliferate noxious/invasive weeds c) wildlife value orientations or changing public attitudes towards wildlife, e.g. stimulate illegal fishing/collection of aquatic species, or promote the introduction of nonnative species for fishing d) insufficient regulations for collection or harvest of certain wildlife, e.g. amphibians e) spread of aquatic nuisance species f) unregulated commercial take of aquatic resources g) poaching	i. urge ecologically responsible ordinances ii. increase enforcement, deterrents and fines iii. reevaluate or develop regulations pertaining to collection or harvest of certain wildlife, e.g. amphibians iv. public education and outreach v. follow aquatic nuisance species regulations and recommendations
6. HUMAN INTRUSIONS & DISTURBANCE		
6.1 Recreational Activities	a) damage to rivers, streams and riparian habitat from off-road vehicles b) anthropogenic disturbance to aquatic or riparian associated wildlife, e.g. boating c) impacts to shoreline and submerged vegetation from wake boating d) littering e) spread of aquatic nuisance species	i. increase enforcement, deterrents and fines ii. restrict or eliminate off-road vehicle use in environmentally sensitive areas iii. increase public education and outreach efforts (i.e. signage) iv. reclamation/rehabilitation v. develop regulations for wake boat use vi. follow aquatic nuisance species regulations and recommendations
6.2 Military Exercises	a) anthropogenic disturbance to aquatic and riparian associated wildlife	i. support responsible processes
6.3 Work & Other Activities	a) anthropogenic disturbance to aquatic and riparian associated wildlife	i. urge ecologically responsible ordinances
7. NATURAL SYSTEMS MODIFICATIONS		

CLASSIFICATION	THREAT TO RIVERS, STREAMS & RIPARIAN	CONSERVATION ACTION
7.1 Fire & Fire Suppression	a) wildfire in riparian habitat b) public resistance to use of prescribed fire/controlled burns	i. increase public education and outreach efforts ii. implement prescribed fire/controlled burns
7.2 Dams & Water Management/ Use	a) conversion of natural stream, river or other existing habitat to impoundment b) impoundments may proliferate concentration of salts, heavy metals, etc. c) low-head dams impeded fish passage d) addition of water may proliferate spread of West Nile virus to riparian associated wildlife e) inappropriate movement of water as water management f) lack of cottonwood regeneration due to altered hydrology g) aggradation/degradation/sedimentation h) change in water infiltration rates i) dry dams or retention dams j) water supply projects	i. offer incentives and programs to protect, enhance, and restore rivers, streams and riparian ii. offer incentives and programs for alternative water sources, e.g. wells, portable water iii. reclaim deteriorating dams and dugouts iv. incentivize low-head dam removal and/or modification v. do not develop dry dams or retention dams vi. education about dynamic water systems and water management vii. incentivize buffers/exclusion zones viii. exclude impoundments in ecologically sensitive or inappropriate areas ix. monitor and research water quality x. develop and implement watershed plans xi. implement best management practices upstream xii. rehabilitate existing dams to incorporate fish passage
7.3 Other Ecosystem Modification	a) loss of hygrophyte diversity b) diminishing soil health, e.g. compaction and loss of water infiltration c) changes in water systems d) tile and surface drainage, impacts to water quality, hydrology and wetland loss e) dry dams and retention dams f) impacts to riparian wildlife g) amplification of run-off events h) modification of watersheds i) channelization	i. promote wetland plant diversity ii. promote soil health iii. ecosystem education and awareness iv. research impacts of tile drainage on wetland ecosystems v. construct fish passages on existing dams vi. re-evaluate surface/subsurface laws, regulations and policies vii. incorporate climate smart native species
7.4 Removing / Reducing Human Maintenance	a) loss of indigenous peoples management regimes	i. include indigenous peoples culture and values
8. INVASIVE & PROBLEMATIC SPECIES, PATHOGENS & GENES		
8.1 Invasive Non-Native / Alien Plants & Animals	a) spread and proliferation of invasive or detrimental plants, e.g. hybrid cattail b) spread and proliferation of noxious weeds c) spread and proliferation of invasive woody vegetation d) spread of invasive insects, e.g. emerald ash borer, Japanese beetle e) aquatic nuisance species f) feral and free-roaming domestic animals	i. removal or reduction of invasive or detrimental plants using grazing, fire, chemical and mechanical treatments ii. removal or reduction of noxious weeds using grazing, fire, chemical, mechanical and biological treatments iii. develop recommended plant lists and sources of local ecotype seed iv. engage the horticultural industry to educate and promote recommended plants and reduce the use of problematic invasive or detrimental plants

CLASSIFICATION	THREAT TO RIVERS, STREAMS & RIPARIAN	CONSERVATION ACTION
	g) fish stocking h) increased pesticide use in riparian areas i) competitive advantage of invasive species	v. public education and outreach vi. follow aquatic nuisance species regulations and recommendations vii. support programs and initiatives to reduce or remove feral animals from native habitat viii. encourage pet owners to keep animals indoors, in an outdoor enclosure, or on a leash, to protect both the welfare of the animal and wildlife ix. research control or reduction of invasive plants x. evaluate impacts of fish stocking, decrease rates or do not stock fish in ecologically sensitive wetlands xi. integrated pest management xii. follow firewood cutting and movement regulations
8.2 Problematic Native Species	a) spread and proliferation of reed canarygrass	i. removal or reduction of undesirable native plants using grazing, fire, chemical and mechanical treatments
8.3 Introduced Genetic Material	a) genetically modified plants enable the use of a broad range of pesticides and herbicides b) increase of herbicide resistant plants c) neonicotinoid effects on non-target organisms d) potential pesticide resistance	i. promote pragmatic use of herbicides and pesticides
8.4 Pathogens & Microbes	a) Dutch elm disease	i. follow firewood cutting and movement regulations ii. increase public education/outreach efforts
9. POLLUTION		
9.1 Domestic & Urban Waste Water	a) pipeline leaks b) inappropriate disposal of untreated sewage c) septic system drainage into rivers and streams d) non-point runoff from housing and urban areas, e.g. fertilizer and pesticides from lawns and golf courses	i. require pipeline warning system for leak detection ii. improve reporting and disclosure of incidents iii. increase enforcement and deterrents iv. encourage building setback, no structures within 100 feet (minimum) of river or stream v. require septic setback, or lagoon septic systems vi. incentivize riparian herbaceous or forest buffers vii. discourage synthetic fertilizer use
9.2 Industrial & Military Effluents	a) pipeline leaks, e.g. oil and brine water b) oil and brine water spills at production or exploration facilities c) oil and brine water spills during transportation d) inappropriate disposal of brine water e) inappropriate disposal of radioactive waste f) coal mining and coal-fired power plant waste seepages g) nonpoint runoff from military bases h) thermal pollution i) emerging contaminants (i.e., PFAS)	i. require pipeline warning system for leak detection ii. require check valves to contain oil in pipeline in the event of a pipeline rupture iii. improve reporting and disclosure of incidents iv. quantify the magnitude of incidents, full disclosure of environmental impact v. increase enforcement, deterrents, and fines vi. additional monitoring vii. improved reclamation and remediation
9.3 Agriculture & Forestry Effluents	a) fertilizer and pesticide runoff from cropland b) runoff from improperly designed or sited feedlots	i. require warning system for waste leakage detection ii. require full containment feedlot runoff control system

CLASSIFICATION	THREAT TO RIVERS, STREAMS & RIPARIAN	CONSERVATION ACTION
	c) livestock excrement and urine (fecal coliform), Escherichia coli, point source pollution d) tile drainage, nonpoint source pollution e) in-stream turbation f) improper disposal of pesticides	iii. improve reporting and disclosure of incidents iv. quantify the magnitude of incidents, full disclosure of environmental impact v. promote and support regenerative grazing vi. increase enforcement, deterrents and fines vii. follow/implement best management practices
9.4 Garbage & Solid Waste	a) illegal waste sites b) litter c) landfill leachate	i. improve reporting and disclosure of incidents ii. increase enforcement, deterrents and fines iii. install monitoring wells
9.5 Air-borne Pollutants	a) dust, e.g. from increased traffic on gravel roads, mines or quarries, coal-fired power plants, b) pesticide or herbicide drift c) hydrogen sulfide d) methane e) CO2 f) decreased photosynthesis g) wind dispersion of nutrients, pollution, or sediments h) mercury contamination from wildfire smoke	i. require warning system for air-borne pollutant detection ii. quantify the magnitude of incidents, full disclosure of environmental impact iii. increase enforcement, deterrents and fines iv. promote carbon credits/sequestration
9.6 Excess Energy	a) light and thermal pollution causing disturbance to riparian associated wildlife, e.g. from natural gas flaring or urban areas b) noise pollution, e.g. from increased traffic, work sites c) data center disturbance to wildlife, e.g., noise, heat	i. improve reporting and disclosure of incidents ii. quantify the magnitude of incidents, full disclosure of environmental impact iii. increase enforcement, deterrents and fines
10. GEOLOGICAL EVENTS		
10.3 Avalanches / Landslides	a) land sloughing b) anthropogenic causes to bank, destabilization	i. offer incentives or programs for sensitive or susceptible land ii. implement methods for streambank and shoreline stabilization iii. incentive riparian herbaceous or forest buffers
11. CLIMATE CHANGE		
11.1 Ecosystem Encroachment	a) changes in native and invasive species composition b) changes in phenology c) changes in species life cycle requirements d) timing and intensity of weather events	i. alter management plans to adapt to predicted changes ii. provide habitat connectivity to ease species shifts iii. research predicted changes and potential impacts iv. monitor effect of changes v. some change is natural, dynamic landscape vi. hybridizing climate tolerant species vii. offer incentives/programs for ecologically sensitive areas viii. identify riparian refugia based on climate models
11.2 Changes Geochemical Regimes		

CLASSIFICATION	THREAT TO RIVERS, STREAMS & RIPARIAN	CONSERVATION ACTION
11.3 Changes Temperature Regimes	a) proliferates invasive plants b) increased duration and frequency c) lower oxygen d) reduced instream flows e) increased algae f) higher water temperature g) shorter winter season h) increased fires i) drought j) increased temperature degree days k) limits management actions	i. alter management plans ii. protection of instream flows iii. offer incentives and programs to protect, enhance, and restore riparian areas iv. support data collection efforts v. evaluate carbon sequestration programs vi. habitat suitability modelling
11.4 Changes Precipitation & Hydrological Regimes	a) proliferates invasive plants b) loss of wildlife or plant production c) increased mortality of wildlife	i. offer incentives and programs to protect, enhance, and restore riparian areas ii. alter management plans iii. maintain instream flows
11.5 Severe / Extreme Weather Events	a) siltation, sedimentation and erosion b) proliferate invasive plants c) consequences of urban development in floodplain	i. offer incentives and programs to protect, enhance, and restore rivers, streams and riparian ii. incentivize buffers iii. prohibit development in the floodplain iv. oppose dry dams, drainage projects
12. OTHER		
12.1 Human Dimensions	a) social apathy of the value of healthy wetlands and ecosystem services they provide b) lack of knowledge of aquatic ecosystem c) economic incentives	i. increase awareness, understanding, and appreciation of the aquatic ecosystem and ecosystem services ii. increase public education and outreach iii. provide demonstration sites iv. incorporate wetland education into K-12 classrooms v. human dimension research/surveys vi. economic incentives for beneficial activities

FOREST THREATS AND ACTIONS

Table 32. Direct threats and conservation actions for forest.
Threats and actions are not listed in order of priority.

CLASSIFICATION	THREAT TO FOREST	CONSERVATION ACTION
1. RESIDENTIAL & COMMERCIAL DEVELOPMENT		
1.1 Housing & Urban Areas	a) conversion of forest to urban development b) vegetation planted for ornamental purposes can invade adjacent forest c) pesticide/herbicide application and drift impacts to adjacent forest habitat d) predation of forest wildlife by domestic animals near urban areas e) increased noise and light pollution	i. offer incentives and programs to protect, enhance, and restore forest habitat ii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iii. urge ecologically responsible urban planning and zoning iv. urge ecologically responsible urban and county policies v. public education and outreach for native landscaping and management vi. increase awareness, understanding, and appreciation of the forest/woodland ecosystem vii. increase education regarding the impact of free-roaming domestic animals and wildlife conflicts viii. promote responsible and conscientious use of pesticides
1.2 Commercial & Industrial Areas	a) conversion of forest to commercial and industrial development b) fragmentation of forest c) vegetation planted for ornamental purposes can invade adjacent forest d) pesticide/herbicide application and drift impacts to adjacent forest e) increased noise and light pollution f) increased risk of wildfire g) vacant or abandoned commercial and industrial areas	i. offer incentives and programs to protect, enhance, and restore forest habitat ii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iii. urge ecologically responsible planning and zoning iv. urge ecologically responsible urban and county policies v. education and outreach vi. consolidate new developments to minimize disturbance vii. promote responsible and conscientious use of pesticides
1.3 Tourism & Recreational Areas	a) expanding cabin developments b) city campground expansion into forest c) golf courses, skill hills	i. urge ecologically responsible planning and zoning ii. urge ecologically responsible urban and county policies iii. education and outreach iv. increase awareness, understanding, and appreciation of the forest/woodland ecosystem
2. AGRICULTURE		
2.1 Annual & Perennial Non-Timber Crops	a) conversion of forest to cropland development b) fragmentation of forests due to cropland development	i. offer incentives and programs to protect, enhance, and restore forests, e.g. Forest Stewardship Tax Law

CLASSIFICATION	THREAT TO FOREST	CONSERVATION ACTION
	c) pesticide/herbicide application and drift impacts to adjacent forest habitat d) increase in soil erosion and sedimentation from removal of trees e) impacts to water table and water infiltration rates, drain tile	ii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iii. offer midterm conservation agreements for native forest management and protection i. maintain Farm Bill regulatory provisions ii. offer incentives for wildlife friendly farming, tax-based or direct payments iii. increase awareness and utilization of forestry best management practices iv. promote responsible and conscientious use of pesticides
2.2 Wood & Pulp Plantations	a) promotes a monoculture of trees b) non-native tree expansion	i. use forestry best management practices
2.3 Livestock Farming & Ranching	a) heavy grazing in and around forests resulting in loss of understory vegetation and prohibits regeneration b) disturbance, erosion, and decline in soil health in high livestock traffic areas c) conversion of forest to large, confined animal feeding operations d) incentives that convert forest to cropland e) increase of noxious weeds and invasive plants from poor grazing management practices	i. offer incentives and programs to protect, enhance, and restore forests, e.g. Forest Stewardship Tax Law ii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iii. incentivize good grazing management iv. manage livestock grazing in sensitive upland forest v. offer incentives and programs for alternative water sources, e.g. wells, portable water vi. promote and support regenerative grazing management vii. support grazing lands coalitions viii. use forestry best management practices ix. feedlot setbacks x. promote carbon credits, biodiversity credits xi. encourage smooth wire, at least for bottom wire, and apply visibility markers (wildlife-friendly fencing) xii. encourage temporary or virtual fencing when possible xiii. promote responsible livestock practices that minimize disease spread (i.e. double fences, appropriate removal of carcasses, etc.)
3. ENERGY PRODUCTION & MINING		
3.1 Oil & Gas Drilling	a) conversion of forest to well pads, field or production facilities, access roads b) fragmentation of forest to well pads, field or production facilities, access roads c) disturbance associated with oil and gas development can proliferate noxious/invasive weeds d) inadequate or improper reclamation e) illegal dumping of materials and waste f) anthropogenic disturbance to forest associated wildlife, e.g. dust, noise and light pollution	i. well pad and facility consolidation, minimize footprint of development ii. engage in early consultation with the siting of well pads iii. develop crucial habitat maps or species avoidance areas iv. follow/implement best management practices v. incentivize companies for implementing ecologically sound development

CLASSIFICATION	THREAT TO FOREST	CONSERVATION ACTION
	g) diminished forage quality and plant communities due to increased road dust h) increased wildfire risk from drilling and operational activities i) social apathy to negative ecological impacts of oil and gas drilling j) governance apathy to negative ecological impacts of oil and gas drilling k) increased risk of accidental discharge of chemicals or waste	vi. urge ecologically responsible ordinances and suitable reclamation standards and foster relationships with oil companies to stimulate ecologically sound development xiii. urge requirements to promptly reclaim dry or abandoned wells xiv. enforce regulatory compliance and close loopholes which are used to delay or avoid reclamation vii. public education and outreach viii. public disclosure of impacts/footprint ix. research the impacts of oil and gas drilling on forest habitat and wildlife x. explore novel alternatives to offset impacts of oil and gas development
3.2 Mining & Quarrying	a) conversion of forest to mines or quarries, or for riprap b) inadequate or improper reclamation c) increase of noxious weeds and invasive plants when forest is mined	i. minimize footprint of development (e.g. consolidate disturbance) ii. suitable reclamation standards iii. tree mitigation iv. education and outreach v. promote or develop local and state ordinances vi. delay or halt mining/quarrying for new metals or minerals until local ordinances have been approved
3.3 Renewable Energy	a) conversion of forest for alternative fuel crops b) fragmentation of forest by wind or solar facilities c) direct or indirect mortality of wildlife species from structures d) anthropogenic disturbance to forest associated wildlife, e.g. noise, light e) increase of noxious weeds and invasive plants when land is disturbed	i. offer incentives and programs to protect, enhance, and restore forests ii. engage in early consultation with the siting of well pads iii. develop crucial habitat maps or species avoidance areas iv. follow/implement best management practices v. incentivize companies for implementing ecologically sound development vi. urge ecologically responsible ordinances and suitable reclamation standards vii. urge accountability for ecological impacts viii. minimize footprint of development ix. tree mitigation x. research to determine best areas for placement to minimize impacts to wildlife xi. use livestock to control weeds xii. establish pollinator-friendly plantings under solar arrays
4. TRANSPORTATION & SERVICE CORRIDORS		
4.1 Roads & Railroads	a) conversion of forest to roads and railroads b) fragmentation of forest by roads and railroads c) anthropogenic disturbance to forest associated wildlife, e.g. dust, noise and light pollution	i. urge ecologically responsible ordinances and suitable reclamation standards ii. appropriate road restrictions, including speed limits iii. timing restrictions for construction

CLASSIFICATION	THREAT TO FOREST	CONSERVATION ACTION
	d) direct mortality of wildlife species with vehicles or trains e) proliferate noxious/invasive weeds f) road and railway incident secondary effects, e.g. spills and explosions g) improper herbicide uses in railroad rights-of-way h) potential for wildfires, either accidental or from negligent actions i) road salt impacts to roadside plants and rights-of way j) inadequate reclamation	iv. use pipelines versus trucking liquids and gas tree mitigation v. use forestry best management practices vi. maintain natural corridors or construct wildlife accommodations, i.e. jump outs, wildlife crossings, etc. vii. use native local ecotype seed, including pollinator-friendly, when seeding road rights-of-way
4.2 Utility & Service Lines	a) conversion of forest during line development b) fragmentation of forest by utility and service lines c) disturbance associated with development of utility and service lines can proliferate noxious/invasive weeds d) inadequate reclamation e) intensification and accumulation of infrastructure f) direct mortality of wildlife species, particularly birds, by collision or electrocution g) changes in predator community (i.e. utility poles attract raptors which may increase depredation on other wildlife)	i. consolidation corridors, or overlapping easements ii. urge ecologically responsible ordinances and suitable reclamation standards iii. engage in early consultation with the siting of utility and service lines iv. tree mitigation v. timing restrictions for construction vi. require line marking devices ii. use avian protection plans or guidance documents to minimize bird/powerline interactions vii. use native local ecotype seed, including pollinator-friendly, when reseeding easement rights-of-way
5. BIOLOGICAL RESOURCE USE		
5.1 Hunting & Collecting Terrestrial Animals	a) anthropogenic disturbance to forest associated wildlife, e.g. off-road travel b) disturbance/movement can proliferate noxious/invasive weeds c) wildlife value or changing public attitudes towards wildlife, promoting the introduction of nonnative species for hunting d) damage to trees from certain tree stands and clearing of trees for shooting lanes e) insufficient regulations for collection or harvest of certain wildlife, e.g. reptiles and amphibians f) poaching g) supplemental feeding h) lead ammunition impacts to non-target wildlife	i. urge ecologically responsible ordinances ii. increase enforcement and deterrents iii. reevaluate or develop regulations pertaining to collection or harvest of certain wildlife, e.g. reptiles and amphibians iv. encourage using portable tree stands, do not use screw-in steps v. public education and outreach vi. encourage non-toxic ammunition use
5.2 Gathering Terrestrial Plants	a) unregulated collection of edible/medicinal plants for commercial use/sale	i. increase enforcement and deterrents ii. public education and outreach
5.3 Logging & Wood Harvest	a) unregulated logging	i. develop Forest Stewardship Management Plans, follow a silvicultural prescription ii. use forestry best management practices
5.4 Fishing & Harvesting Aquatic Resources	a) anthropogenic disturbance to forest associated wildlife, e.g. off-road travel	i. urge ecologically responsible ordinances ii. increase enforcement and deterrents iii. public education and outreach

CLASSIFICATION	THREAT TO FOREST	CONSERVATION ACTION
	b) disturbance/movement can proliferate noxious or invasive weeds c) poaching	
6. HUMAN INTRUSIONS & DISTURBANCE		
6.1 Recreational Activities	a) damage to forests from off-road vehicles b) anthropogenic disturbance to forest associated wildlife, e.g. geocaching unauthorized camping, firewood collection, wildlife harassment (e.g. drones) c) trail development through sensitive habitat or key wildlife areas d) proliferate noxious or invasive weeds e) potential for wildfires, either accidental or from negligent actions f) unauthorized recreational shooting/explosive targets	i. increase enforcement, deterrents and fines ii. restrict or eliminate off-road vehicle use in environmentally sensitive areas iii. engage in early consultation with the siting of recreational areas and trails iv. public education and outreach
6.2 Military Exercises	a) anthropogenic disturbance to forest	i. support responsible processes
6.3 Work & Other Activities	a) anthropogenic disturbance to forest	i. urge ecologically responsible ordinances ii. increase enforcement, deterrents and fines
7. NATURAL SYSTEMS MODIFICATIONS		
7.1 Fire & Fire Suppression	a) fire suppression results in poor forest health and increase in wildfire risk or severity due to increased fuel loads b) lack of funding for fire management c) public resistance to use of prescribed fire/controlled burns d) insufficient awareness regarding the advantages of prescribed fire/controlled burns	i. offer incentives and programs to implement prescribed fire ii. support fire coalitions and cooperative ventures iii. obtain funding for fire management programs, staff and training iv. involve and educate rural or local fire departments v. public education and outreach vi. support pro-prescribed fire strategies vii. research the effects of fire management viii. promote and use forestry best management practices
7.2 Dams & Water Management/ Use	a) conversion of forest to impoundment b) impoundments may proliferate concentration of salts, heavy metals, etc. c) lack of regeneration due to altered hydrology d) inappropriate siting of impoundment e) dry dams or retention dams f) proliferate noxious or invasive weeds g) degradation of forest from livestock congregation at dams and impoundments	i. offer incentives and programs to protect, enhance, and restore forest ii. offer incentives and programs for alternative water sources, e.g. wells, portable water iii. reclaim deteriorating dams and dugouts iv. remove low-head dams v. do not develop dry dams or retention dams vi. education about dynamic water systems and water management vii. incentivize buffers/exclusion zones viii. exclude impoundments in ecologically sensitive or inappropriate areas ix. develop and implement watershed plans

CLASSIFICATION	THREAT TO FOREST	CONSERVATION ACTION
7.3 Other Ecosystem Modification	a) diminishing soil health, e.g. compaction and loss of water infiltration	i. promote soil health ii. ecosystem education and awareness
7.4 Removing / Reducing Human Maintenance	a) lack of succession b) disease c) invasive species d) loss of indigenous peoples management regimes	i. education and outreach ii. promote and use best management practices iii. support funding and programs iv. include indigenous peoples culture and values
8. INVASIVE & PROBLEMATIC SPECIES, PATHOGENS & GENES		
8.1 Invasive Non-Native / Alien Plants & Animals	a) spread and proliferation of invasive or detrimental plants, e.g. Kentucky bluegrass, smooth brome b) spread and proliferation of noxious weeds c) spread and proliferation of invasive woody vegetation d) spread of invasive insects, e.g. emerald ash borer, Japanese beetle e) feral and free-roaming domestic animals	i. removal or reduction of invasive or detrimental plants using fire, chemical and mechanical treatments ii. removal or reduction of noxious weeds using fire, chemical, mechanical and biological treatments iii. develop recommended plant lists and sources of local ecotype seed iv. engage the horticultural industry to educate and promote recommended plants and reduce the use of problematic invasive or detrimental plants v. public education and outreach vi. enforce emerald ash borer regulations vii. follow firewood cutting and movement regulations viii. support programs and initiatives to reduce or remove feral animals from native habitat ix. encourage pet owners to keep animals indoors, in an outdoor enclosure, or on a leash, to protect both the welfare of the animal and wildlife x. research control or reduction of invasive plants xi. use forestry best management practices
8.2 Problematic Native Species	a) aspen decay b) damaging pests, e.g. forest tent caterpillar	i. encourage mechanical options for control of pests versus insecticides ii. maintain or improve forest stand health
8.3 Introduced Genetic Material	a) genetically modified plants enable the use of a broad range of pesticides and herbicides b) increase of herbicide resistant plants c) risk of loss of genetics with plants and wildlife d) neonicotinoid effects on non-target organisms	i. promote pragmatic use of herbicides and pesticides
8.4 Pathogens & Microbes	a) Dutch elm disease b) aspen decay	i. monitor trees for disease ii. use fire or mechanical disturbance to encourage aspen regeneration iii. utilize preventative guidelines iv. education and outreach
9. POLLUTION		
9.1 Domestic & Urban Waste Water	a) pipeline leaks b) inappropriate disposal of untreated sewage c) non-point runoff from housing and urban areas, e.g. fertilizer and pesticides from lawns and golf courses	i. require pipeline warning system for leak detection ii. improve reporting and disclosure of incidents iii. increase enforcement and deterrents iv. public education and outreach

CLASSIFICATION	THREAT TO FOREST	CONSERVATION ACTION
9.2 Industrial & Military Effluents	a) pipeline leaks, e.g. oil and brine water b) oil and brine water spills at production or exploration facilities a) oil and brine water spills during transportation b) inappropriate disposal of brine water c) inappropriate disposal of radioactive waste d) coal mining and coal-fired power plant waste seepages	i. require pipeline warning system for leak detection ii. require check valves to contain oil in pipeline in the event of a pipeline rupture iii. improve reporting and disclosure of incidents iv. quantify the magnitude of incidents, full disclosure of environmental impact v. increase enforcement, deterrents and fines vi. support policies to update deteriorating infrastructure
9.3 Agriculture & Forestry Effluents	a) fertilizer and pesticide runoff from cropland b) runoff from improperly designed or sited feedlots	i. require warning system for waste leakage detection ii. require full containment feedlot runoff control system iii. improve reporting and disclosure of incidents iv. quantify the magnitude of incidents, full disclosure of environmental impact v. increase enforcement, deterrents and fines
9.4 Garbage & Solid Waste	a) illegal waste sites b) litter	i. improve reporting and disclosure of incidents ii. increase enforcement, deterrents and fines
9.5 Air-borne Pollutants	a) dust, e.g. from increased traffic on gravel roads, mines or quarries, coal-fired power plants, b) pesticide or herbicide drift c) hydrogen sulfide d) excess carbon dioxide e) wind dispersion of nutrients, pollution, or sediments f) wildfire smoke	i. require warning system for air-borne pollutant detection ii. quantify the magnitude of incidents, full disclosure of environmental impact iii. increase enforcement, deterrents and fines iv. promote carbon credits
9.6 Excess Energy	a) light and thermal pollution causing disturbance to forest associated wildlife, e.g. from natural gas flaring or urban areas b) noise pollution, e.g. from increased traffic, work sites c) data center disturbance to wildlife, e.g., noise, heat	i. improve report and disclosure of incidents ii. quantify the magnitude of incidents, full disclosure of environmental impact iii. increase enforcement, deterrents and fines
10. GEOLOGICAL EVENTS		
10.3 Avalanches / Landslides	a) land sloughing	i. offer incentives or programs for sensitive or susceptible land
11. CLIMATE CHANGE		
11.1 Ecosystem Encroachment	a) changes in species composition b) changes in phenology c) changes in species life cycle requirements d) timing and intensity of weather events	i. alter management plans to adapt to predicted changes ii. provide habitat connectivity to ease species shifts iii. research predicted changes and potential impacts iv. monitor effect of changes, utilize existing data v. some change is natural, dynamic landscape
11.2 Changes Geochemical Regimes		

CLASSIFICATION	THREAT TO FOREST	CONSERVATION ACTION
11.3 Changes Temperature Regimes	a) proliferates invasive plants b) proliferates tree disease c) limits management actions d) loss of wildlife or plant production e) increased mortality of wildlife	i. offer incentives and programs to protect, enhance, and restore forests
11.4 Changes Precipitation & Hydrological Regimes	a) proliferates invasive plants b) pests increase c) prolonged drought causes tree mortality d) increased duration and frequency	i. alter management plans
11.5 Severe / Extreme Weather Events	a) siltation, sedimentation and erosion b) proliferate invasive plants c) consequences of urban development in floodplain d) high wind events can destroy trees e) prolonged flooding causes tree mortality	i. offer incentives and programs to protect, enhance, and restore forests ii. incentivize buffers iii. prohibit development in the floodplain iv. oppose dry dams, drainage projects
12. OTHER		
12.1 Human Dimensions	a) social apathy of the value of the healthy forests and ecosystem services they provide b) lack of knowledge of the forest ecosystem	i. increase awareness, understanding, and appreciation of forests and ecosystem services ii. public education and outreach iii. provide demonstration sites iv. incorporate forest education into K-12 classrooms v. human dimension research/surveys vi. promote North Dakota Natural Areas Registry

BADLANDS THREATS AND ACTIONS

Table 33. Direct threats and conservation actions for badlands.
Threats and actions are not listed in order of priority.

CLASSIFICATION	THREAT TO BADLANDS	CONSERVATION ACTION
1. RESIDENTIAL & COMMERCIAL DEVELOPMENT		
1.1 Housing & Urban Areas	a) conversion of badlands habitats to urban development, and in some cases, county ordinances that promote larger lots rather than smaller (such as 10 acres as opposed to 1 acre) b) fragmentation of badlands habitats from urban development c) disturbance associated with urban development can disperse noxious/invasive weeds d) vegetation planted for ornamental purposes can invade adjacent native prairies e) mowing of adjacent native and/or tame grasslands for ornamental grooming f) pesticide/herbicide application and drift impacts adjacent plant/wildlife species composition g) loss of grazing and burning of grasslands near urban and recreational areas h) predation of grassland wildlife by domestic animals near urban areas i) vacant or abandoned housing (e.g. temporary housing units) j) increased noise and light pollution k) lower tolerance to wildlife as rural communities become urban areas	i. offer incentives and programs to protect, enhance, and restore badlands habitat ii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iii. urge ecologically responsible urban planning and zoning iv. urge ecologically responsible urban and county policies v. public education and outreach for native landscaping and management vi. increase awareness, understanding, and appreciation of the badlands ecosystem vii. increase education regarding the impact of free-roaming domestic animals and wildlife conflicts
1.2 Commercial & Industrial Areas	a) conversion and disturbance of badlands habitats associated with industrial lodging b) increased garbage load, illegal dumping c) disturbance associated with development can proliferate noxious/invasive weeds d) direct mortality to wildlife species e) increased noise and light pollution f) increased risk of wildfire g) vacant or abandoned commercial and industrial areas	i. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures ii. urge ecologically responsible ordinances and suitable reclamation standards iii. consolidate new developments to minimize disturbance iv. consider state mitigation standards
1.3 Tourism & Recreational Areas	a) conversion of badlands habitats to tourism and recreational areas b) disturbance associated with recreational development can disperse noxious/invasive weeds c) pesticide/herbicide application and drift impacts adjacent plant/wildlife species composition d) unrestrained domestic animals can harass wildlife	i. promote “Keep It Native” campaign for greenways, trails, recreational areas, and minimize project footprint ii. urge ecologically responsible ordinances and responsible siting of new development iii. public education and outreach
2. AGRICULTURE		

CLASSIFICATION	THREAT TO BADLANDS	CONSERVATION ACTION
2.1 Annual & Perennial Non-Timber Crops	a) conversion of badlands habitat to cropland development b) fragmentation of badlands habitats due to cropland development c) displacement of wildlife during conversion process d) pesticide/herbicide application and drift impacts adjacent plant/wildlife species composition e) increase in soil erosion from lack of residual cover on cropland f) decline in soil health g) impacts to water table and water infiltration rates h) changing farm demographics resulting in a shift from livestock ranching to crop production, loss of connection to the land, and loss of rural community lifestyle	i. offer incentives and programs to protect, enhance, and restore badlands habitat ii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iii. strengthen Farm Bill regulatory provisions (i.e. swampbuster, sodbuster, sodsaver) iv. support regulatory reform of practices that promote conversion of habitat to crop v. offer incentives for wildlife friendly farming, tax-based or direct payments vi. promote and support regenerative grazing management, collaborate with grassland based agricultural groups vii. support demo projects and best management practices viii. promotion of cover crops and soil health ix. promote responsible and conscientious use of pesticides x. promote equal risk management for grassland-based agriculture
2.3 Livestock Farming & Ranching	a) absence of grazing b) underutilization of grazing or over-rest c) overutilization of grazing or overgrazing d) shift from ranching (pro-grass) lifestyle to confined animal feeding operations e) disturbance, erosion, and decline in soil health in high livestock traffic areas f) opposing attitude of using prescribed fire as co-management tool g) non-traditional livestock farms may proliferate disease transmission, genetic mixing, escapees, to wild populations h) inappropriate fencing (i.e. not wildlife-friendly) i) incentives to convert grassland to cropland j) public perception that livestock are bad for the climate and lack of knowledge on the importance of grasslands for carbon sequestration and storage k) increase of noxious weeds and invasive plants from poor grazing management practices	i. encourage grazing as a grassland management tool for high resistance and resilience ii. develop or support programs, initiatives and statutory language that strengthen the efficacy of conservation measures iii. develop provisions for Farm Bill disaster assistance for livestock producers iv. establish grassbanks between state/federal/non-governmental land and private ranches v. incentivize good grazing management vi. promote and support regenerative grazing management use existing resources such as best management practices and ecological site descriptions vii. build market and corporate support of grass-based livestock viii. support grazing lands coalitions and work with grass-based agriculture groups ix. use best management practices or ecological site descriptions x. assessment of economic and ecological values of grasslands and associated wildlife, ecosystem services xi. promote carbon credits, biodiversity credits xii. encourage smooth wire, at least for bottom wire, and apply visibility markers (wildlife-friendly fencing) xiii. encourage temporary or virtual fencing when possible xiv. educate the public on the benefits of working grasslands

CLASSIFICATION	THREAT TO BADLANDS	CONSERVATION ACTION
		xv. support prescribed fire, including training and education xvi. promote responsible livestock practices that minimize disease spread (i.e. double fences, appropriate removal of carcasses, etc.)
3. ENERGY PRODUCTION & MINING		
3.1 Oil & Gas Drilling	a) conversion of badlands habitats to well pads, field or production facilities, access roads b) fragmentation of badlands habitats to well pads, field or production facilities, access roads c) disturbance associated with oil and gas development can proliferate noxious/invasive weeds d) inadequate or improper reclamation e) illegal dumping of materials and waste f) increased wildfire risk from drilling and operational activities g) anthropogenic disturbance to grassland associated wildlife, e.g. dust, noise and light pollution h) diminished forage quality and plant communities due to increased road dust i) social apathy to negative ecological impacts of oil and gas drilling j) governance apathy to negative ecological impacts of oil and gas drilling k) increased risk of accidental discharge of chemicals or waste	i. well pad and facility consolidation, minimize footprint of development ii. engage in early consultation with the siting of well pads iii. develop crucial habitat maps or species avoidance areas iv. follow/implement best management practices v. incentivize companies for implementing ecologically sound development vi. urge ecologically responsible ordinances and suitable reclamation standards and foster relationships with oil companies to stimulate ecologically sound development xv. urge requirements to promptly reclaim dry or abandoned wells xvi. enforce regulatory compliance and close loopholes which are used to delay or avoid reclamation vii. public education and outreach viii. public disclosure of impacts/footprint ix. research the impacts of oil and gas drilling on grassland habitat and wildlife x. explore novel alternatives to offset impacts of oil and gas development
3.2 Mining & Quarrying	a) conversion of badlands habitats to mines or quarries b) anthropogenic disturbance to grassland associated wildlife, e.g. dust, noise and light pollution c) inadequate or improper reclamation d) increase of noxious weeds and invasive plants when grassland is mined e) increased risk of accidental chemicals or waste f) decrease in soil health and increase in soil erosion	i. minimize footprint of development (e.g. consolidate disturbance) ii. suitable reclamation standards iii. education and outreach iv. promote or develop local and state ordinances v. delay or halt mining/quarrying for new metals or minerals until local ordinances have been approved
3.3 Renewable Energy	a) conversion of badlands habitats to energy facilities b) fragmentation of badlands by energy facilities c) direct or indirect mortality of wildlife species from structures d) anthropogenic disturbance to badlands associated wildlife, e.g. noise, light e) increase of noxious weeds and invasive plants when land is disturbed	i. incentivize companies for implementing ecologically sound development ii. urge ecologically responsible ordinances and suitable reclamation standards iii. urge accountability for ecological impacts iv. minimize footprint of development v. research to determine the best areas for placement to minimize impacts to wildlife vi. use livestock to control weeds vii. establish pollinator-friendly plantings under solar arrays

CLASSIFICATION	THREAT TO BADLANDS	CONSERVATION ACTION
4. TRANSPORTATION & SERVICE CORRIDORS		
4.1 Roads & Railroads	a) conversion of badlands habitats to roads and railroads b) fragmentation of badlands habitats by roads and railroads c) anthropogenic disturbance to grassland associated wildlife, e.g. dust, noise and light pollution d) direct mortality and displacement of wildlife species with vehicles or trains e) roads acting as migration barriers for terrestrial wildlife f) proliferate noxious/invasive weeds g) road and railway incident secondary effects, e.g. spills and explosions h) improper herbicide uses in railroad rights-of-way i) potential for wildfires, either accidental or from negligent actions j) road salt impacts to roadside plants and rights-of way	i. urge ecologically responsible ordinances and suitable reclamation standards ii. appropriate mitigation, e.g. native grassland ecosystems iii. appropriate road restrictions, including speed limits iv. timing restrictions for construction v. maintain natural corridors or construct wildlife accommodations, i.e. jump outs, wildlife crossings, etc. vi. use pipelines versus trucking liquids and gas vii. use native local ecotype seed, including pollinator-friendly, when seeding road rights-of-way viii. promote adjustments in the timing and frequency of mowing along rights-of-way to minimize impacts to wildlife
4.2 Utility & Service Lines	a) fragmentation of badlands habitats by utility and service lines b) disturbance associated with development of utility and service lines can proliferate noxious/invasive weeds c) inadequate reclamation d) intensification and accumulation of infrastructure e) reduced management and flexibility in easement rights-of-way f) direct mortality of wildlife species, particularly birds, by collision or electrocution g) changes in predator community (i.e. utility poles attract raptors which may increase depredation on other wildlife)	i. consolidation corridors, or overlapping easements ii. encourage buried lines when feasible iii. urge ecologically responsible ordinances and suitable reclamation standards iv. engage in early consultation with the siting of utility and service lines v. timing restrictions for construction vi. require line marking devices iii. use avian protection plans or guidance documents to minimize bird/powerline interactions vii. use native local ecotype seed, including pollinator-friendly, when reseeding easement rights-of-way
5. BIOLOGICAL RESOURCE USE		
5.1 Hunting & Collecting Terrestrial Animals	a) anthropogenic disturbance to badlands associated wildlife, e.g. off-road travel, dog training during nesting and brood-rearing period b) disturbance/movement can proliferate noxious/invasive weeds c) wildlife value or changing public attitudes towards wildlife, promoting the introduction of nonnative species for hunting d) insufficient regulations for collection or harvest of certain wildlife, e.g. reptiles and amphibians e) poaching f) supplemental feeding g) increased wildlife violations in western North Dakota	i. urge ecologically responsible ordinances ii. increase enforcement and deterrents iii. reevaluate or develop regulations pertaining to collection or harvest of certain wildlife, e.g. reptiles and amphibians iv. public education and outreach v. amend dog training laws and regulations to minimize impacts to wildlife during sensitive life cycle periods vi. encourage non-toxic ammunition use

CLASSIFICATION	THREAT TO BADLANDS	CONSERVATION ACTION
	h) lead ammunition impacts to non-target wildlife	
5.2 Gathering Terrestrial Plants	a) unregulated collection of edible/medicinal plants for commercial use/sale	i. increase enforcement and deterrents ii. public education and outreach
5.3 Logging & Wood Harvest	a) not a threat	i. use as management tool to restore grassland
5.4 Fishing & Harvesting Aquatic Resources	a) anthropogenic disturbance to grassland associated wildlife, e.g. off-road travel b) disturbance/movement can proliferate noxious or invasive weeds c) poaching d) increased wildlife violations in western North Dakota	i. urge ecologically responsible ordinances ii. increase enforcement and deterrents iii. public education and outreach
6. HUMAN INTRUSIONS & DISTURBANCE		
6.1 Recreational Activities	a) damage to badlands habitat from off-road vehicles b) anthropogenic disturbance to badlands associated wildlife, e.g. unauthorized camping, target shooting, firewood collection, wildlife harassment (e.g. drones) c) trail development through sensitive habitat or key wildlife areas d) littering e) spelunking, spread of White-Nose Syndrome f) proliferate noxious or invasive weeds g) potential for wildfires, either accidental or from negligent actions	i. restrict or eliminate off-road vehicle use in environmentally sensitive areas ii. engage in early consultation with the siting of recreational areas iii. urge ecologically responsible ordinances iv. increase enforcement, deterrents and fines v. public education and outreach
6.2 Military Exercises	a) anthropogenic disturbance to badlands associated wildlife	i. support responsible processes
6.3 Work & Other Activities	a) anthropogenic disturbance to badlands associated wildlife b) increased illegal drug manufacturing, smuggling and trafficking in western North Dakota; disturbance to wildlife or habitat	i. urge ecologically responsible ordinances ii. increase enforcement, deterrents and fines
7. NATURAL SYSTEMS MODIFICATIONS		
7.1 Fire & Fire Suppression	a) fire suppression results in woody encroachment, succession, loss of native diversity, and increase in wildfire risk or severity due to increased fuel loads b) inappropriate fire control (fire breaks, bulldozers) c) lack of funding for fire d) public resistance to use of prescribed fire/controlled burns e) insufficient awareness regarding the advantages of prescribed fire/controlled burns	i. offer incentives and programs to implement prescribed fire/controlled burns ii. support fire coalitions and cooperative ventures iii. obtain funding for fire management programs, staff and training iv. involve and educate rural or local fire departments v. develop fire management plans vi. public education and outreach vii. support pro-prescribed fire strategies
7.2 Dams & Water Management/ Use	a) conversion of badlands habitat, e.g. slope wetlands, to impoundment b) may proliferate concentration of salts, heavy metals, etc.	i. offer incentives and programs for alternative water sources, e.g. wells, portable water ii. reclaim deteriorating dams and dugouts

CLASSIFICATION	THREAT TO BADLANDS	CONSERVATION ACTION
	c) addition of water may proliferate the spread of West Nile virus and other diseases to grassland associated wildlife d) inappropriate movement of water as water management e) change in water infiltration rates f) proliferate noxious or invasive weeds g) degradation of grasslands from livestock congregation at dams and impoundments	iii. education about dynamic water systems and water management iv. incentivize buffers/exclusion zones
7.3 Other Ecosystem Modification	a) loss of pollinators b) loss of native plant diversity c) diminishing soil health, e.g. compaction and loss of water infiltration d) changes in water systems e) loss of bat/cavity roosting habitat	i. promote diversity ii. plant diverse grass and forb mixes and pollinator plantings iii. promote soil health iv. ecosystem education and awareness v. follow/implement Best Management Practices for tree removal (e.g. timing)
7.4 Removing / Reducing Human Maintenance	b) loss of indigenous peoples management regimes, e.g. loss of fires set by indigenous peoples	ii. include indigenous peoples culture and values
8. INVASIVE & PROBLEMATIC SPECIES, PATHOGENS & GENES		
8.1 Invasive Non-Native / Alien Plants & Animals	a) spread and proliferation of invasive or detrimental plants, e.g. Kentucky bluegrass, smooth brome b) spread and proliferation of noxious weeds c) spread and proliferation of invasive woody vegetation d) spread of invasive insects, e.g. emerald ash borer, Japanese beetle e) feral and free roaming domestic animals	i. removal or reduction of invasive or detrimental plants using grazing, fire, chemical and mechanical treatments ii. removal or reduction of noxious weeds using grazing, fire, chemical, mechanical and biological treatments iii. prohibit or disincentive new seeding of invasive or detrimental plants, particularly Kentucky bluegrass and smooth brome iv. incentivize native plant seeding v. develop recommended plant lists and sources of local ecotype seed vi. engage the horticultural industry to educate and promote recommended plants and reduce the use of problematic invasive or detrimental plants vii. public education and outreach viii. support programs and initiatives to reduce or remove feral animals from native habitat ix. encourage pet owners to keep animals indoors, in an outdoor enclosure, or on a leash, to protect both the welfare of the animal and wildlife x. research control or reduction of invasive plants xi. follow firewood cutting and movement regulations xii. install boot brushes at trail heads xiii. encourage weed free hay programs xiv. minimize/consolidate disturbance (e.g. development) xv. incentivize and promote adaptive management or climate informed approach

CLASSIFICATION	THREAT TO BADLANDS	CONSERVATION ACTION
8.2 Problematic Native Species	a) spread and proliferation of native woody vegetation, e.g. Eastern red cedar, Rocky Mountain juniper	i. removal or reduction of undesirable native plants using grazing, fire, chemical and mechanical treatments ii. develop programs and incentives for woody invasive management iii. promote natural control iv. public education and outreach v. consider climate adaptation in woody species management
8.3 Introduced Genetic Material	a) genetically modified plants enable the use of a broad range of pesticides and herbicides b) increase of herbicide resistant plants c) risk of loss of genetics with plants and wildlife	ii. promote pragmatic use of herbicides and pesticides
8.4 Pathogens & Microbes	a) Dutch elm disease b) Plague (prairie dogs, mammals)	i. utilize preventative guidelines ii. education and outreach
9. POLLUTION		
9.1 Domestic & Urban Waste Water	a) pipeline leaks b) inappropriate disposal of untreated sewage c) non-point runoff from housing and urban areas, e.g. fertilizer and pesticides from lawns and golf courses	i. require pipeline warning system for leak detection ii. improve reporting and disclosure of incidents iii. increase enforcement and deterrents iv. public education and outreach
9.2 Industrial & Military Effluents	a) pipeline leaks, e.g. oil and brine water b) oil and brine water spills at production or exploration facilities c) oil and brine water spills during transportation d) inappropriate disposal of brine water e) inappropriate disposal of radioactive waste f) coal mining and coal-fired power plant waste seepages	i. require pipeline warning system for leak detection ii. require check valves to contain oil in pipeline in the event of a pipeline rupture iii. improve reporting and disclosure of incidents iv. quantify the magnitude of incidents, full disclosure of environmental impact v. increase enforcement, deterrents and fines vi. support policies to update deteriorating infrastructure
9.3 Agriculture & Forestry Effluents	a) fertilizer and pesticide runoff from cropland b) runoff from improperly designed or sited feedlots	i. require warning system for waste leakage detection ii. require full containment feedlot runoff control system iii. improve reporting and disclosure of incidents iv. quantify the magnitude of incidents, full disclosure of environmental impact v. increase enforcement, deterrents and fines
9.4 Garbage & Solid Waste	a) illegal waste sites b) litter	i. improve reporting and disclosure of incidents ii. increase enforcement, deterrents and fines
9.5 Air-borne Pollutants	a) dust, e.g. from increased traffic on gravel roads, mines or quarries, coal-fired power plants, b) pesticide or herbicide drift c) hydrogen sulfide d) excess carbon dioxide e) wind dispersion of nutrients, pollution, or sediments f) wildfire smoke	i. require warning system for air-born pollutant detection ii. quantify the magnitude of incidents, full disclosure of environmental impact iii. increase enforcement, deterrents and fines iv. promote carbon credits

CLASSIFICATION	THREAT TO BADLANDS	CONSERVATION ACTION
9.6 Excess Energy	a) light and thermal pollution causing disturbance to grassland associated wildlife, e.g. from natural gas flaring or urban areas b) noise pollution, e.g. from increased traffic, work sites c) data center disturbance to wildlife, e.g., noise, heat	i. improve reporting and disclosure of incidents ii. quantify the magnitude of incidents, full disclosure of environmental impact iii. increase enforcement, deterrents and fines
10. GEOLOGICAL EVENTS		
10.3 Avalanches / Landslides	a) land sloughing	i. offer incentives or programs for sensitive or susceptible land
11. CLIMATE CHANGE		
11.1 Ecosystem Encroachment	a) changes in species composition b) changes in phenology c) changes in species life cycle requirements d) timing and intensity of weather events	i. alter management plans to adapt to predicted changes ii. provide habitat connectivity to ease species shifts iii. research predicted changes and potential impacts iv. monitor effect of changes, utilize existing data v. some change is natural, dynamic landscape
11.2 Changes Geochemical Regimes		
11.3 Changes Temperature Regimes	a) proliferates invasive plants b) limits management actions c) loss of animal or plant production d) increased mortality of animals	i. establish grassbanks between state/federal/non-governmental land and private ranches ii. promotion of cover crops and soil health
11.4 Changes Precipitation & Hydrological Regimes	a) proliferates invasive plants b) limits management actions c) loss of wildlife or plant production	i. establish grassbanks between state/federal/non-governmental land and private ranches ii. promotion of cover crops and soil health
11.5 Severe / Extreme Weather Events	a) siltation, sedimentation and erosion b) proliferate invasive plants	i. offer incentives and programs to protect, enhance, and restore grasslands ii. incentivize buffers
12. OTHER		
12.1 Human Dimensions	a) social apathy of the value of healthy badlands habitats and ecosystem services they provide b) lack of knowledge of badlands ecosystem c) view of badlands as being of no significance, e.g. “wasteland” d) public misconception that livestock are bad for the environment e) misdirected conservation efforts, e.g. planting trees in grasslands, increased trail pressure	i. increase awareness, understanding, and appreciation of the badlands ecosystem and ecosystem services ii. public education and outreach iii. support grassland coalitions iv. provide demonstration sites v. incorporate badlands education into K-12 classrooms vi. human dimension research/surveys

THREATS AND ACTIONS SUMMARY - ALL HABITATS

For all habitat types, the following are the top recurring threats:

1) **Conversion of habitat**
   The most frequent conversion occurs when grassland is broken and transformed to annual crop production. This process often includes the conversion of small, shallow wetlands embedded within grasslands. Urban, commercial and industrial development also results in the conversion of habitat, including forests and riparian areas.
2) **Invasive non-native species**
   The spread and proliferation of invasive or detrimental plants, noxious weeds, woody vegetation, and aquatic nuisance species negatively impact the health and resilience of native habitats.
3) **Fire suppression**
   The lack or removal of fire in the grassland ecosystem results in woody encroachment, succession, and loss of native diversity.
4) **Underutilization of grazing**
   The grassland ecosystem needs large grazing herbivores. The absence or underutilization of grazing in the grassland ecosystem results in succession, loss of native diversity, and loss of landscape heterogeneity.
5) **Energy development impacts**
   Increasing demand and development of North Dakota's abundant energy resources may result in the direct conversion of habitat, fragmentation, displacement of wildlife, and anthropogenic disturbance.
6) **Conservation awareness**
   Insufficient public recognition of the critical role resilient habitats and the important ecosystem services they provide for wildlife, water quality, and the well-being of North Dakota's communities.

For all habitat types, the following are the top recurring actions:

1) **Offer incentives and programs to protect, enhance, and restore habitat**
   The use of voluntary conservation programs is a common approach for landowners and partners to conserve habitat. Programs should encourage working lands, offer midterm conservation agreements for management and protection of habitat, and promote equal risk management for grassland-based agriculture.
2) **Control or reduce invasive species**
   Remove or reduce invasive or detrimental plants, noxious weeds, and woody vegetation by using grazing, fire, chemical and mechanical treatments. Enforce aquatic nuisance species and invasive tree pest regulations and recommendations.
3) **Offer incentives and programs to implement prescribed fire/controlled burns**
   Prescribed fire or controlled burns can improve the health of the ecosystem, reduce the intensity or risk of wildfires, and remove invasive plants.
4) **Support grazing as a grassland management tool**
   Promote and support regenerative grazing management and work with grass-based agriculture groups. Incentivize good grazing management, build market and corporate support of grass-based livestock, and promote carbon and biodiversity credits.
5) **Urge ecologically responsible energy development and suitable reclamation standards**
   Engage in early consultation and foster relationships with energy proponents, incentivize companies for implementing ecologically sound development, and urge requirements for prompt and proper reclamation.
6) **Public education and outreach**
   Enhance public awareness, understanding, and appreciation of North Dakota's diverse habitats and wildlife.

CHAPTER 6
MONITORING

This chapter includes information on the required element:

Element 5: descriptions of the proposed plans for monitoring species and their habitats identified in the first element, for monitoring the effectiveness of the conservation actions in the fourth element, and for adapting these conservation actions to respond appropriately to new information or changing conditions.

OVERVIEW

This chapter describes the process of adaptive management, a synopsis of habitat and species monitoring efforts, and opportunities for storing data that will be collected or compiled through implementation of the SWAP. These monitoring components complement each other and will provide a more comprehensive assessment of the efficacy of the SWAP.

Developing a multifaceted statewide monitoring program has many challenges. North Dakota is a large state of roughly 45 million acres, with about 90% held in private ownership. Approximately 600 species of vertebrates spend at least a portion of their life cycle within this geographic area. Roughly 120 - 150 of these species (largely game species) have varying degrees of monitoring or survey work conducted on them by several agencies. The two principal agencies that conduct much of that monitoring are the North Dakota Game and Fish Department and the U.S. Fish and Wildlife Service. The U.S. Forest Service, U.S. Army Corps of Engineers, U.S. National Park Service and various universities conduct lesser amounts. Most of the remaining 450 vertebrate species receive considerably less monitoring. Now with the addition of a host of invertebrates to the SWAP it includes more challenges. Most surveys conducted for these species are somewhat disjointed and/or are secondary in terms of monitoring objectives. A shortage of resources frequently limits the degree and scope of surveys which are initiated. In some instances, volunteers or private citizens with bird watching or similar interests carry out monitoring efforts. For example, each year the U.S. Geological Survey coordinates the annual Breeding Bird Survey, and the National Audubon Society coordinates a Christmas Bird Count; both are conducted largely by volunteers. Other examples include reptile and amphibian inventories on national parks and grassland bird surveys on fish and wildlife refuges.

There is no existing framework that can be easily modified to implement a monitoring plan for all the state's indigenous species and their habitats. Developing a monitoring plan for North Dakota's SGCN and habitats will require a multifaceted approach that includes but is not limited, to amalgamating the information from existing monitoring efforts to create a central reporting system and repository, modifying or expanding current surveys to include species of greatest conservation need where feasible, and implementing new monitoring efforts.

Perhaps most important to developing a statewide monitoring plan is pooling or sharing past, present and future survey information collected in North Dakota by land management agencies, universities, non-government organizations, the public, etc. Individually these monitoring efforts are somewhat small, infrequent, and often conducted on a local spatial scale (e.g. refuge or park). However, when information from these surveys is viewed collectively, or in conjunction with other surveys over time, meaningful presence, absence, range and distribution data can be generated. It is clear there will be a need to work cooperatively with these agencies, and across state lines, to coordinate monitoring efforts. The Midwest Landscape Initiative (MLI) is a coalition of state wildlife agencies and organizations in the 13 states of the Midwest Association of Fish and Wildlife Agencies (MAFWA). In November 2024, the MLI finalized *Inventory and Monitoring Resources for Midwest SWAPS and Regional Conservation Planning* to help inform Midwest SWAP monitoring.

ADAPTIVE MANAGEMENT

Adaptive management (Hollings 1987) is an iterative process to improve the speed with which we learn and incorporate that learning into management and planning. Adoption of adaptive management inherently makes the leap from implicit uncertainty in the knowledge of the systems under management, to explicit acknowledgement of key uncertainties about systems and management of those systems. Identifying and reducing the number of key uncertainties becomes an objective of system management.

There are several requirements or steps to building and adopting an adaptive management system. They are:

- Managers include scientists and stakeholders in planning of programs and developing of measures of effectiveness. In so doing three key elements are identified:
  - Measurable indicators of system responses to management alternatives.
  - Policies, programs or activities that will affect the system.
  - Ecological processes that link management actions to changes in the measurable indicators.
- Develop tools to predict outcomes from a suite of management alternatives.
- Identify key uncertainties in the system.
- Develop and implement management actions.
- Monitor indicators or proxies for responses to management actions.
- Evaluate information gathered during monitoring. This process includes reporting of consequences, development of recommendations to the management and stakeholders, and further refinement of key uncertainties and measurable indicators.
- Re-evaluation of management plans, programs or actions with stakeholders and scientists and adjusting (if necessary).

The objectives of a monitoring program are:

1. To assist in establishing scientifically based priorities for allocating limited resources.
2. Provide information and develop tools to assist management in decision making and planning.
3. To increase our ecological understanding of species and their habitats.
4. Provide data to identify and evaluate the effects of management actions and programs.

These objectives are consistent with the tenets of adaptive management, which is a system of improved management by design. Adopting an approach of proactive and flexible management is critical to the success of the SWAP. Functionally, managers have always adapted programs to better meet the Department's objectives. The use of an adaptive management system for monitoring species and their habitats will lead to more effective management of fish and wildlife resources.

This process is best suited for selecting between or prioritizing management actions. The elements of adaptive management will be addressed under three headings: Planning; Implementation; and Monitoring and Evaluation. Planning includes setting objectives, identifying key uncertainties, identifying indicators and formulating models. Implementation is where plans become action at the habitat and species level. Monitoring and evaluation can happen at two levels, either species or habitat measurements. The monitoring focus is determined by objective, ability and practicality.

Planning

The Department has an array of resources to incorporate into the planning process. These include, but are not limited, to federal, state, non-governmental conservation organizations, universities, and other scientists. These experts all have extensive knowledge and are involved with existing monitoring programs that can contribute to the overall wildlife planning community. A series of annual workshops involving both terrestrial and aquatic experts were used to develop threats and conservation actions for CWCS in 2005. These meetings included private, state, federal and academic experts in wildlife

research and natural resource management. Based on open discussions, priorities and uncertainties were identified and discussed at both the species and habitat level. This process was used again to revise the threats and conservation actions for the SWAP. In the fall of 2014, the NDGF convened the first SWAP Summit and in 2024 the SWAP Summit was repeated to review threats and conservation actions and identify emerging conservation issues (see Chapter 5). The Department recognizes that the complexity of information required to address adaptive management models for all species and habitats statewide does not exist. Through the expert workshops and SWAP planning process, the Department has amalgamated the information from all partners, as well as identified information that is lacking. Through this process the goal is to develop both qualitative and quantitative aspects of monitoring species and their habitats.

Implementation

Implementation involves following through with management and conservation actions on the landscape. From workshop and management planning efforts, either a single or suite of management actions will be developed. In a learning-modeling framework there are 3 ways to approach management alternatives. Each has differing costs in both time and money. These approaches are Trial and Error, Stepwise, and Complete Enumeration or the Horse Race approach (Figure 35). Trial and Error is a single step approach that is usually the least expensive method but can take substantially longer to evaluate programs with many alternatives for delivery. Stepwise is similar in cost to Trial and Error but can switch to an alternative without revisiting the planning process. Time is saved and monetary costs include the additional planning for alternatives. The Horse Race is the most efficient way to compare a suite of alternatives, but it can be prohibitive to implement and monitor all reasonable alternatives simultaneously. The approach best suited for each individual program or action will be used depending on logistics and budgets.

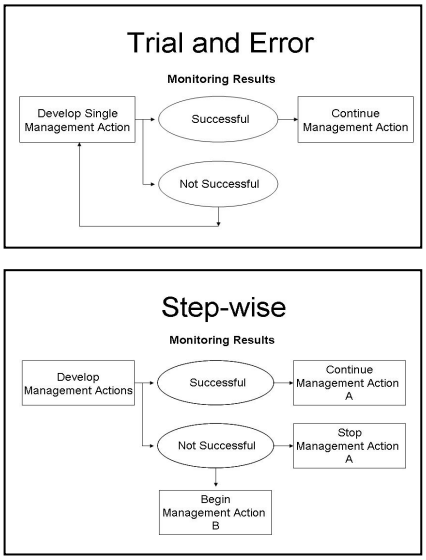


Figure 35. Visual depictions of Learning by Design.

Single species management for wildlife planning, such as raptor recovery or re-introduction type efforts, is rare and expensive. Management action usually involves providing for or protecting habitat necessary to the life cycle of one or more SGCN. Understanding habitat associations, and species response to habitat manipulation, becomes crucial to the evaluation of program delivery. As implementation actions are defined, mechanisms for measuring habitat capacity and/or species response must too. The Department will work from study results, existing literature or expert opinions and workshops, to identify mechanisms for measuring the success of specific conservation actions.

Monitoring and Evaluation

Monitoring is incomplete without evaluation. Monitoring is discussed here in the context that it leads toward evaluation and is not solely the "collection of data." Monitoring as a part of the adaptive management process is the periodic collection of data to be analyzed for the purpose of informing management on the efficacy of a program. Specifically, when possible, it is addressing the question, "Is/Are the management action/s having the intended species or habitat response?" The answers to this question are vital to the evolution of both science and management. Monitoring should be designed to help us to understand species or their habitats in a way that contributes to the ability to manage or benefit populations. Where information is lacking, it is necessary to develop demographic, range, population, and species habitat use information to begin the process of informed management planning.

HABITAT MONITORING

North Dakota has a diversity of habitat types and conditions. Quantity and quality of habitat in relation to the larger landscape, climate, land use practices such as grazing or fire, and various other biotic and abiotic factors will affect species' use of habitat. Many monitoring efforts focus on condition, quantity and quality of various habitats or landscapes. Most of these efforts are conducted by state and federal agencies. The following are examples of habitat monitoring that incorporate issues of scale and condition to track habitat quantity and quality over time at varying geographic scales. The Department will continue to use these monitoring efforts to assess changes in surveyed habitat.

- Four-Square-Mile Survey: In 1987, the USFWS initiated a survey to annually measure wetland habitat conditions and assess habitat use and productivity of waterfowl populations. This survey was developed by statisticians and biologists from Northern Prairie Wildlife Research Center and is administered and conducted in conjunction with USFWS HAPET offices. Conducted annually in a sub-sample of 500 foursquare mile plots throughout the Prairie Pothole Region of the U.S. (estimated 150-200 in North Dakota), and in more recent years has expanded to south and west of the Missouri River in North Dakota. The condition of habitat (e.g. wetland status, grassland, CRP) is documented in addition to waterfowl census. This effort attains habitat quantity, quality, and use information.
- Waterfowl Breeding Population and Habitat Survey for South and North Dakota: This aerial survey conducted in May of each year provides an overview of general waterfowl breeding population and climate conditions for most of North Dakota. The habitat information helps biologists make predictions as to the year's waterfowl production but could be utilized to make inferences of breeding habitat quantity and quality for other wetland associated birds. The number of wetlands and conditions (e.g. poor, good) are documented. This effort attains habitat quantity and quality information along with population estimates.
- US Forest Service Land and Resource Monitoring: The USFS conducts a variety of habitat monitoring efforts on the Little Missouri National Grasslands, Sheyenne National Grasslands, and Cedar River National Grasslands (collectively known as Dakota Prairie Grasslands) in North Dakota. Woody draw habitat trends in the badlands, Stream and Wetland Condition, Visual Obstruction Readings (VOR), and similarity index for seral state determinations (Floristic Quality Index) are just a few examples of habitat condition monitoring the USFS conducts. These are outlined in the Dakota Prairie Grasslands Biennial Monitoring Evaluation Report. This effort attains habitat quality information.
- North Dakota Forest Health - ND Forest Service: Through a cooperative agreement with the North Dakota Forest Service, North Dakota State University Extension Service, NDSU Department of Plant Pathology, and Department of Plant Sciences, a forest health specialist has been funded for North Dakota to coordinate and direct forest health monitoring and management throughout the state. This involves conducting insect and disease surveys, providing educational outreach, and delivering training and technical assistance to natural resource professionals. This effort led to the development of the *North Dakota Forest Action Plan*. This serves as a strategic framework to outline priority forest resources, designate important issues, and identify strategies to address challenges and opportunities. Additionally, the *Turtle Mountain Landscape Forest Stewardship Plan* was developed with a goal of establishing the current baseline condition of the forested resource and identify mutual goals for future forested conditions."
- Northern Research Station's Forest Inventory and Analysis (FIA) - US Forest Service: According to the USFS website "The Forest Inventory and Analysis (FIA) collects, analyzes, reports and distributes data about the Nation's forests: how much forest exists who owns it, what condition it is in, where it is located, and how it has changed". The North Research Station is responsible for inventorying more than 176 million acres of forest land spread across 3 states, including North Dakota. This information can be used in many ways, such as in evaluating wildlife habitat conditions, assessing the sustainability of ecosystem management practices, and supporting planning and decision-making activities undertaken by public and private enterprises. The FIA Program combines this information with related data on insects, diseases, and other types of forest damage and stressors to assess the health, condition, and potential

future risks to forests. The Nationwide Forest Inventory (NFI) component is the best-known component of the FIA program. This component consists of a three-stage systematic sample of sites across all forested lands of the U.S.

- Watershed Management Program – ND Department of Environmental Quality (DEQ): The Watershed Management Program is primarily responsible for monitoring and assessing water quality in streams, rivers, lakes and wetlands across North Dakota. This is done by developing Total Maximum Daily Loads (TMDLs), maintaining an ambient monitoring network, conducting lake water quality assessments, conducting biological monitoring and providing technical assistance for watershed projects. Additionally, implementation initiatives such as the Nutrient Reduction Strategy, the Basin Water Quality Management Framework and information/ education programs are conducted.
- North Dakota Game and Fish Department
    - Wildlife Management Area Field Mapping: The NDGF maps vegetation features and managed portions of state-owned wildlife management areas in a GIS. This effort included mapping the boundaries of fields, identifying the field status (e.g. native prairie, dense nesting cover, crop type), and activity for that year (e.g. idle, grazed, hayed, burned). This mapping effort will, over time, provide detailed, local level habitat status. This effort attains habitat quantity and quality information.
    - Photo Point Monitoring: The NDGF maintains a database of photo point locations on WMAs, PLOTS, and USFS managed land. Some photographs date back to 1960, allowing for habitat change monitoring over 50+ years.
    - Wildlife Management Areas Native Prairie Monitoring: Over the past several years, native prairie mapping has been done for all Wildlife Management Areas (WMAs). A total of 38,184 acres of native prairie were mapped statewide, approximately 17% of the total WMA acreage. There are grazing systems put in place on 34,389 acres, however, this is a mix of both native grasslands and replanted grasslands. In 2024, a monitoring system was put in place to begin to better understand the current conditions of the native grasslands throughout the state, with a priority given to tracts that have a current management regime (grazing system) in place. Working with the United States Fish and Wildlife Service, random transections were generated within WMA grasslands and a monitoring system was created, like that of the Native Prairie Adaptive Management protocol. Two seasonal employees were hired to collect data using the Belt Transect Method, working throughout WMAs in the western half of the state (to be continued in 2025 throughout the eastern half).
- Natural Heritage Inventory of Rare Communities – ND Parks and Recreation Department: The main purpose of the Natural Heritage Inventory is to identify North Dakota's natural features and establish priorities for their protection. Information from the Heritage Inventory has been used to identify high quality natural areas and potential nature preserves. This effort attains habitat quantity and quality information.

Monitoring Statewide Changes in Habitat

National Land Cover Database

The Annual National Land Cover Database (NLCD) provides a seamless land cover for the entire United States for the years 1985 to 2023. There are 16 standard land cover classifications that allow for comparing land cover changes and trends over time. Changes in pixels depict a change in land cover type, or habitat type. While the NLCD is not absolute, it is considered one of the leading tools for analyzing habitat changes on a statewide basis over time. Figure 36 depicts changes from herbaceous cover (grassland, pasture, shrubland and emergent wetlands) to cultivated cropland or developed from 2015 to 2023. The map illustrates the percent change or loss of habitat per 1 square mile that has occurred since the 2015 SWAP. Despite the collaboration among various partners to implement conservation strategies aimed at protecting, restoring, and enhancing habitats, these measures have not kept pace with the widespread habitat loss that has occurred in the past 10 years.

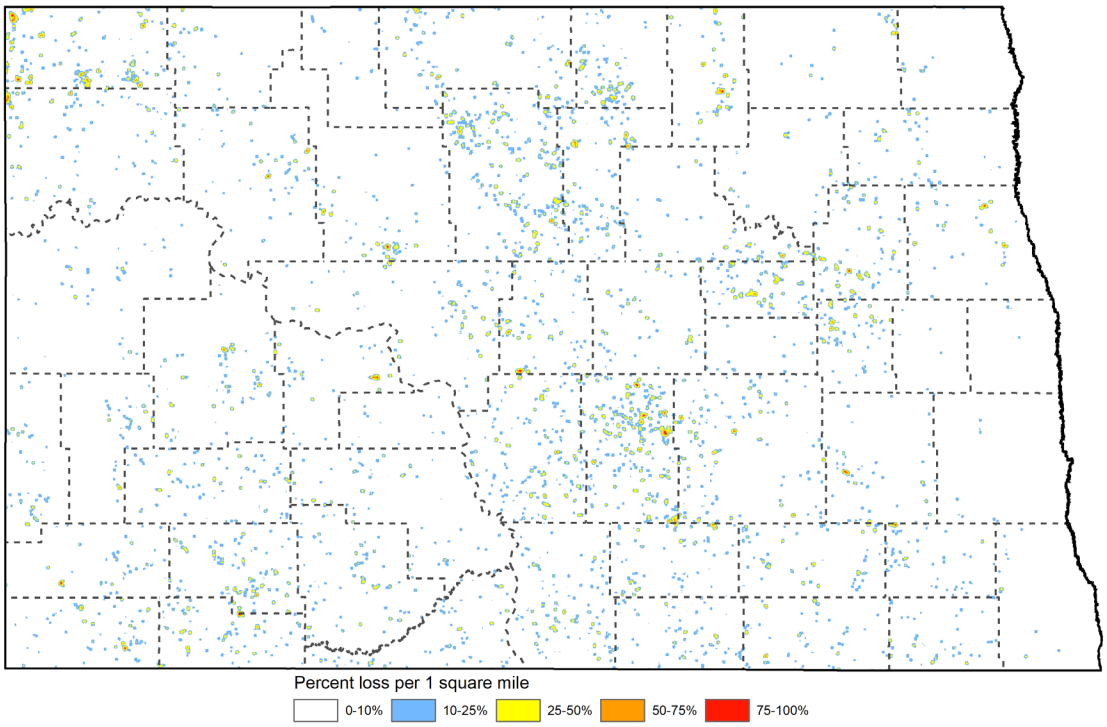
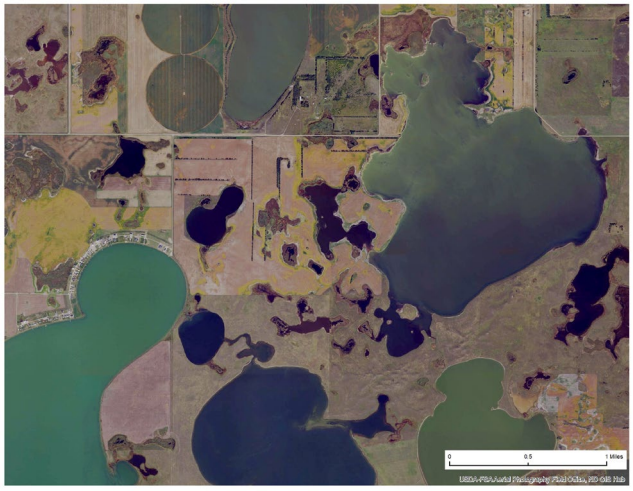


Figure 36. Change in grassland, shrubland, pasture and emergent wetland land cover classes to cultivated crops or developed land cover classes, from 2015 to 2023. Illustrated as percent change or loss of habitat per 1 square.

Wetlands

Of the nearly 5 million natural wetland acres, 60% have been lost or converted. Furthermore, the conversion of grasslands and changes in wetland hydrology, influenced by wetland drainage and consolidation, along with climate and alterations in land use, have had profound and lasting effects on the prairie and wetland ecosystems (Figure 37).

2004 aerial image of central Kidder County. More intact grasslands, wetlands, and abundant shoreline habitat availability for species such as Piping Plover.



2024 aerial image of central Kidder County. Landscape changes can cause a shift towards more permanent and full lakes, a phenomenon referred to as lakefication.

Figure 37. Hydrologic shifts in wetlands from 2004 to 2024.

Conservation Reserve Program

The USDA Conservation Reserve Program (CRP) has a significant positive impact on soil, water, and habitat conservation, making it one of the most remarkable conservation and wildlife success stories in North Dakota. Landowners can participate in various CRP practices, from planting native or introduced grasses to creating filter strips or specialized habitats like pollinator areas. The program's positive effects on wildlife, including increased waterfowl populations and improved grassland bird nesting, are well documented. CRP grasslands can be found in every county, ranging from near-pristine native grasslands to areas dominated by non-native species like Kentucky Bluegrass and Smooth Brome. Despite some CRP lands declining in quality over time, they still provide critical breeding and wintering habitats for numerous wildlife species. At its peak in 2007, CRP enrollment reached 3.38 million acres, but it has since declined by 63% to 1.24 million acres as of 2022 due to factors such as shifts in agricultural practices, lower rental rates, and reduced acreage caps (Figure 38). This decline has had a detrimental effect on many species of greatest conservation need and species of greatest inventory need. A stronger focus on working lands, an increase in rental rates, and a higher acreage cap may be needed to reverse this trend.

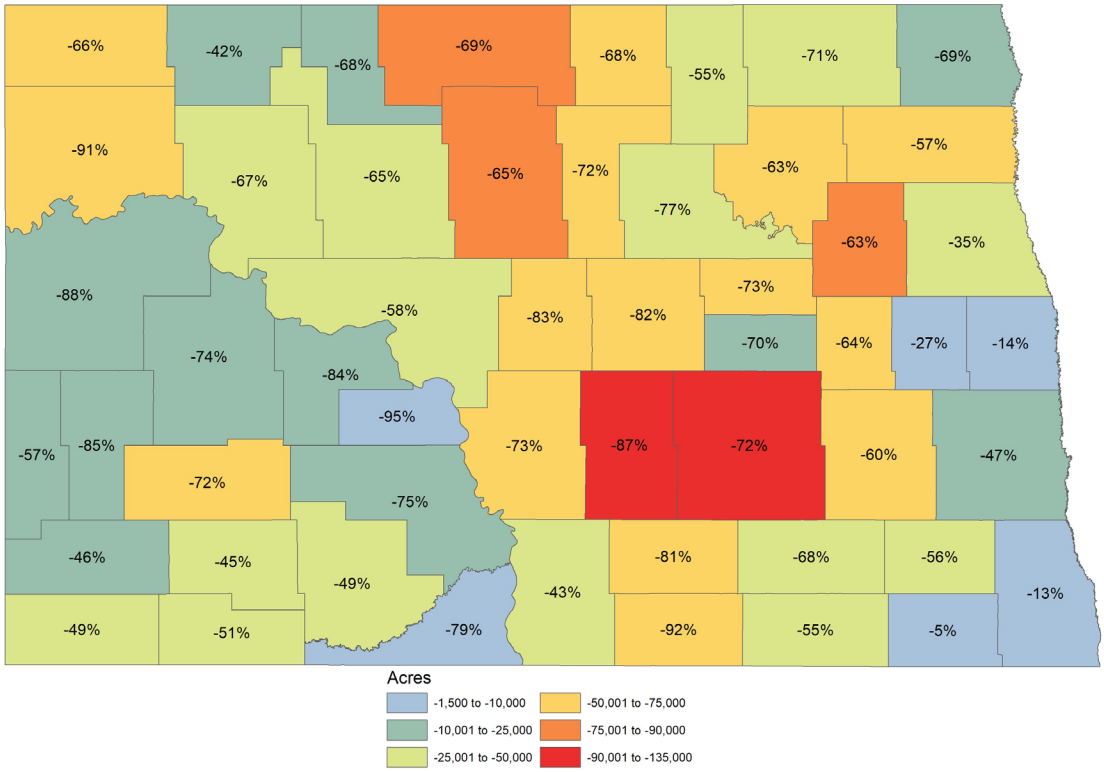


Figure 38. Percent loss of CRP general and continuous enrollment acres from 2007 to 2022.

SPECIES MONITORING

Species specific research and survey efforts, needs, and monitoring plans may be found in Appendices A-F.

BIRDS

There are 57 species of birds listed as SGCN, and 11 species listed as SGIN. This represents the largest group of taxa on the list, and some of the more commonly studied and/or monitored species. See Appendix A for species specific monitoring efforts. The USFWS and USGS are two key partner agencies that state wildlife agencies collaborate with on various bird monitoring programs. In March 2025, bird experts that work in North Dakota were asked for feedback on the significance of various bird monitoring programs and efforts in North Dakota. Experts were asked to score from 1 (least important) to 5 (extremely important) for maintaining or expanding various bird monitoring efforts in North Dakota. Some of the programs listed are well-established, while others have been minimally or never implemented in the state. See Appendix A for species specific monitoring efforts.

Extremely Important - Bird Survey/Monitoring Efforts to Maintain or Increase (in order from highest to lowest)

- Breeding Bird Survey – the best long-term population trend data for most breeding birds. Ensuring that all 44 BBS are executed every year is essential, and to strategically create new routes where needed.
- Waterfowl Breeding Population and Habitat Survey – critical for Adaptive Harvest Management and long-term trends of waterfowl populations.
- Four-square Mile Breeding Waterfowl Survey – critical for allocation of conservation resources.
- Lek Surveys – crucial for monitoring prairie grouse and good indicator nesting habitat quality and availability.
- eBird – demonstrates potential for various applications, yet there is a need for more skilled users to enhance its effectiveness.
- North American Bird Banding Program/Bird Banding Lab – critical national program for management of migratory birds and estimating vital rates, but should be used in targeted situations.

Important - Bird Survey/Monitoring Efforts to Maintain or Increase (in order from highest to lowest)

- Integrated Monitoring in Bird Conservation Regions – currently occurring in limited region of ND. Potential to survey areas typically not sampled and collect valuable data, but could duplicate other efforts that are less costly.
- Long-billed Curlew Survey – specialized survey but could be adapted to better complement other efforts (e.g., BBS).
- GPS or Satellite Tracking – valuable tool for species specific research needs.
- Raptor Nest Inventory – important to maintain for infrastructure siting and reducing impacts to sensitive raptors.
- Multi Species Inventory & Monitoring – not currently implemented in ND but would produce substantial dataset of species occupancy.
- Colonial Waterbird Inventory – periodic inventory (e.g. every 10 years) to track change in colony locations and size would be valuable.
- International Shorebird Survey – not currently implemented in ND. Necessary shorebird identification skills and fluctuating nature of suitable habitats might pose challenges for conducting surveys, yet the survey may provide valuable insights into at-risk shorebird populations.

Lower Importance - Bird Survey/Monitoring Efforts to Maintain or Increase (in order from highest to lowest)

- Inventory & Monitoring of Secretive Marsh Birds – not currently implemented in ND or possibly elsewhere. Methods could be used in future studies or improved with ARUs.
- Breeding Bird Atlas – interest exists in conducting a follow-up on Breeding Birds of North Dakota (Stewart, 1975), but number of people/birders and financial resources are limited.
- Integrated Waterbird Management & Monitoring – not currently implemented in ND. The Four-square Mile survey achieves similar outcomes and is regarded as a more effective survey.
- Motus Wildlife Tracking System – currently few towers in ND. It can best be utilized with targeted and species specific research needs.

- MAPS Program – currently one station in ND. Labor and time intensive but the program is valuable for assessing demographic information, especially if it targeted SGCN or SGIN.
- Nightjar Survey Network – not currently implemented in ND. Useful survey but few nightjar species in ND, and only one on SGIN list.
- Christmas Bird Count – positive effort to encourage birding as an outdoor activity, but limited use for managing wintering birds in ND.
- Breeding Shorebird Survey – specialized survey with specific objectives. The BBS achieves similar outcomes.

Additional Actions for Birds

- Future monitoring should follow recommendations North American Bird Conservation Initiative 'Opportunities for Improving Avian Monitoring'.
- Consider employing Autonomous Recording Units (ARUs) in existing and future monitoring/survey efforts.
- Explore the potential for surveys to address a wider range of birds, for instance, Piping Plover monitoring could also apply to other shorebirds that breed in the same areas.

AMPHIBIANS AND REPTILES

There are 2 species of amphibians, and 4 reptiles listed as SGCN, along with 4 amphibians and 8 reptiles listed as SGIN. There is no statewide monitoring effort in place. A monitoring system using presence/absence data will produce distribution trends over time. See Appendix B for species specific monitoring efforts.

Existing Surveys

- Reptiles and amphibians have been surveyed recently by North Dakota State University on select state Wildlife Management Areas.
- Smaller local surveys are being conducted by state universities. Records can be tracked in the NDGF nongame database.
- Citizen based reports are collected by private organizations such as Herpmapper.

National Surveys

Several national organizations have developed standardized monitoring protocols. Once these protocols are adopted as national standards, they could serve as potential monitoring schemes to consider for North Dakota.

- PARC - Partners in Amphibian and Reptile Conservation http://www.parcplace.org/
- ARMI – Amphibian Research and Monitoring Initiative http://armi.usgs.gov/
- NAAMP – North American Amphibian Monitoring Program https://www.usgs.gov/centers/eesc/science/north-american-amphibian-monitoring-program

Amphibian and Reptile Monitoring/Survey Goal

- No statewide monitoring effort is currently in place. Collaboration with NDSU to develop a citizen science-based monitoring protocol has occurred.

MAMMALS

North Dakota's SWAP includes 12 SGCN and 14 SGIN mammal species. A monitoring protocol for mammals, especially small mammals, has been identified as one of the greatest needs for mammal conservation. It was agreed that a monitoring system using presence/absence data to develop trends would be the most effective means for tracking changes in small mammal distribution over time. The NDGF has identified this as a major need in this SWAP and will continue to develop a monitoring protocol. See Appendix C for species specific monitoring efforts.

Existing Surveys

- Swift fox will be monitored by the NDGF.

- Black-tailed Prairie Dogs (BTPD) are monitored as part of a range-wide survey as stated in the North Dakota Black-tailed Prairie Dog Management Plan. The USFS Dakota Prairie Grasslands and Theodore Roosevelt National Park survey their lands for BTPD.
- Presence/absence of Black-Footed Ferrets will be noted during black-tailed prairie dog surveys.
- University research includes local level projects, typically on targeted species.

Mammal Monitoring/Survey Goals

- Development of an acoustic monitoring plan for bats is in development by the ND Bat Working Group, a group of state partners that includes the NDGF.
- The NDGF will partner and share information with various agencies where opportunities exist to best monitor mammal populations.
- The NDGF incidental reporting system will be used to augment data on mammal populations.
- The NDGF will continue work to develop a monitoring protocol to track species within the state.
- The NDGF will develop a protocol such that future funded research may be combined with other independent studies for more robust estimates based on sample size.

FISH

North Dakota's SWAP includes 16 SGCN and 3 SGIN fish species. Many of these species can be monitored by niche based upon habitat needs, such as riffle stream fishes. The list also includes species that must be monitored individually due to habitat preferences (e.g. Blacknose Shiner) or small population (e.g. Pallid Sturgeon). See Appendix D for species specific monitoring efforts.

Existing Surveys

- The NDGF partners with VCSU to survey select streams on a yearly basis.
- The NDDEQ IBI stream surveys and prairie fish surveys cover substantial reaches of major rivers in the state.
- Individual species monitoring, such as for pallid sturgeon, are conducted by partnering agencies.
- NDGF conducts annual surveys for young-of-the-year paddlefish and tags adult paddlefish.

Fish Monitoring/Survey Goals

- SGCN fish species are monitored with a combination of annual lake and river/stream surveys.

INVERTEBRATES

Invertebrates are the largest taxa group in North Dakota. Freshwater mussels have been included in the SWAP since its original development in 2005. In the 2015 revision, three butterflies were added. This edition will be the Department's first effort to include aquatic insects and a more robust evaluation of terrestrial insects. The NDGF does not currently monitor insect populations internally, but by working with and supporting partners, has begun to compile information, identify data gaps, and work towards a better understanding of population trends.

Terrestrial Invertebrates

Twenty-three terrestrial insects are identified as SGCN with another 37 listed as SGIN. See Appendix E for species specific monitoring efforts.

Insect Monitoring/Survey Goals

- Continue to compile insect data.
    - Presence/absence
    - Range and distribution
- Develop monitoring protocols for species added to the SGCN list.

Aquatic Invertebrates

Insects are the largest taxa group in North Dakota and ten specific taxa have been incorporated as SGCN. The NDGF does not monitor insect populations currently but recognizes the importance of gathering this information. The lack of information on insect populations is a daunting task to overcome. The NDGF has started to compile known information to identify the most important data gaps. The Department also plans to begin evaluating aquatic insect assemblages on waterbodies associated with state Wildlife Management Areas. See Appendix F for species specific monitoring efforts.

Existing Surveys

- No existing NDGF annual surveys are in place, but development of standardized surveys are currently planned.
- The NDDEQ surveys aquatic insects as a part of an IBI development and stream assessment program for prairie streams.
- University research conducts surveys on a local level.

Insect Monitoring/Survey Goals

- Continue to collect data to develop range and distribution on aquatic SGCN.

Freshwater Mussels

Ten species of mussels are listed as SGCN. This represents two thirds of the species known to inhabit North Dakota. Freshwater mussels have been surveyed by VCSU through various SWG projects, and a framework monitoring protocol was developed. See Appendix F for species specific monitoring efforts.

Existing Surveys

- Freshwater mussels will be surveyed periodically by contract to track populations.

Freshwater Mussel Monitoring/Surveys Goals

- Implement a monitoring protocol to evaluate freshwater mussel species within the state using information gathered during opportunistic SWG projects.

THREATENED AND ENDANGERD SPECIES

There are twelve federal threatened or endangered species on the SGCN or SGIN list. These include Whooping Crane, Piping Plover, Red Knot, Pallid Sturgeon, Black-footed Ferret, Northern Long-eared Bat, Suckley's Cuckoo Bumble Bee, Rusty Patched Bumble Bee, Monarch Butterfly, Regal Fritillary, Poweshiek Skipperling, and Dakota Skipper.

Existing Surveys

- Whooping Crane: spring and fall migration sightings are reported to the USFWS or NDGF Migratory Game Bird Biologists.
- NPWRC is leading research and survey efforts on Piping Plovers.
- The USACE conducts annual monitoring of Piping Plovers and Least Terns along the Missouri River System.
- The USFWS monitors Pallid Sturgeon in the Missouri River system.
- Black-footed Ferrets are considered extirpated but would be reported if sighted during Black-tailed Prairie Dog surveys.
- Black-footed Ferrets identified in the Department's Furbearer Observation Report will be investigated.
- Dakota Skipper are currently monitored closely at known sites as well as potential sites identified by surveyors.
- Several partners survey bats annually in the state. Northern Long-eared Bats are report to the USFWS.
- Pollinators have been surveyed by NDSU, USGS Northern Prairie Wildlife Research Center, and USFWS HAPET.

MONITORING CONSERVATION ACTIONS

Understanding species response to conservation actions is crucial to program delivery. As SWG funded conservation actions are implemented, monitoring the effectiveness of the actions will be a requirement of each project. Each project will identify specific objectives, deliverables, and a plan, including the appropriate geographic scale, for how it will be monitored. Monitoring may be limited or less frequent for those conservation actions that have demonstrated beneficial effects. Conservation actions that do not meet the project's objectives will be reevaluated. In addition to SWG funded conservation actions, partners will be encouraged to monitor conservation actions affecting SGCNs and associated habitat.

DATABASES

Databases of existing and newly obtained information allows the Department and partners to evaluate conservation actions and conservation goals based on the best available information. This will be a key component in maintaining efficient adaptability of the state's plan as we progress into the implementation phase. It will also provide enhanced accessibility and additional information to be used in revisions of the state's SWAP. There are several options for storing and obtaining spatial data and other information to support habitat and species monitoring efforts. Databases or opportunities which will be used are presented below.

ND Game and Fish Department Spatial Database

The nongame database was developed to maintain spatial information on SGCN and other nongame species. Data incorporated into the nongame database is derived from several sources including SWG projects, Department survey efforts, Scientific Collection reports and the public. This information is used to augment other monitoring efforts to bolster knowledge of these species. The Department also maintains an extensive database of fish and wildlife information which is available only to Department staff. Examples include grouse lek sites, nongame fish stream sampling, Black-tailed Prairie Dog towns, or telemetry data. GIS databases will continue to grow in use for maintaining species and habitat information.

North Dakota GIS Hub

The North Dakota GIS Hub was created in 2001 because of widespread demand from state agencies wanting a mechanism for sharing the great amount of GIS data useful to many agencies. The GIS Hub provides easy and quick access to a large amount of geographic information such as aerial imagery, land cover, topography, National Wetlands Inventory, statewide parcel dataset, federal and state land ownership, roads and more. All data is available for download and can be accessed. The ND GIS Hub may be found at https://www.gis.nd.gov/

The North Dakota Natural Heritage Program

Within North Dakota, the ND Parks and Recreation Department (NDPRD) Natural Heritage Program has served as a repository for rare and unique species and habitat information. However, a lack of funding and other resources has limited the effectiveness of the program with respect to data entry, retrieval and the ability of staff to network with those who carry out monitoring and survey efforts across the state. The Department provided the Natural Heritage Program with a state wildlife grant to upgrade its software to allow for more efficient data entry and retrieval. The Natural Heritage Program serves as the primary repository for plant information and the Department is the primary repository for wildlife information. In 2010 the Natural Heritage Program staff developed a list plant species of conservation priority and completed a species account for each, including conservation threats and actions. Although the SWAP may include information on plants, use of SWG funding restricted to wildlife and their habitats. Nonetheless, plants compose habitat, and many species are rare and/or declining. The supplementary plant document may be requested from the Department or NDPRD.

CHAPTER 7
REVIEWING THE STATE WILDLIFE ACTION PLAN

This chapter includes information on the required element:

Element 6: descriptions of procedures to review the SWAP at intervals not to exceed ten years.

Each state is required to update the SWAP at least every 10 years. To meet the 2025 SWAP deadline, Department staff initiated the revision process in 2023. Over the next 18 to 20 months, substantial time was devoted to extensive scoping, communicating with our partners and the public, amalgamating new information, reviewing documents and a host of other tasks associated with revising a larger strategic level planning document. Based on our experience with this process, and the level of satisfaction from our partners and the public, we do not believe that the benefits of revising the SWAP more frequently (e.g. every 5 years) is justified. Should an emerging issue arise that requires a revision to the SWAP, such as adding SGCNs, the Department will conduct a Minor Revision.

The Department commits to a Major Revision of the SWAP in 2035.

CHAPTER 8
COORDINATING WITH PARTNERS AND THE PUBLIC

This chapter includes information on the required elements:

Element 7: coordinating the development, implementation, review, and revision of the plan with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats.

Element 8: broad public participation is an essential element of developing and implementing the SWAP, the projects that are carried out while the SWAP is developed, and the Species in Greatest Need of Conservation that Congress has indicated such programs and projects are intended to emphasize.

COORDINATING WITH PARTNERS

Strengthening and developing partnerships is essential to the success of the SWAP. During the initial development of the 2005 SWAP, this was achieved through two main approaches: group meetings and individual outreach. Initially, group meetings were held to introduce the newly implemented SWG program and gather broad insights from larger groups of experts on the state's natural resources. After synthesizing this information, individual experts were consulted to further refine the ideas. This process not only laid the foundation for the original SWAP but also opened an ongoing line of communication between the Department and its partners that continued through the 2015 and 2025 SWAP revision. The exchange of information between our partners and the Department is a continuous process, but there was a need to provide a way to connect our partners together to share new information and spark new ideas to further the conservation of SGCNs and their habitats. To promote the sharing of information, several gatherings have been held, including SWAP coordination sessions in 2006 and 2010, and SWAP Summits held in 2014 and 2024.

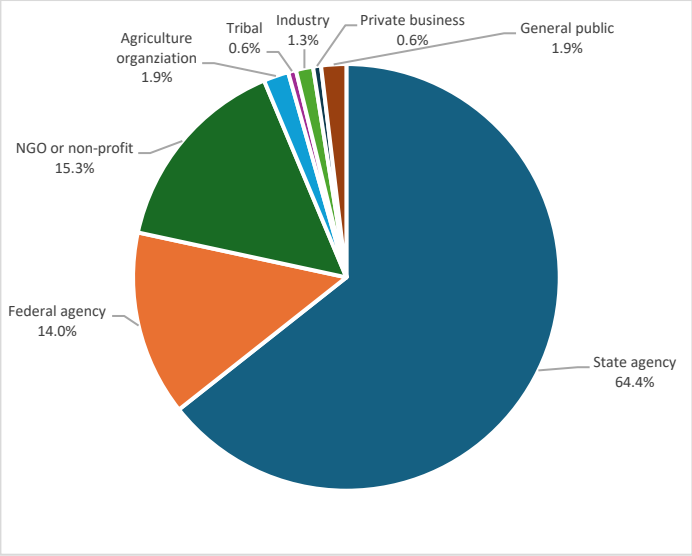
The success of these partnerships is evident not only in the achievements under the SWG program, but significant progress has been made in the conservation of SGCNs and their habitats by partners through various programs. Over the past two decades, nearly 75 SWG partner projects have been completed, encompassing all taxa and providing valuable research and conservation implementation based on the SWAP. See https://gf.nd.gov/wildlife/swg. The variety of projects and the large number of partners highlight the strength of the state's SWAP, demonstrating widespread commitment not only from Department staff but also from partners across the fish and wildlife community.

Beyond using SWG funding, conservation partners have played a vital role in implementing and delivering the ND SWAP by contributing expertise, resources, and on-the-ground support to protect the state's diverse habitats and wildlife. Through collaborative efforts involving state and federal agencies, non-profit organizations, tribal entities, private landowners, and academic institutions, these partners have helped prioritize conservation actions, conduct critical research and monitoring, and enhance habitat restoration projects. Their collective efforts ensure the plan's goals are translated into effective conservation outcomes, fostering a landscape where wildlife populations can thrive while balancing the needs of local communities and land use. See Partner Success Stories for just a few of the commendable projects that implement the SWAP (*note: in development for final SWAP to be submitted in fall 2025*).

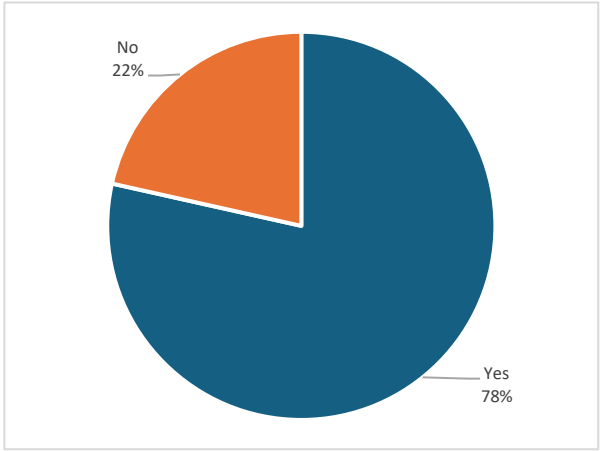
SWAP Stakeholder Survey 2022

On November 3, 2022, the Department requested partners to complete a SWAP survey on how they use the plan and what areas of the plan or emerging issues they would like to see emphasized. The survey closed on December 15, 2022, and 195 responses were counted. This survey helped guide the Department in revising the 2025 SWAP. The following are the key results from the survey:

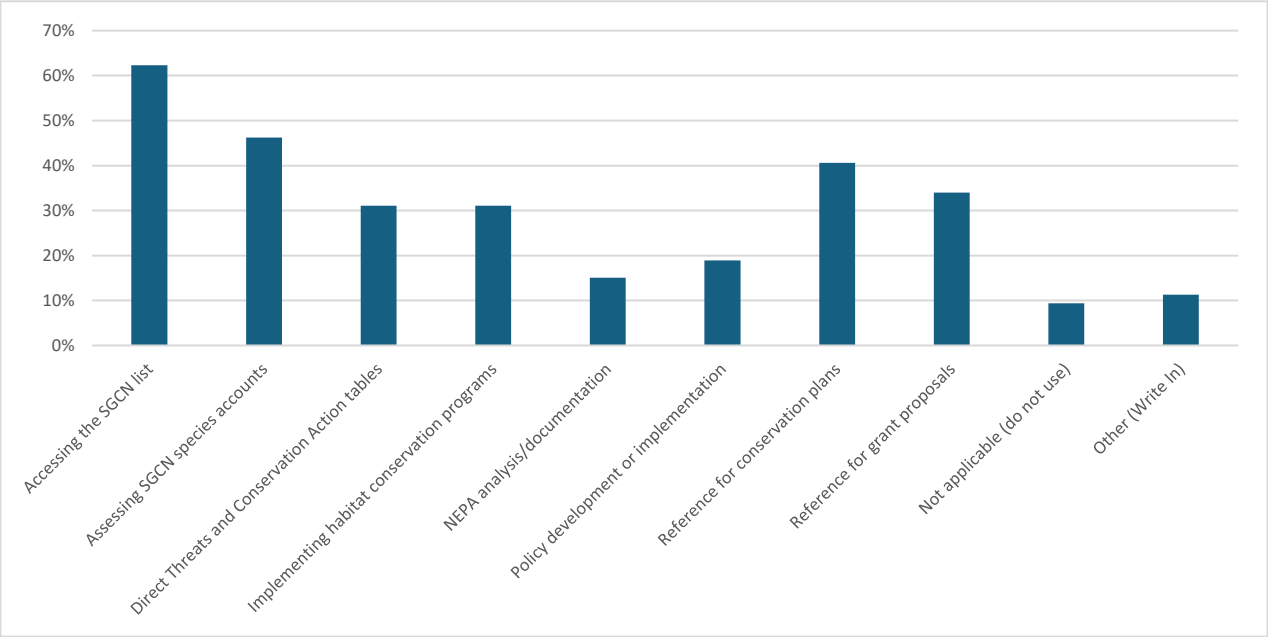
Who do you work for or represent?



Are you familiar with the 2015 State Wildlife Action Plan, including the plan itself or the 115 species listed?

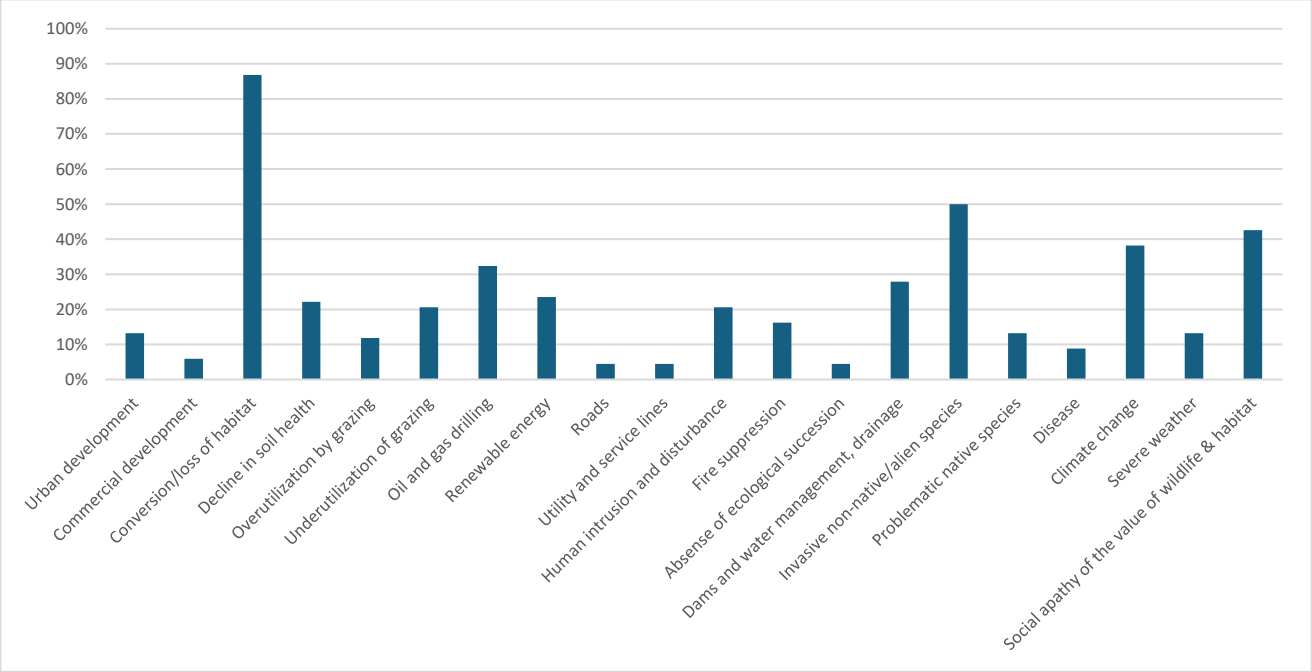


How do you use the 2015 ND State Wildlife Action Plan? Check all that apply.

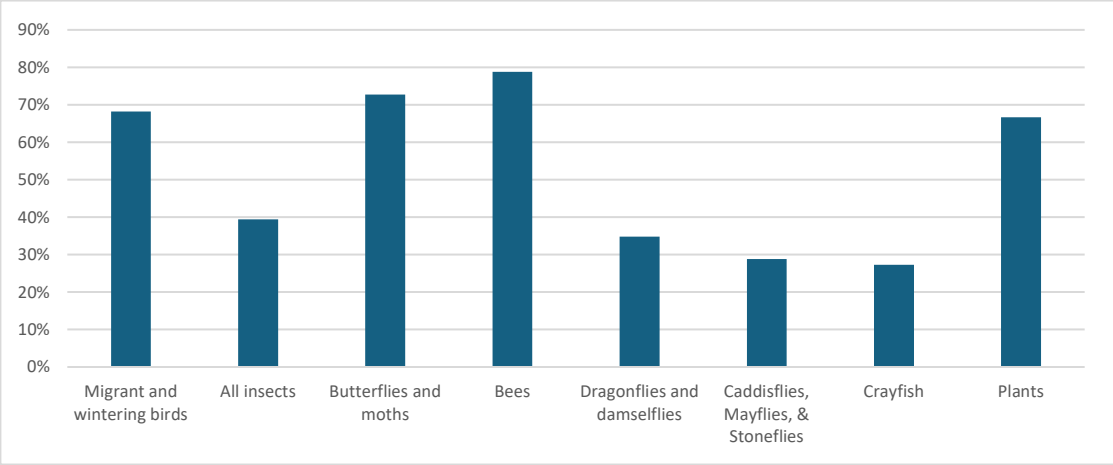


'Other' Write Ins: developing research objectives to inform species management; education or teaching; ensuring ND Administrative Code is protective of aquatic species; Integrated Natural Resources Plan (Sikes Act); media programs; Outdoor Heritage Fund; reference for publications; Surface Coal Mining Wildlife Inventory and Monitoring Plan; Climate Change addendum for class activity; Wetland Mitigation Banks; pollinator projects; environmental analysis of roadway projects.

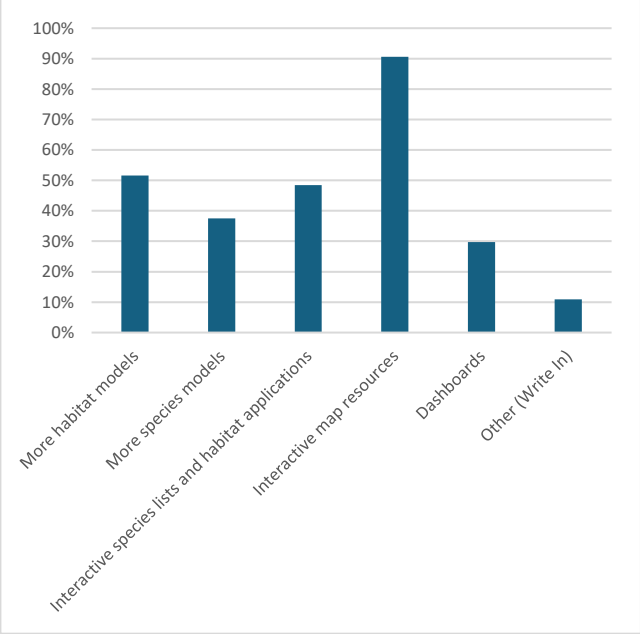
What challenges or threats do you see as most important to species in North Dakota? You may select up to 5 options.



The current species list includes birds (breeding birds and ESA listed), mammals, reptiles and amphibians, fish, freshwater mussels, and the four insect species listed or proposed for listing under the ESA. Please indicate if you think we should consider the following species/groups of species for the 2025 list:

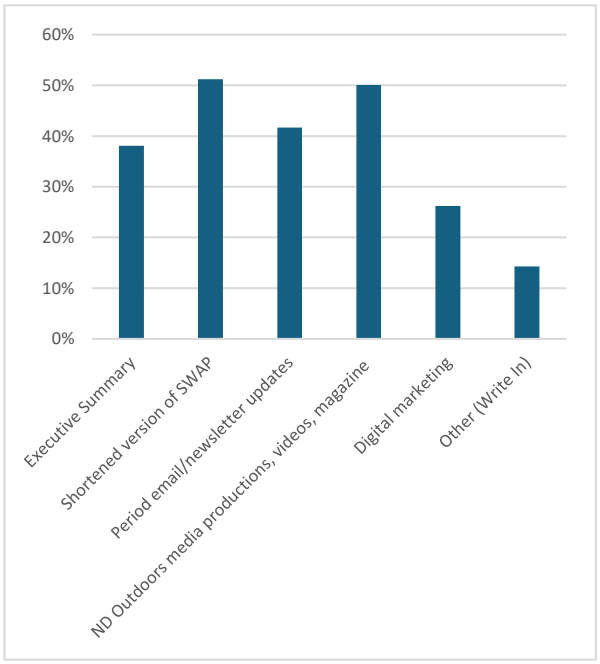


What tools do you want to see included in the next version of the ND State Wildlife Action Plan?



'Other' Write Ins: climate projections and range shift models; landscape and habitat management; known species and habitat details (finer than county level); links to other species management plans; more citizen science.

How else could we improve the ND State Wildlife Action Plan to make it easier to use, more accessible or more recognized? Check all that apply.



'Other' Write Ins: alphabetize the species lists; awareness campaign; FAQ sheet; infographics or one-pagers; public outreach focus on landowners/small towns; radio programs; action videos to support species.

Figure 39. Results from 2022 stakeholder survey.

Individual Partner Coordination Meetings 2023-2024

From late 2023 through April 2025, the Department met one-on-one with partners to discuss the SWAP revision, changes proposed for the 2025 plan, needed improvements, and for the partners to contribute their knowledge and expertise early in the process. Meetings were held in-person or virtually and started with the Department providing a brief history of the SWAP, significant changes proposed (i.e., changing the name from Species of Conservation Priority to Species of Greatest Conservation Need, including insect SGCNs), followed by an open discussion about how partners use the SWAP.

Table 34. State Wildlife Action Plan partner meetings for the 2025 update.

PARTNER COORDINATION MEETINGS			
PARTNER	DATE	PARTNER	DATE
US Forest Service	12/12/2023	FMHA	2/1/2024
North Dakota Dept. of Environmental Quality	12/13/2023	North Dakota Dept. of Water Resources	2/1/2024
North Dakota Dept. of Transportation	12/20/2023	US Army Corps of Engineers	2/1/2024
University of Jamestown	1/4/2024	EPA	2/1/2024
Prairie Pothole Joint Venture	1/5/2024	Pheasants Forever	2/5/2024
World Wildlife Fund	1/8/2024	United Tribes Technical College	2/5/2024
North Dakota Parks & Recreation	1/16/2024	US Fish & Wildlife Service	2/6/2024
University of North Dakota	1/17/2024	North Dakota State University & Extension Service	2/6/2024
North Dakota Public Service Commission	1/18/2024	North Dakota Trust Lands	2/12/2024

PARTNER COORDINATION MEETINGS			
PARTNER	DATE	PARTNER	DATE
The Nature Conservancy	1/19/2024	North Dakota Wildlife Federation	2/13/2024
Valley City State University	1/19/2024	Ducks Unlimited	3/27/2024
North Dakota Natural Resources Trust	1/23/2024	Audubon Great Plains	4/15/2024
American Bird Conservancy	1/23/2024	Delta Waterfowl	4/16/2024
Northern Great Plains Joint Venture	1/24/2024	Northern Prairie Wildlife Research Center	5/6/2024
USDA-NRCS	1/24/2024	Rancher/Grazer stakeholder meeting	5/14/2024
North Dakota Forest Service	1/25/2024	National Park Service	5/16/2024
USDA – Wildlife Services	1/29/2024	Grazing Association	5/22/2024
Turtle Mountain Band of Chippewa Indians	1/31/2024	SWAP Summit	9/11/2024
Xerces Society	1/31/2024	NDDOT Tribal Coordination Meeting	4/9/2025

SWAP Summit 2024

On September 11, 2024, the NDGF hosted a second State Wildlife Action Plan Summit. The meeting was attended by 62 participants from 30 different state and federal agencies and NGOs, in addition to 14 NDGF staff members who were either running the event or participating in the sessions. Like 2014, the summit began with a SWAP overview, the process used to revise the species of greatest conservation need list, ideas for improving the SWAP for useability, and a presentation from the North Central Climate Adaptation Science Center on incorporating climate change in the SWAP. The results of this meeting formed the foundation of Chapter 5, Threats and Actions.

Grasslands and grazing tour, July 2021.

NDGF and Minnesota DNR view the Drayton Dam modification.

NDGF Director Jeb Williams speaks at a Habitat and Hunting Access Summit in December 2024.

Research Ecologist Andy Boyce releases a Western Meadowlark fitted with a GPS transmitter.

PARTNER SUCCESS STORIES

In development. To be completed prior to submittal to USFWS.

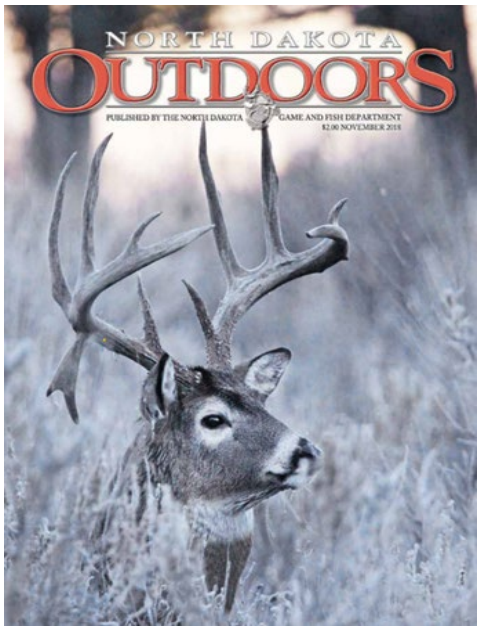
PUBLIC PARTICIPATION

The mission of the North Dakota Game and Fish Department is to protect, conserve, and enhance fish and wildlife populations, along with their habitats, to support both consumptive and non-consumptive public use. The Department serves as the primary governmental advocate for fish and wildlife, working diligently to conserve and improve these resources while safeguarding them from irreversible harm. Their goal is to ensure the long-term preservation of these natural resources for the benefit of North Dakota's citizens. As part of this responsibility, the Department recognizes the importance of keeping the public informed about local and national fish and wildlife issues. To achieve this, the Department employs various tools to communicate the progress and objectives of the State Wildlife Grants program and the State Wildlife Action Plan. A key method is through direct interaction between Department biologists and the public. The Conservation Division staff, well-versed in SWG and SWAP message, effectively relay this information through media and in-person engagements. These staff members participate in numerous interviews and public presentations throughout the year, serving as an effective source of information.

The Department's Communications Division also plays a crucial role in public outreach, utilizing digital media, video, and print to share important updates. Over the past decade, several broadcast news features have been produced on SWG-funded research and priority conservation species. These stories air statewide on network television and local cable channels. Additionally, the Department offers a weekly webcast on their website, featuring interviews with experts on various topics. The department also publishes a monthly magazine, *North Dakota Outdoors*, which regularly highlights wildlife issues, including detailed coverage of the SWG program. The magazine has featured extensive articles on SWG and SGCN efforts. All these resources are accessible on the Department website, making information on the benefits of the SWG programs widely available to the public.

Table 35. ND Outdoors magazine articles pertaining to the SWAP, SWG, or SGCNs and nongame species.

ND OUTDOORS MAGAZINE	
TITLE	DATE
Focus on Grasslands in a Prairie State	July 2016
Moss-back Makeover - Snapping Turtles in North Dakota	October 2016
Migratory Bird Treaty Turns 100	October 2016
North Dakota's Shorebird Connection	May 2017
Sage Grouse Recovery Effort Underway	May 2017
Milkweeds for Monarchs	June 2017
Forgotten Fish of Western North Dakota's Small Streams	June 2017
Grassland Birds	July 2017
Keeping Common Birds Common	June 2020
Powerful Prairie Melody Fading	June 2021
Lasting Look at Conspicuous Birds	June 2022
Rattlesnake Health Check	July 2022
Answering Curlew Questions	June 2023
Birding Beyond Your Back Yard	July 2023
Sturgeon Return to Pembina River	November 2023
Soaring out of Obscurity	May 2024
Last of the Leks	May 2024
Study Follows State Bird	June 2024



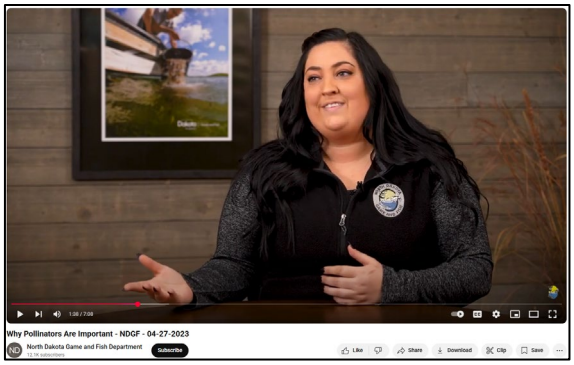
ND OUTDOORS MAGAZINE	
TITLE	DATE
New Species Added to SWAP	July 2024
Listening for Grassland Birds	July 2024
Water Quality Indicators	November 2024
A Checkoff for Nongame	February 2025

Table 36. ND Outdoors broadcast news features pertaining to the SWAP, SWG, SGCNs, or other nongame species.

ND OUTDOORS NEWS BROADCAST TV			
TITLE	DATE	TITLE	DATE
State Wildlife Action Plan	05/18/2015	Softshell Turtles	10/21/2019
Turtles in ND	07/14/2015	North American Wetlands Conservation Act	12/03/2019
Pollinator PLOTS	08/10/2015	Bird Watching	04/28/2020
Northern Prairie Wildlife Research Center	09/15/2015	Baby Animals	06/15/2020
River Watch	10/19/2015	American Bitterns	08/24/2020
Swift Fox Survey	11/16/2015	Wetland Restoration Project	09/22/2020
Wetland Recharge	04/11/2016	Mussel Relocation on the Sheyenne River	11/16/2020
Pollinator Plots	05/31/2016	Bald Eagle Comeback	03/16/2021
Grassland Birds	06/27/2016	The Importance of Pollinators	04/20/2021
Monarch Study	07/05/2016	Prairie Chicken Partnership	04/27/2021
Bee Study	08/09/2016	Bat Study	06/28/2021
Prairie Rattlesnakes	10/24/2016	Conservation Forage Program	07/05/2021
CREP – NDGF	04/24/2017	Ruffed Grouse Displaying	04/14/2022
Sage Grouse Transplant	05/08/2017	Long-billed Curlew Study	06/14/2022
Watchable Wildlife Photo Contest	09/04/2017	Counting Birds for Nearly 60 years!	07/11/2022
Painted Lady Butterflies	09/25/2017	Rattlesnake Den	07/14/2022
Aspen Tree Management	11/20/2017	Grazing-Grasslands-Birds	08/15/2022
Owls	03/05/2018	How You Can Help Pollinators!	04/25/2023
Paddlefish Tagging	04/30/2018	Long-billed Curlews Returned to North Dakota	06/05/2023
Monarch Life Cycle	06/22/2018	Paddlefish Tagging Garrison Reach	06/13/2023
Grassland Birds	07/02/2018	Toad Study	07/17/2023
Conservation and Outdoor Skills Park	07/05/2018	Drayton Dam Modification	10/02/2023
Burrowing Owls	08/13/2018	Lake Sturgeon Stocking	10/11/2023
Pollinator Project	09/24/2018	Watchable Wildlife Tax Checkoff	02/26/2024
Stream Fish Surveys	10/01/2018	Bald Eagle Nests	04/01/2024
Paddlefish Stocking	10/22/2018	Sage Grouse 2024	04/22/2024
Monarch Park Pass	03/11/2019	Western Meadowlark Tagging	06/10/2024
Bald Eagle Nests	04/09/2019	ARUs and Grassland Birds	07/08/2024
Long-Billed Curlews	06/17/2019	Aquatic Invertebrates Survey	11/18/2024
Paddlefish Garrison Reach of Missouri River	06/24/2019	Tracking Long-billed Curlews and Western Meadowlarks	02/24/2025
Amphibian Study	08/12/2019		

Table 37. ND Outdoors weekly webcasts pertaining to the SWAP, SWG, or SGCNs and nongame species.

ND OUTDOORS WEEKLY WEBCAST	
TITLE	DATE
State Wildlife Action Plan	05/14/2015
Baby Animals	06/11/2015
Baby Animals	06/09/2016
Birding in ND	06/01/2017
Pollinators	03/01/2018
Bird Watching in North Dakota	04/25/2019
Paddlefish Population in the Garrison Reach of Missouri River	06/13/2019
Simple Tips and Tricks of Bird Watching	05/07/2020
Baby Animals	06/10/2020
Wildlife Production Habitat	06/18/2020
Bald Eagles Today	03/04/2021
Long-billed Curlews	06/16/2022
Why Pollinators Are Important	04/27/2023
Long-Billed Curlew Study Update 2023	06/01/2023
Birding in North Dakota	06/14/2023
Sage Grouse Populations	04/18/2024
Why Are Wetlands Important?	05/09/2024
Leave Baby Animals Alone at This Time of Year	06/06/2024
Habitat for Wildlife Production!	06/27/2024
State Wildlife Action Plan Revision 2025	10/24/2024
Tracking Nongame Bird Species	02/25/2025



SUMMARY OF PARTNER AND PUBLIC REVIEW PROCESS

The following summarizes the timeline of the review process for the 2025 North Dakota State Wildlife Action Plan.

- Draft SGCN and SGIN list for Department internal review: 1/19/2023 through 2/24/2023.
- Draft SGCN and SGIN list for partner and species expert review: fall 2023 through early 2024.
- 2025 Spring Advisory Board Meetings: April 14, 15, 21 and 22. The North Dakota Game and Fish Department Advisory Board hosts public meetings at eight locations across the state. These public meetings provide citizens with an opportunity to discuss fish and wildlife issues and ask questions of their district advisors and agency personnel. NDGF personnel presented an update on the SWAP and provided an opportunity for the public to provide feedback.
- Draft SWAP for partner and public review: 5/20/2025 through 6/30/2025.
- Submit final SWAP to the U.S. Fish and Wildlife Service: July/August 2025.
- Anticipated approval: October 2025.

CHAPTER 9
WILDLIFE-ASSOCIATED RECREATION AND EDUCATION

This chapter includes information on nature-based recreation and education.

WILDLIFE-ASSOCIATED RECREATION

A significant challenge for the Department and for the future of species of greatest conservation need is to stay relevant within societal changes occurring within North Dakota and the whole nation. Although North Dakota historically has a strong outdoor heritage, the changing demographics and urbanization of our population is having an impact on societal views of hunting, fishing and general conservation ethics. The Department relies on our constituents for a funding base as well as for political support to fulfill our mission to protect, conserve and enhance fish and wildlife populations and their habitat for sustained public use. The Department needs to continuously improve or expand our strategies to engage the public and increase conservation awareness of fish and wildlife resources and the actions to combat threats.

Nature-based recreation and education is vital for effective State Wildlife Action Plans. To increase public awareness of conservation needs; while maintaining their personal connection with nature, biodiversity is important to individuals participating in nature-based recreation. Therefore, by restoring and protecting vital habitats, the Department ensures future generations can enjoy and observe a diversity of wildlife.

By conserving wildlife diversity, we're also enhancing the experience of wildlife watchers which contribute significantly to the state's economy. According to the *2022 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*, wildlife-watching participants contributed 250.2 billion dollars or 63% of the total annual expenditures for wildlife-related recreation in the United States (Figure 40).

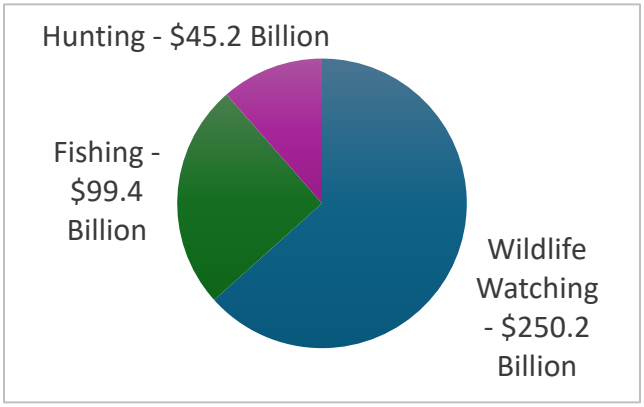


Figure 40. Economic contributions of outdoor activities.

SWAPs are vital in identifying strategies to conserve wildlife and their habitats, but equally important is to effectively increase public awareness and advocacy through various activities by increasing recreational and educational opportunities for the public.

The following actions were identified to increase public participation and education:

- **Hunting and Fishing:** SWAPs often identify threats to both terrestrial and aquatic habitats for both game and nongame species. By protecting or restoring habitat, SGCN's also benefit from management of games species.
- **Wildlife Viewing and Photography:** By conserving diverse ecosystems and protecting wildlife, SWAPs support wildlife viewing activities, such as birdwatching and nature photography. These activities provide significant economic benefits to local communities.
- **Outdoor Recreation:** Healthy ecosystems, protected by SWAPs, offer a wide range of outdoor recreational opportunities, including hiking, camping, and boating. These activities contribute to physical and mental well-being and support local economies.

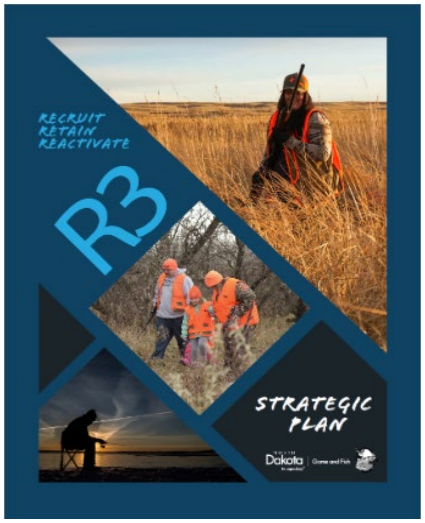
- **Nature-Based Tourism:** SWAPs can help promote nature-based tourism, attracting visitors from around the world. This can generate revenue for local businesses and create jobs in the tourism industry.
- **Public Access:** Many SWAPs include provisions for increasing public access to wildlife-rich areas through the development of trails, wildlife viewing platforms, and interpretive signage.
- **Shooting Ranges:** Shooting sports have gained considerable popularity with limited ranges in the state. Shooting sports also contribute considerable federal dollars to the Department and the local economy. The Department currently manages five public shooting ranges on its wildlife management areas.

EDUCATION

Environmental education is extremely relevant to the successful implementation of the SWAP. Educating our constituents on conservation threats and actions is key in creating advocacy for issues such as habitat loss, climate change, urbanization, wetland drainage, energy development and other threats to our SGCNs. Individuals that are conservation literate appreciate North Dakota's landscapes and can advocate change through legislative actions, community outreach, agricultural producer support as well as teaching future generations of conservation challenges.

The Department experiences several challenges in implementing environmental education programs such as funding, personnel, societal changes, lack of empathy for the environment and lack of volunteers to assist in the implementation of programs. By implementing additional opportunities for education, we develop additional advocacy to successful implement our SWAP and hopefully recover more SGCNs. However, to stay relevant today, the Department has identified the following enhancements to our existing environmental education programs.

- **Educational and Interpretive Opportunities:** SWAPs can support educational programs and interpretive centers that teach people about wildlife, ecology, and conservation. These programs can inspire future generations of conservationists and outdoor enthusiasts. The Department maintains a Conservation & Outdoor Skills Park at the North Dakota State Fairgrounds and at the Outdoors & Wildlife Learning Site (OWLS) at the Headquarters property in Bismarck.
- **Pollinator Education/Demonstration Plots:** By promoting and implementing urban pollinator plots, the Department can educate people regarding the importance of maintaining a healthy prairie ecosystem and its importance to bee's and other pollinator species. The Department maintains a list of preferred blooming plants in North Dakota on its website for anyone interested in learning more about gardening for pollinators.
- **Community Science:** Providing the public an opportunity to actively participate in research and monitoring efforts connects them with nature as well as providing needed monitoring data.
- **Outreach/Communication:** Utilize the Department's communication strategies to increase awareness of conservation activities promoting landscape stewardship and education opportunities.
- **Producer Education:** Create workshops or field trips to inform agricultural producers of programs available to benefit their operation as well as for wildlife production.
- **Recruit, Retain, Reactivate (R3):** Increase marketing efforts and expand programs to support R3 goals such as supporting and incentivizing hunting and fish mentorships opportunities, bolstering external partnerships with other state and federal agencies, tribal governments, nongovernmental agencies and industry partners. Approximately 25% of North Dakota residents participate in fishing/hunting activities, which makes the R3 Strategic Plan a top priority.



- **Shooting sports:** Increase activities associated with school-associated recreational shooting leagues and programs to help sustain and increase outdoor recreation activities outside of the school setting.
- **Hunter and Bow Hunter Safety/Fur Harvester Programs:** Continue to support and expand programs to teach safety and conservation strategies to participants. As a means of increasing participation and, as a matter of convenience, hunter education courses include the regular in-person course, along with the home-study version, along with archery. Most participants choose the in-person course (Figure 41 and Figure 42).

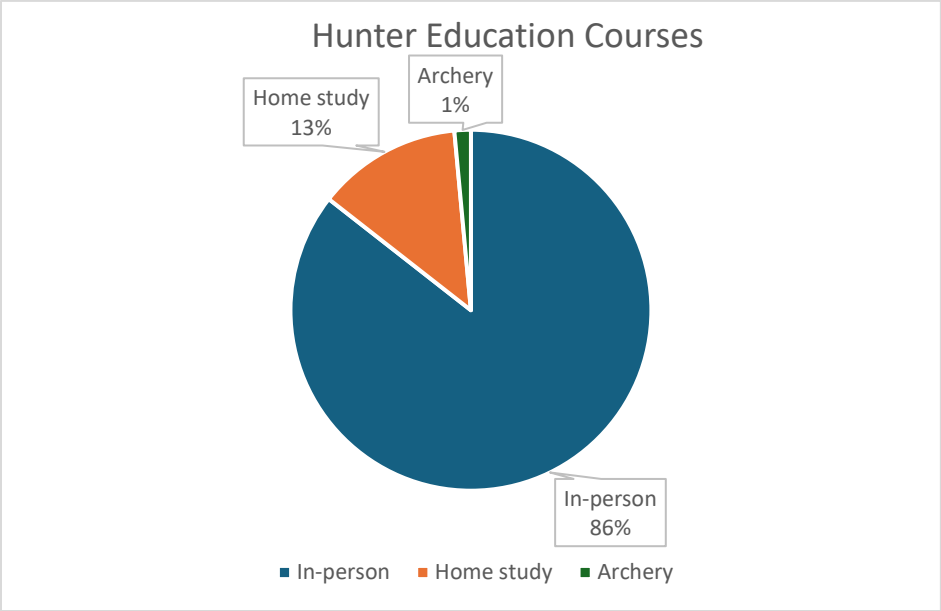


Figure 41. Percentage of participants for hunter education courses offered at the Department.

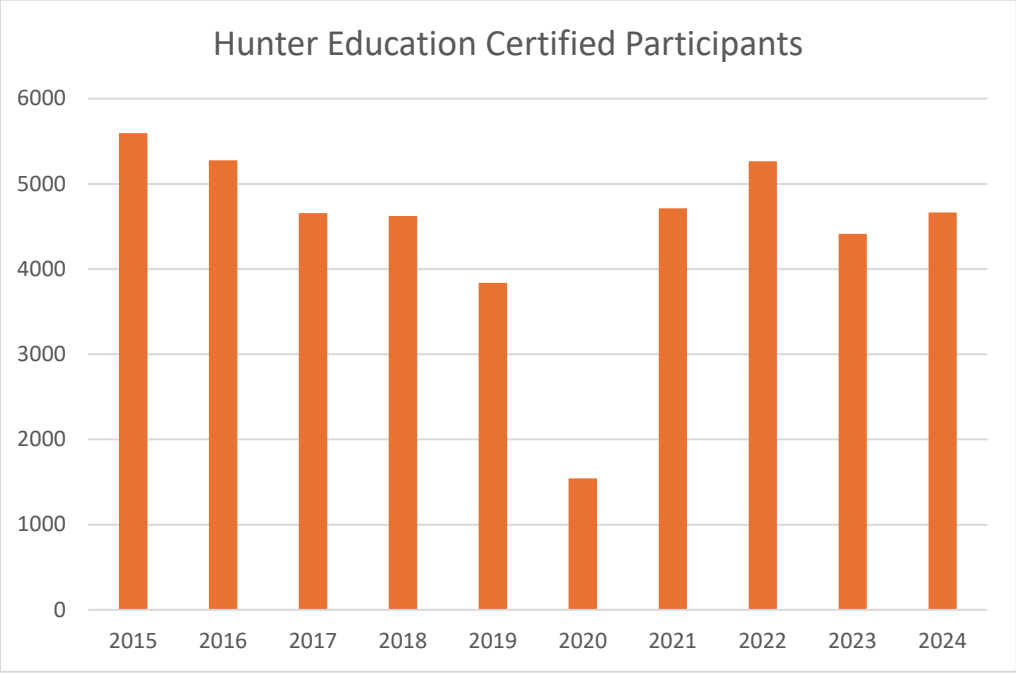


Figure 42. Hunter education participants from 2015-2024.

- **Boating and Water Safety:** Continue enhancing programs to instruct and educate participants to reduce boating and other water related incidents. Despite Department efforts, participation has decreased over the last ten years (Figure 43).

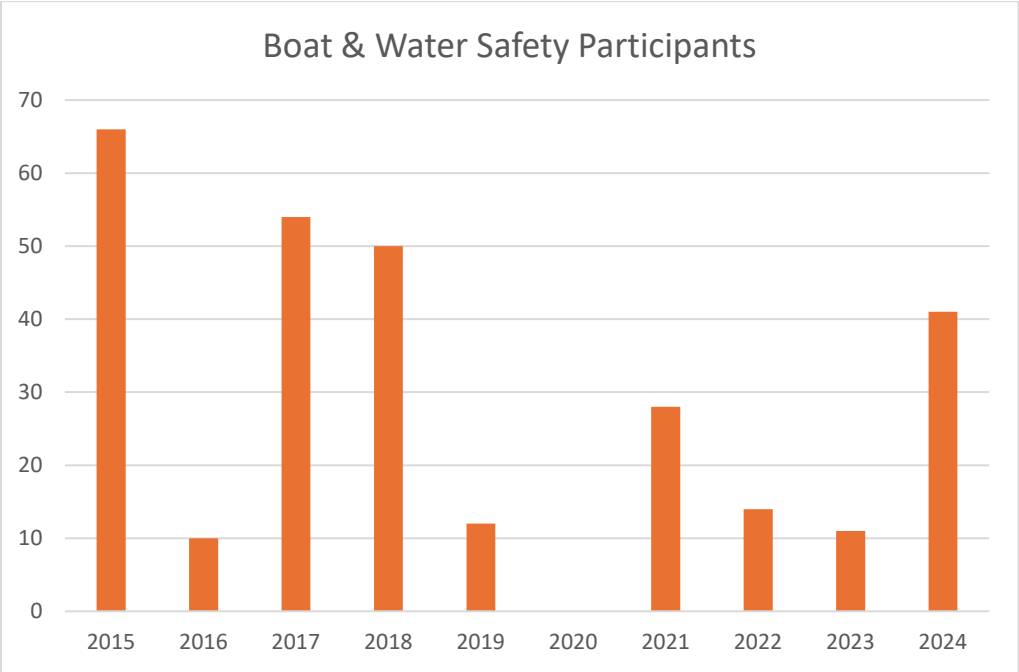


Figure 43. Boat and water safety participants at the Department from 2015-2024.

By investing in nature-based recreation and education, we build advocacy for the conservation of wildlife and their habitats. SWAPs not only protect biodiversity but also safeguard the recreational opportunities that enrich lives and contribute to our state's economy. Through successful implementation of the SWAP, we can ensure that future generations will have the opportunity to experience the many recreational benefits that wildlife and their habitats provide to our constituents.

WORKS CONSULTED

2024 Plowprint Report. World Wildlife Fund. Available https://www.worldwildlife.org/projects/plowprint-report

Association of Fish and Wildlife Agencies, Teaming With Wildlife Committee, State Wildlife Action Plan (SWAP) Best Practices Working Group. 2012. Best Practices for State Wildlife Action Plans—Voluntary Guidance to States for Revision and Implementation. Washington (DC): Association of Fish and Wildlife Agencies. 80 pages. Available https://www.fishwildlife.org/afwa-informs/state-wildlife-action-plans

Association of Fish and Wildlife Agencies (AFWA). 2022. Voluntary Guidance for States to Incorporate Climate Adaptation in State Wildlife Action Plans and Other Management Plans. 2nd edition. Editors: Climate Adaptation and Wildlife Diversity Conservation and Funding Committees, Voluntary Guidance Revision Work Group. Association of Fish and Wildlife Agencies, Washington, DC. Available https://www.fishwildlife.org/afwa-informs/state-wildlife-action-plans

Conservation Measures Partnership (2016) CMP Direct Threats Classification v 2.0. Available https://conservationstandards.org/library-item/direct-threats-classification-v2-0/

HerpMapper. 2025. HerpMapper - A Global Herp Atlas and Data Hub. Iowa, U.S.A. Available http://www.herpmapper.org. (Accessed: 20-03-2025).

Holling, C. S. 1978. Adaptive Environmental Assessment and Management. John Wiley and Sons, London.

Joyce, L. A., & Coulson, D. (2020). Climate scenarios and projections: A technical document supporting the USDA Forest Service 2020 RPA Assessment (RMRS-GTR-413; p. RMRS-GTR-413). U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. https://doi.org/10.2737/RMRS-GTR-413

Lawrence, D. J., Runyon, A. N., Gross, J. E., Schuurman, G. W., & Miller, B. W. (2021). Divergent, plausible, and relevant climate futures for near- and long-term resource planning. Climatic Change, 167(3), 38. https://doi.org/10.1007/s10584-021-03169-y

Lyons, K.G., Torok, P., Hermann, J, Kiehl, K., Kirmer, A., Kollman, J., Overbeck, G. E., Tischew, S., Allen, E. B., Bakker, J. D., Brigham, C., Buisson, E., Crawford, K., Dunwiddie, P., Firn, J., Grobert, D., Hickman, K., Stradic, S. LE., Temperton, V. M. (2023). Challenges and Opportunities for Grassland Restoration: A Global Perspective of Best Practices in the Era of Climate Change. Global Ecology and Conservation, 46, e02612, ISSN 2351-989.

Menz, M. H. M., Dixon, K. W., Hobbs, R. J. (2013). Hurdles and Opportunities for Landscape-Scale Restoration. Science, 339(6119): 525-527. DOI: 10.1126/science.1228334.

Midwest Landscape Initiative. The Midwest Conservation Blueprint. Available https://mcap-fws.hub.arcgis.com/pages/midwest-conservation-blueprint

Midwest Landscape Initiative and Terwilliger Consulting, Inc. 2022. 2022 Update: Regional Species of Greatest Conservation Need in the Midwestern United States. Midwest Association of Fish and Wildlife Agencies, Washington, D.C. Available https://www.mlimidwest.org/

Midwest Landscape Initiative and Terwilliger Consulting, Inc. July 2024. Voluntary Lexicon and Best Practice Recommendations for Midwest State Wildlife Action Plans. Available https://www.mlimidwest.org/reports/

Midwest Landscape Initiative and Terwilliger Consulting, Inc. November 2024. Inventory and Monitoring Resources for Midwest SWAPs and Regional Conservation Planning. Available https://www.mlimidwest.org/reports/

Miller, B. W., Schuurman, G. W., Symstad, A. J., Runyon, A. N., & Robb, B. C. (2022). Conservation under uncertainty: Innovations in participatory climate change scenario planning from U.S. national parks. Conservation Science and Practice, 4(3), e12633. https://doi.org/10.1111/csp2.12633

North Dakota Department Water Quality. October 2021. Watershed Management Program Fact Sheet. Retrieved from: https://deq.nd.gov/publications/WQ/3_WM/Factsheets/WMP_Program_FactSheetFinal.pdf

North Dakota Forest Service. May 2020. North Dakota Forest Action Plan. Retrieved from https://www.ag.ndsu.edu/ndfs/documents/2020-north-dakota-forest-action-plan-final.pdf

North Dakota Forest Service. January 10, 2024. Turtle Mountain Landscape Forest Stewardship Plan. Retrieved from https://www.ag.ndsu.edu/ndfs/documents/landscape-forest-stewardship-plan-turtle-mountain.pdf

North Dakota Indian Affairs Commission. 1999. 50 Years of Tribal/State Relations Anniversary Report – 1949-1999. https://www.indianaffairs.nd.gov/sites/www/files/documents/pdfs/50_yr_anniversary-NDIA.pdf

North Dakota Natural Heritage Program. 2013. North Dakota North Dakota Comprehensive Wildlife Strategy: Proposed Plant Species of Conservation Addendum. North Dakota Natural Heritage Program, North Dakota Parks and Recreation Department, Bismarck, ND.

Nyberg, J. B. 1998. Statistics and the practice of adaptive management. Pages 1-7 in V. Sit and B. Taylor, editors. Statistical methods for adaptive management studies. British Columbia Ministry of Forests, Research Branch, Victoria, British Columbia, Land Management Handbook 42. Retrieved from http://www.for.gov.bc.ca/hfd/pubs/docs/lmh/lmh42.htm

Salafsky N, Salzer D, Stattersfield AJ, Hilton-Taylor C, Neugarten R, Butchart SH, Collen B, Cox N, Master LL, O'Connor S, Wilkie D. A standard lexicon for biodiversity conservation: unified classifications of threats and actions. Conserv Biol. 2008 Aug;22(4):897-911. doi: 10.1111/j.1523-1739.2008.00937.x. Epub 2008 Jun 9. PMID: 18544093.

Soto-Navarro, C., Ravilious, C., Arnell, A. P., de Lamo, X., Harfoot, M. B. J., Hill, S. L. L., Wearn, O. R., Santoro, M., Bouvet, A., Mermoz, S., Le Toan, T., Xia, J., Liu, S., Yuan, W., Spawn, S. A., Gibbs, H. K., Ferrier, S., Harwood, T., Alkemade, R., … Kapos, V. (2020). Above and below ground biomass carbon and soil organic carbon [Data set]. UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC). https://doi.org/10.34892/QDB8-BH36

Smith, Matthew. (2020) Assessment of Amphibian Distributions and Breeding Habitat Characteristics in North Dakota: Final Report. North Dakota Game and Fish Dept. https://gf.nd.gov/node/3897

State Historical Society of North Dakota. Summary of North Dakota History. Accessed March 2025. Available https://www.history.nd.gov/ndhistory/firstpeople.html.

Suding, K., Higgs, E., Palmer, M., Callicott, J. B., Anderson, C. B., Baker, M., Gutrich, J. J., Hondula, K. L., LaFevor, M. C., Larson, B. M. H., Randall, A., Ruhl, J. B., Schwartz, K. Z. S. 2015. Committing to Ecological Restoration. Science, 348(6235). DOI: 10.1126/science.aaa4216

Torok, P., Brudvig, L. A., Kollmann, J., N. Price, J., Tothmeresz, B. (2021). The Present and Future of Grassland Restoration. Restoration Ecology, 29(S1), e13378. ISSN 10612971.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2022. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture, Agriculture Handbook 296. Available https://www.nrcs.usda.gov/resources/data-and-reports/major-land-resource-area-mlra

U.S. Department of Agriculture, National Agricultural Statistics Service. 2024 National Cultivated Layer. Available https://www.nass.usda.gov/Research_and_Science/Cropland/Release/index.php

U.S. Department of Agriculture, National Agricultural Statistics Service. February 2024. 2022 Census of Agriculture, North Dakota State and County Data. Available https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Census_by_State/North_Dakota/index.php

U.S. Department of the Interior, U.S. Fish and Wildlife Service, 2022 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. Available https://www.fws.gov/media/2022-national-survey-fishing-hunting-and-wildlife-associated-recreation

U.S. Geological Survey, 2025, Annual NLCD (National Land Cover Database)—The next generation of land cover mapping: U.S. Geological Survey Fact Sheet 2025–3001, 4 p., https://doi.org/10.3133/fs20253001. Annual NLCD Available https://www.usgs.gov/centers/eros/science/data-access

USNVC (United States National Vegetation Classification) Database 2.04. June 2022. Federal Geographic Data Committee, Vegetation Subcommittee. Washington D.C. Accessed February 2025. Available https://usnvc.org/

Valley City State University, 2024, Aquatic Insects Key. Available http://waterbug.vcsu.edu/key/