Statewide Wildlife Action Plan

2027

Contents

If you are viewing this document digitally, click "State Wildlife Action Plan" at the bottom of any page to return to the Table of Contents. From the Table of Contents, you can also click any section title to go straight to that section.

Cover Photo: *Brewer's Sparrow. Photo by WGFD.*

Foreword

Wyoming is known for intact landscapes, abundant natural resources, and people who are connected to the land. From the Cliff Chipmunk to the Yellowstone Cutthroat Trout, wildlife are key to the landscapes, cultures, and economies of Wyoming. Wyoming's State Wildlife Action Plan (SWAP) reflects a deep desire to maintain species, landscapes, and our natural heritage for generations to come.

Effective conservation hinges on strategic actions that address high-priority challenges that are generated with input from a wide range of partners, collaborators, and stakeholders. Wyoming's SWAP supports statewide conservation efforts by identifying the highest-priority challenges facing the diversity of wildlife throughout the state and providing a list of voluntary recommendations to address those challenges, all of which were generated with input from across the state.

Each state must revise their SWAPs at least every 10 years to incorporate changing conditions and emerging information. Wyoming's 2027 SWAP stands on the shoulders of revisions in 2005, 2010, and 2017. This revision provides a comprehensive review of available information, follows best practices recommended by practitioners, supports building and maintaining strong relationships throughout the state, and is useful and user-friendly.

We invite all of Wyoming to draw from the SWAP to tackle priority challenges by implementing priority, voluntary actions.

Executive Summary

State Wildlife Action Plans (SWAPs) are strategic roadmaps to conserve the health and diversity of species within each state. Successfully completing a SWAP also makes each state eligible to receive funds through the State Wildlife Grants (SWG) program, a key funding source that is administered through the U. S. Fish and Wildlife Service. The funds Wyoming receives from SWG each year, alongside matching funds from additional sources, help to manage species that may not be associated with license sales or other forms of revenue. This roadmap and funding support provide a proactive approach to conservation and management, which serves to prevent future listings under the Endangered Species Act. Every state completes and maintains a SWAP, which means that every state contributes to nationwide efforts to manage species and their habitats. In sum, SWAPs are strategic planning documents that coordinate efforts to manage wildlife and their habitats across scales, as well as functional components of critical funding sources.

States must update their SWAPs every 10 years, and each SWAP must meet 8 federally required elements while doing so. Wyoming's 2027 SWAP is the culmination of thousands of hours of work by >100 professionals and stakeholders throughout the state. Wyoming's SWAP identifies 308 Species of Greatest Conservation Need (SGCN) and the habitats they rely on. Additionally, the highest priority challenges for both SGCN and their habitats have been identified with corresponding voluntary actions that Wyoming communities can implement to conserve SGCN and their habitats. It also includes a plan for monitoring and evaluating progress towards management goals.

Wyoming's 2027 SWAP has been constructed to be useful and accessible to a broad range of professionals and purposes. The Wyoming Game and Fish Department (WGFD) coordinates the development of the SWAP, but it is a plan for the entire state. The challenges identified in the SWAP can only be met through coordinated effort that leverages the collective experiences and resources of the entire state. There is relevant information in the SWAP whether you are a biologist with the WGFD, a steward with a land trust, a researcher seeking to conduct applied studies, a landowner wanting to improve habitat on your property, or a teacher wanting to incorporate more ecology into your classroom.

The SWAP is arranged so that readers can navigate directly to the information most relevant to them. The SWAP is arranged into the following sections:

Chapters 1 and 2 set the stage for the remainder of the SWAP by providing a broad overview of the SWAP and an introduction to Wyoming's ecological and social context. Chapter 1 includes suggestions of how different readers might implement this plan into their conservation work.

Chapters 3 – 11 identify priority challenges and priority, voluntary actions that are relevant to the 308 amphibians, birds, crustaceans, fish, mammals, mollusks, plants, and reptiles identified as SGCN. Each taxonomic group is self-contained within its own chapter. Chapter 3 provides detailed documentation of how SGCN, challenges, and actions were identified.

Chapters 12 – 29 include descriptions of 11 terrestrial habitat types and 6 aquatic basins that are key to the conservation of SGCN. Each habitat type or basin is self-contained within its own chapter, including information regarding the ecological context, priority challenges, and priority, voluntary actions relevant to each habitat or basin. Chapter 12 provides detailed documentation of how challenges and actions were identified.

Chapter 30 reflects on the progress made towards management of SGCN and their habitats over the past 10 years by listing all SWG-supported projects and highlighting select projects. This chapter also includes a monitoring and evaluation plan for the next 10 years.

Chapter 31 summarizes the approach to incorporating stakeholders and members of the public into the 2027 revision.

Appendices A – H provide additional context and justification for the remainder of the plan. Appendices also include required components of the SWAP, such as the roadmap and documentation of changes from previous versions (Appendix A).


Hornyhead Chub. Photo by Kellyn Chandler/WGFD.

Acknowledgments

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Rhiannon Jakopak (WGFD) coordinated the 2027 revision.

Warlber. Photo by Amy Anderson/WGFD.

Pilose Crayfish. Photo by Stephen Siddons/WGFD.

Chapter 1: Purpose and Overview of Wyoming's State Wildlife Action Plan

History of SWG and SWAPs

State Wildlife Action Plans (SWAPs) have shaped management and conservation across the United States for over 20 years. Congress created the State Wildlife Grant (SWG) program in 2001; through the SWG program, Congress annually appropriates funds to help states carry out the actions identified in their SWAPs. The SWG program, which is administered by the U. S. Fish and Wildlife Service (USFWS), allocates funds to each state based on a combination of their population size and land mass. Wyoming has received over $13 million from the SWG program since 2002, which has been used to support over 185 projects focused on the management of Species of Greatest Conservation Need (SGCN) and their habitats.

To incorporate changing conditions and emerging information, SWAPs must be revised at least every 10 years. Wyoming created its first SWAP, then called a Comprehensive Wildlife Conservation Strategy, in 2005. The SWAP was revised again in 2010 and in 2017. This revision stands on the shoulders of those thorough efforts.

Required elements

There are 8 federally required elements that each SWAP must address. These 8 elements require that each SWAP include:

1. Information on the distribution and abundance of species of wildlife, including low and declining populations as the state fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife; and,

2. Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1); and,

3. Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats; and,

4. Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions; and,

5. Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions; and,

6. Descriptions of procedures to review the plan at intervals not to exceed ten years; and,

7. Plans for 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.

8. Congress also affirmed through this legislation, that broad public participation is an essential element of developing and implementing these plans, the projects that are carried out while these plans are developed, and the SGCN that Congress has indicated such programs and projects are intended to emphasize.

Within these required elements, states have considerable flexibility to create a plan that is well-suited to the unique cultural and ecological contexts they operate within. Together, each state contributes to a nationwide strategy for conserving and managing the diversity of wildlife and their habitats.

How to use this plan

Wyoming's 2027 SWAP identifies species, habitats, challenges, and actions to focus on between 2027 and 2037. The SWAP is non-regulatory, and all actions identified within the plan may be pursued voluntarily. Agencies and organizations across the state may pursue these efforts collaboratively.

Wyoming's SWAP serves as a roadmap for conservation work across the entire state. Agencies, organizations, and individuals wishing to use the information in the SWAP should recognize that the species list, challenges, and actions reflect a statewide perspective. Species ranges may span jurisdictional boundaries, multiple states, habitat types, or ecological contexts, so this information should be tailored to the specific context of a given location before implementation.

The plan is organized so that each of the chapters devoted to SGCN or habitats are standalone, with additional background information provided in introductory chapters and appendices. The plan is crafted so that a broad array of management professionals and stakeholders can find utility and can easily navigate to the most relevant portions.

If you seek to learn about challenges affecting SGCN or their habitats, or which actions would be most strategic for their conservation, you may navigate directly to the relevant SGCN or habitat chapter. If you seek detailed information about how SGCN, habitats, challenges or actions were identified, refer to *Chapter 3* and 12. The challenges and actions relevant to each species and their habitats may be useful to keep in mind when siting new development projects where the species occur, identifying strategies to bolster populations, or developing research projects.

The SWAP should complement and support other management plans.The challenges and actions identified within this plan can be used to generate or improve existing theories of change, workplans, and research agendas.

For those who are already pursuing conservation and management actions, this document will help identify how actions may have broader ramifications than intended. For example, a project that is improving habitat quality for one species might also be able to improve habitat for co-occurring species.

The challenges and actions that are outlined in the 2027 SWAP reflect the available information and current conditions. They should be viewed not as a to-do list, but instead as a list of suggestions that are flexible to changing conditions and opportunities.

Wyoming's SWAP exists to keep common species common, deliver conservation interventions to prevent species from being listed under the Endangered Species Act, and gain information about species to support their conservation. Species will remain identified as SGCN until their conservation status improves to the point that they do not warrant additional conservation action or until enough information is garnered about them to indicate that additional conservation attention is not warranted. The SWAP serves as a strategic, collaborative, and statewide roadmap to guide conservation efforts, with the ultimate goal of removing species from being considered SGCN.

Revision timeline

Wyoming kicked off the 2027 revision in 2024, with the required letter of intent to the USFWS. Between October 2024 and June 2026, a revision strategy was crafted, working groups made up of experts from around the state were coordinated, all aspects of the plan were revised or generated, and multiple stages of review were received. More specific details regarding changes from the 2017 SWAP are available in the roadmap in *Appendix A*. The 2027 revision was submitted to the USFWS for review and to initiate revision implementation in summer 2026.

Brewers Sparrow. Photo by Don Jones/WGFD.

Upland Sandpiper. Photo by Andrea Orabona/WGFD.

Chapter 2: Wyoming's Conservation Context

To contextualize the information found within Wyoming's SWAP, a high-level overview of Wyoming's social and ecological context is provided.

Wyoming's social and ecological context

Wyoming remains the least populated state, with an estimated 587,618 residents as of 2024. The population is projected to grow to over 608,000 residents by 2037 (Economic Analysis Division 2025). The state is primarily rural. Cheyenne, the state's capitol, had 65,704 residents and Casper, the next most populated city, had 58,823 residents; all other municipalities had under 35,000 residents (Liu 2025). Only Laramie County and Natrona County, which contain Cheyenne and Casper respectively, meet the U. S. Department of Agriculture's classification of "metropolitan" (high-density areas containing >50,000 residents; U. S. Department of Agriculture 2025). This rural context shapes the culture and landscapes of Wyoming.

Main industries in the state include energy production and development, tourism and recreation, and agriculture.

Humans have found a home in Wyoming for over 12,000 years. Depending on the time period and location, tribes including Eastern Shoshone, Northern Arapaho, Shoshone-Bannock, Crow, Cheyenne, Ute, and many more moved through or lived within what is now Wyoming.

Land ownership across the state is 50% federal, 43% private, 6% state, and 1% other (Bureau of Land Management 2022). Federal lands include those owned and managed by the Bureau of Land Management, Bureau of Reclamation, National Park Service, U. S. Fish and Wildlife Service, and U. S. Forest Service. The federal category also encompasses the Wind River Reservation, shared by Eastern Shoshone and Northern Arapaho tribes, which encompasses 2.2 million acres. Private lands include individual homes, subdivisions, ranches and ranchettes, and farmland. State lands include those owned and managed by the Office of State Lands and Investment, State Parks and Historic Sites, the University of Wyoming, and the Wyoming Game and Fish Commission.

Wildlife are deeply valued by most people in the state. The wildlife value orientation framework combines many aspects of a person's relationship to wildlife into different typologies, and this framework can be used to understand how people in Wyoming value wildlife. Forty-eight percent of Wyoming residents tend to believe that wildlife should be used and managed for human benefit (i.e., traditional wildlife value orientation; Dietsch et al. 2018). Twenty-two percent of Wyomingites hold views that wildlife are like humans and should be managed accordingly (i.e., mutualist orientation). Twenty-six percent held a combination of these mindsets that vary based on the context (i.e., pluralist). Only 5% are distanced from wildlife-related issues, underscoring how much most people in Wyoming value wildlife, even if the specific relationships to wildlife differ.

Wyoming is the 9th largest state in terms of area, and the 97,914 square miles contain considerable geologic, topographic, climatic, and ecological variability. Average elevation is approximately 6,400 feet above sea level but varies from 3,104 in Crook County to 13,800 feet at the top of Gannett Peak (3D Elevation Program, 10 m resolution; U. S. Geological Survey 2024). Elevation plays a critical role in shaping temperature, evapotranspiration, water type and availability, and species composition, and Wyoming's high elevation leads to a state that is relatively cool and dry. Average annual temperature across the state is 41.9°F, and it varies between an average of 21.5°F in January to an average of 66.2°F in July (30-year normals [1991 – 2020], PRISM Group 2025). Mean annual precipitation is 16.6 inches per year, and much of the state's water comes by way of snow (30-year normal [1991 – 2020], PRISM Group 2025). There are approximately 295,156 miles of rivers in the state, and major rivers include the Bear, Green, Platte, Powder, Snake, Wind-Bighorn, Yellowstone and associated tributaries (U. S. Geological Survey 3D National Hydrography Program 2025).

From a biodiversity standpoint, over 800 species of birds, mammals, fish, amphibians, reptiles, mollusks, and crustaceans breed within Wyoming's borders, and over 4,000 native vascular plants live within the state. Wildlife benefits people in many ways, including through economic contributions to livelihoods, sustenance in the form of game meat, recreational and spiritual values, pollination and seed dispersal, and broader structuring and regulation of ecosystems (Chaplin-Kramer et al. 2025).

Chapter 3: Species of Greatest Conservation Need Overview

A key objective of the State Wildlife Action Plan (SWAP) is to identify Species of Greatest Conservation Need (SGCN). Because of their conservation status, SGCN warrant additional conservation attention through targeted conservation efforts, increased funding, and considerations in land use and development planning. Species can be identified as SGCN based on known challenges or if there is a lack of information to adequately assess a species' status.

Wyoming's 2027 SWAP identifies 308 SGCN: 9 amphibians, 89 birds, 9 crustaceans, 29 fish, 55 mammals, 37 mollusks, 55 plants, and 25 reptiles (*Table 1*; *Appendix B*). Mollusks and crustaceans include groups, which lump species together because their ecologies are similar or suspected to be similar, although significant uncertainties regarding taxonomy or ecology remain. Due to the addition of the plant taxonomic group, new research, and updated population status, 13 species were removed and 75 species were added relative to the 2017 SWAP (*Appendix C*). Plants are a new taxonomic group included in the SWAP, and they represent the bulk of the added species.

Chapters focused on each of the taxonomic groups of SGCN follow this introduction and overview of the SGCN identification process. Each chapter contains a brief overview of the ecological and biological context for a taxonomic group in Wyoming and challenges and actions that are applicable to each SGCN.

Table 1. Species of Greatest Conservation Need (SGCN) in Wyoming.

SGCN are organized by taxa, conservation priority tier (Tier), and Native Species Status and cell (NSS and Cell, respectively), and then alphabetized by common name. Detailed information about the cell, NSS rank, and conservation priority tier are available in the "Identifying SGCN" portion of this chapter. Changes from the 2017 list to the 2027 list are provided in *Appendix C*.

Common name	Scientific name	Cell	NSS	Tier
Amphibians (9 species)				
Western (Boreal) Toad	*Anaxyrus boreas*	Aa	1	I
Wyoming Toad	*Anaxyrus baxteri*	Aa	1	I
Wood Frog	*Lithobates sylvaticus*	Ba	2	II
Columbia Spotted Frog	*Rana luteiventris*	Bb	3	II
Great Plains Toad	*Anaxyrus cognatus*	Bb	3	II
Northern Leopard Frog	*Lithobates pipiens*	Bb	3	II
Great Basin Spadefoot	*Spea intermontana*	Bc	4	II
Plains Spadefoot	*Spea bombifrons*	Bc	4	II
Western Tiger Salamander	*Ambystoma mavortium*	Bc	4	III
Birds (89 species)				
Common Loon	*Gavia immer*	Aa	1	I

Common name	Scientific name	Cell	NSS	Tier
Yellow-billed Cuckoo	*Coccyzus americanus*	Ab	2	II
Brewer's Sparrow	*Spizella breweri*	Bb	3	I
Mountain Plover	*Anarhynchus montanus*	Bb	3	I
Sage Thrasher	*Oreoscoptes montanus*	Bb	3	I
American Bittern	*Botaurus lentiginosus*	Bb	3	II
Baird's Sparrow	*Centronyx bairdii*	Bb	3	II
Black Tern	*Chlidonias niger*	Bb	3	II
Black-crowned Night Heron	*Nycticorax nycticorax*	Bb	3	II
Bobolink	*Dolichonyx oryzivorus*	Bb	3	II
Boreal Owl	*Aegolius funereus*	Bb	3	II
Burrowing Owl	*Athene cunicularia*	Bb	3	II
Calliope Hummingbird	*Selasphorus calliope*	Bb	3	II
Caspian Tern	*Hydroprogne caspia*	Bb	3	II
Chestnut-collared Longspur	*Calcarius ornatus*	Bb	3	II
Clark's Nutcracker	*Nucifraga columbiana*	Bb	3	II
Evening Grosbeak	*Hesperiphona vespertina*	Bb	3	II
Forster's Tern	*Sterna forsteri*	Bb	3	II
Golden Eagle	*Aquila chrysaetos*	Bb	3	II
Grasshopper Sparrow	*Ammodramus savannarum*	Bb	3	II
Great Gray Owl	*Strix nebulosa*	Bb	3	II
Harlequin Duck	*Histrionicus histrionicus*	Bb	3	II
Lark Bunting	*Calamospiza melanocorys*	Bb	3	II
Loggerhead Shrike	*Lanius ludovicianus*	Bb	3	II

Common name	Scientific name	Cell	NSS	Tier
Long-billed Curlew	*Numenius americanus*	Bb	3	II
Pinyon Jay	*Gymnorhinus cyanocephalus*	Bb	3	II
Rufous Hummingbird	*Selasphorus rufus*	Bb	3	II
Sagebrush Sparrow	*Artemisiospiza nevadensis*	Bb	3	II
Snowy Egret	*Egretta thula*	Bb	3	II
Thick-billed Longspur	*Rhynchophanes mccownii*	Bb	3	II
Trumpeter Swan	*Cygnus buccinator*	Bb	3	II
Upland Sandpiper	*Bartramia longicauda*	Bb	3	II
Western Cattle-Egret	*Ardea ibis*	Bb	3	II
White-faced Ibis	*Plegadis chihi*	Bb	3	II
Willow Flycatcher	*Empidonax traillii*	Bb	3	II
Wilson's Phalarope	*Phalaropus tricolor*	Bb	3	II
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Bc	4	II
Plains Sharp-tailed Grouse	*Tympanuchus phasianellus jamesii*	Bc	4	II
Common Nighthawk	*Chordeiles minor*	Cb	4	II
Ferruginous Hawk	*Buteo regalis*	Cb	4	II
Greater Sage-Grouse	*Centrocercus urophasianus*	Bc	4	II
MacGillivray's Warbler	*Geothlypis tolmiei*	Cb	4	II
Peregrine Falcon	*Falco peregrinus*	Bc	4	II
Columbian Sharp-tailed Grouse	*Tympanuchus phasianellus columbianus*	Cb	4	II
Short-eared Owl	*Asio flammeus*	Bc	4	II
Swainson's Hawk	*Buteo swainsoni*	Cb	4	II
American Kestrel	*Falco sparverius*	Bc	4	III

Common name	Scientific name	Cell	NSS	Tier
American Pipit	*Anthus rubescens*	Bc	4	III
American White Pelican	*Pelecanus erythrorhynchos*	Bc	4	III
Ash-throated Flycatcher	*Myiarchus cinerascens*	Bc	4	III
Bald Eagle	*Haliaeetus leucocephalus*	Cb	4	III
Bewick's Wren	*Thryomanes bewickii*	Bc	4	III
Black-throated Gray Warbler	*Setophaga nigrescens*	Bc	4	III
Blue Grosbeak	*Passerina caerulea*	Bc	4	III
Blue-gray Gnatcatcher	*Polioptila caerulea*	Bc	4	III
Bushtit	*Psaltriparus minimus*	Bc	4	III
Canyon Wren	*Catherpes mexicanus*	Bc	4	III
Common Yellowthroat	*Geothlypis trichas*	Cb	4	III
Great Blue Heron	*Ardea herodias*	Bc	4	III
Juniper Titmouse	*Baeolophus ridgwayi*	Bc	4	III
Northern Pintail	*Anas acuta*	Bc	4	III
Northern Pygmy-Owl	*Glaucidium gnoma*	Bc	4	III
Pygmy Nuthatch	*Sitta pygmaea*	Bc	4	III
Red Crossbill	*Loxia curvirostra*	Cb	4	III
Red-eyed Vireo	*Vireo olivaceus*	Bc	4	III
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Cb	4	III
Virginia's Warbler	*Leiothlypis virginiae*	Bc	4	III
Williamson's Sapsucker	*Sphyrapicus thyroideus*	Bc	4	III
Woodhouse's Scrub-Jay	*Aphelocoma woodhouseii*	Bc	4	III
Black Rosy-Finch	*Leucosticte atrata*	U	U	I

Common name	Scientific name	Cell	NSS	Tier
American Goshawk	*Astur atricapillus*	U	U	II
Black-backed Woodpecker	*Picoides arcticus*	U	U	II
Brown-capped Rosy-Finch	*Leucosticte australis*	U	U	II
Clark's Grebe	*Aechmophorus clarkii*	U	U	II
Field Sparrow	*Spizella pusilla*	U	U	II
Flammulated Owl	*Psiloscops flammeolus*	U	U	II
Franklin's Gull	*Leucophaeus pipixcan*	U	U	II
Lewis's Woodpecker	*Melanerpes lewis*	U	U	II
Snowy Plover	*Anarhynchus nivosus*	U	U	II
Western Grebe	*Aechmophorus occidentalis*	U	U	II
American Barn Owl	*Tyto furcata*	U	U	III
Black-chinned Hummingbird	*Archilochus alexandri*	U	U	III
Dickcissel	*Spiza americana*	U	U	III
Gray Vireo	*Vireo vicinior*	U	U	III
Merlin	*Falco columbarius*	U	U	III
Purple Martin	*Progne subis*	U	U	III
Scott's Oriole	*Icterus parisorum*	U	U	III
Virginia Rail	*Rallus limicola*	U	U	III
White-winged Crossbill	*Loxia leucoptera*	U	U	III
Crustaceans (8 species, 1 group)				
Pilose Crayfish	*Pacifastacus gambelii*	Aa	1	I
Constricted Fairy Shrimp	*Branchinecta constricta*	Ab	2	II
Fairy Shrimp	*Branchinecta serrata*	Bb	3	II

Common name	Scientific name	Cell	NSS	Tier
Ringed Crayfish	*Faxonius neglectus*	Bc	4	II
Calico/Papershell Crayfish	*Faxonius immunis*	Bc	4	III
Beavertail Fairy Shrimp	*Thamnocephalus platyurus*	Bc	4	III
Fairy shrimp (Mackin Fairy Shrimp)	*Streptocephalus mackini*	U	U	II
Devil Crayfish/Great Plains Mudbug	*Lacunicambarus nebrascensis*	U	U	III
Other shrimp group (17 species)		U	U	II
Fish (29 species)				
Bluehead Sucker	*Pantosteus discobolus*	Aa	1	I
Flannelmouth Sucker	*Catostomus latipinnis*	Aa	1	I
Kendall Warm Springs Dace	*Rhinichthys osculus thermalis*	Aa	1	I
Northern Pearl Dace	*Margariscus nachtriebi*	Aa	1	I
Green Sucker	*Pantosteus virescens*	Ab	2	I
Hornyhead Chub	*Nocomis biguttatus*	Ab	2	II
Sturgeon Chub	*Macrhybopsis gelida*	Ab	2	II
Suckermouth Minnow	*Phenacobius mirabilis*	Ab	2	II
Western Silvery Minnow	*Hybognathus argyritis*	Ab	2	II
Colorado River Cutthroat Trout	*Oncorhynchus clarkii pleuriticus*	Ba	2	II
Roundtail Chub	*Gila robusta*	Ba	2	II
Yellowstone Cutthroat Trout	*Oncorhynchus clarkii bouvieri*	Bb	3	I
Finescale Dace	*Chrosomus neogaeus*	Bb	3	II
Goldeye	*Hiodon alosoides*	Bb	3	II
Iowa Darter	*Etheostoma exile*	Bb	3	II
Northern Leatherside	*Lepidomeda copei*	Bb	3	II

Common name	Scientific name	Cell	NSS	Tier
Northern Plains Killifish	*Fundulus kansae*	Bb	3	II
Plains Minnow	*Hybognathus placitus*	Bb	3	II
Plains Topminnow	*Fundulus sciadicus*	Bb	3	II
Burbot	*Lota lota*	Bc	4	II
Sauger	*Sander canadensis*	Bc	4	II
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*	Bc	4	II
Snake River Cutthroat Trout	*Oncorhynchus clarkii behnkei*	Bc	4	II
Brassy Minnow	*Hybognathus hankinsoni*	Bc	4	III
Flathead Chub	*Platygobio gracilis*	Bc	4	III
Quillback	*Carpiodes cyprinus*	Bc	4	III
Bonneville Cutthroat Trout	*Oncorhynchus clarkii utah*	Cb	4	II
Bigmouth Shiner	*Ericymba dorsalis*	Cb	4	II
Orangethroat Darter	*Etheostoma spectabile*	Cb	4	III
Mammals (55 species)				
Black-footed Ferret	*Mustela nigripes*	Aa	1	I
Canada Lynx	*Lynx canadensis*	Aa	1	I
Little Brown Myotis	*Myotis lucifugus*	Ab	2	I
Northern Long-eared Myotis	*Myotis septentrionalis*	Ab	2	I
Wyoming Pocket Gopher	*Thomomys clusius*	Ab	2	I
Tricolored Bat	*Perimyotis subflavus*	Ab	2	II
American Pika	*Ochotona princeps*	Ba	2	II
Pygmy Rabbit	*Brachylagus idahoensis*	Ba	2	II
Hoary Bat	*Lasiurus cinereus*	Bb	3	I

Common name	Scientific name	Cell	NSS	Tier
Bighorn Sheep	*Ovis canadensis*	Bb	3	II
Dwarf Shrew	*Sorex nanus*	Bb	3	II
Eastern Red Bat	*Lasiurus borealis*	Bb	3	II
Fringed Myotis	*Myotis thysanodes*	Bb	3	II
Idaho Pocket Gopher	*Thomomys idahoensis*	Bb	3	II
Long-legged Myotis	*Myotis volans*	Bb	3	II
Mule Deer	*Odocoileus hemionus*	Bb	3	II
Pallid Bat	*Antrozous pallidus*	Bb	3	II
Plains Harvest Mouse	*Reithrodontomys montanus*	Bb	3	II
Plains Spotted Skunk	*Spilogale interrupta*	Bb	3	II
Preble's Meadow Jumping Mouse	*Zapus hudsonius preblei*	Bb	3	II
Sand Hills Pocket Gopher	*Geomys lutescens*	Bb	3	II
Spotted Bat	*Euderma maculatum*	Bb	3	II
North American Water Vole	*Microtus richardsoni*	Bb	3	II
Wolverine	*Gulo gulo*	Bb	3	II
Yuma Myotis	*Myotis yumanensis*	Bb	3	II
Northern River Otter	*Lontra canadensis*	Bc	4	II
Abert's Squirrel	*Sciurus aberti*	Bc	4	III
Canyon Deermouse	*Peromyscus crinitus*	Bc	4	III
Cliff Chipmunk	*Neotamias dorsalis*	Bc	4	III
Meadow Jumping Mouse	*Zapus hudsonius*	Bc	4	III
Piñon Deermouse	*Peromyscus truei*	Bc	4	III
Spotted Ground Squirrel	*Xerospermophilus spilosoma*	Bc	4	III

Common name	Scientific name	Cell	NSS	Tier
Uinta Chipmunk	*Neotamias umbrinus*	Bc	4	III
Western Spotted Skunk	*Spilogale gracilis*	Bc	4	III
Yellow-pine Chipmunk	*Neotamias amoenus*	Bc	4	III
Black-tailed Prairie Dog	*Cynomys ludovicianus*	Cb	4	II
Long-eared Myotis	*Myotis evotis*	Cb	4	II
Northern Flying Squirrel	*Glaucomys sabrinus*	Cb	4	II
Sagebrush Vole	*Lemmiscus curtatus*	Cb	4	II
Silver-haired Bat	*Lasionycteris noctivagans*	Cb	4	II
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Cb	4	II
Western Small-footed Myotis	*Myotis ciliolabrum*	Cb	4	II
White-tailed Prairie Dog	*Cynomys leucurus*	Cb	4	II
Olive-backed Pocket Mouse	*Perognathus fasciatus*	Cb	4	III
Swift Fox	*Vulpes velox*	Cb	4	III
California Myotis	*Myotis californicus*	U	U	III
Great Basin Pocket Mouse	*Perognathus mollipilosus*	U	U	III
Hayden's Shrew	*Sorex haydeni*	U	U	III
Hispid Pocket Mouse	*Chaetodipus hispidus*	U	U	III
Least Weasel	*Mustela nivalis*	U	U	III
Plains Pocket Mouse	*Perognathus flavescens*	U	U	III
Preble's Shrew	*Sorex preblei*	U	U	III
Ringtail	*Bassariscus astutus*	U	U	III
Silky Pocket Mouse	*Perognathus flavus*	U	U	III
Western Pygmy Shrew	*Sorex eximius*	U	U	III

Common name	Scientific name	Cell	NSS	Tier
Mollusks (35 species, 2 groups)				
California Floater	*Anodonta californiensis*	Aa	1	I
Great Basin Ramshorn	*Helisoma newberryi*	Aa	1	I
Ambersnail	*Mediappendix gelida*	Ab	2	I
Bear Lake Springsnail	*Pyrgulopsis pilsbryana*	Ab	2	I
Cylindrical Papershell	*Anodontoides ferussacianus*	Ab	2	I
Glass Physa	*Physa skinneri*	Ab	2	I
Plain Pocketbook	*Lampsilis cardium*	Ab	2	I
Threeridge Valvata	*Valvata tricarinata*	Ab	2	I
Cave Physa	*Physa spelunca*	Ab	2	II
Glossy Valvata	*Valvata humeralis*	Ab	2	II
Green River Pebblesnail	*Fluminicola coloradoensis*	Ab	2	II
Jackson Lake Springsnail	*Pyrgulopsis robusta*	Ab	2	II
Mossy Valvata	*Valvata sincera*	Ab	2	II
Obtuse Physa	*Physa jennessi*	Ab	2	II
Rocky Mountain Capshell	*Acroloxus coloradensis*	Ab	2	II
Rocky Mountain Duskysnail	*Colligyrus greggi*	Ab	2	II
Swamp Lymnaea	*Lymnaea stagnalis*	Ab	2	II
Wrinkled Marshsnail	*Hinkleyia caperata*	Ab	2	II
Yavapai Mountainsnail	*Oreohelix yavapai*	Ab	2	II
Pygmy Mountainsnail	*Oreohelix pygmaea*	Ba	2	II
Button Sprite	*Menetus opercularis*	Bb	3	II
Giant Floater	*Pyganodon grandis*	Bb	3	II

Common name	Scientific name	Cell	NSS	Tier
Marsh Pondsnail	*Ladislavella elodes*	Bb	3	II
Rotund Physa	*Physella columbiana*	Bb	3	II
Star Gyro	*Gyraulus crista*	Bb	3	II
Two-ridged Ramshorn	*Helisoma anceps*	Bb	3	II
Western Pearlshell	*Margaritifera falcata*	Bb	3	II
Fatmucket	*Lampsilis siliquoidea*	Bc	4	II
Sharp Sprite	*Promenetus exacuous*	Bc	4	II
Umbilicate Sprite	*Promenetus umbilicatellus*	Cb	4	II
Woodland Pondsnail	*Ladislavella catascopium*	Cb	4	II
Other aquatic mollusks group (7 species)		U	U	II
Fragile Ancylid	*Ferrissia californica*	Bb	3	III
Cooper's Rocky Mountain Mountain-snail	*Oreohelix strigosa cooperi*	Bc	4	III
Creeping Ancylid	*Ferrissia rivularis*	U	U	III
Other terrestrial snails group (30 species)		U	U	III
Western Glass-snail	*Vitrina pellucida*	U	U	III
Reptiles (25 species)				
Midget Faded Rattlesnake	*Crotalus oreganus concolor*	Aa	1	I
Hernandez's Short-horned Lizard	*Phrynosoma hernandesi hernandesi*	Ab	2	II
Northern Spiny Softshell	*Apalone spinifera spinifera*	Ba	2	II
Great Basin Gophersnake	*Pituophis catenifer deserticola*	Ba	2	II
Northern Tree Lizard	*Urosaurus ornatus wrighti*	Ab	2	II
Great Plains Earless Lizard	*Holbrookia maculata maculata*	Ba	3	II
Northern Rubber Boa	*Charina bottae bottae*	Bb	3	II

Common name	Scientific name	Cell	NSS	Tier
Prairie Lizard	*Sceloporus consobrinus*	Bb	3	II
Red-bellied Snake	*Storeria occipitomaculata*	Bb	3	II
Smooth Greensnake	*Opheodrys vernalis*	Bb	3	II
Valley Gartersnake	*Thamnophis sirtalis fitchi*	Bb	3	II
Western Milksnake	*Lampropeltis gentilis*	Bb	3	II
Prairie Racerunner	*Aspidoscelis sexlineatus viridis*	Bb	3	II
Plateau Fence Lizard	*Sceloporus tristichus*	Bc	4	II
Plains Short-horned Lizard	*Phrynosoma hernandesi brevirostris*	Bc	4	II
Plains Hog-nosed Snake	*Heterodon nasicus nasicus*	Bc	4	III
Prairie Rattlesnake	*Crotalus viridis*	Bc	4	III
Western Painted Turtle	*Chrysemys picta bellii*	Bc	4	III
Great Basin Skink	*Plestiodon skiltonianus utahensis*	U	U	II
Northern Many-lined Skink	*Plestiodon multivirgatus multivirga-tus*	U	U	II
Plains Black-headed Snake	*Tantilla nigriceps*	U	U	II
Ornate Box Turtle	*Terrapene ornata*	U	U	II
Plains Gartersnake	*Thamnophis radix*	U	U	II
Red-sided Gartersnake	*Thamnophis sirtalis parietalis*	U	U	II
Desert Striped Whipsnake	*Masticophis taeniatus taeniatus*	U	U	III

Common name	Scientific name	WY Contribution	S-rank
Plants (55 species)			
Comb-hair Draba	*Draba pectinipila*	VHigh	S1
Desert Yellowhead	*Yermo xanthocephalus*	VHigh	S1
Farrar Moonwort	*Botrychium farrarii*	VHigh	S1

Common name	Scientific name	WY Contribution	S-rank
Gibbens' Beardtongue	*Penstemon gibbensii*	VHigh	S1
Green River Greenthread	*Thelesperma caespitosum*	VHigh	S1
Hairy Greenthread	*Thelesperma pubescens*	VHigh	S1
Hyattville (Starveling) Milkvetch	*Astragalus jejunus* var. *articulatus*	VHigh	S1
Mystery (Biennial) Wormwood	*Artemisia biennis var. diffusa*	VHigh	S1
Owl Creek Miner's Candle	*Oreocarya subcapitata*	VHigh	S1
Prairie Dodder	*Cuscuta plattensis*	VHigh	S1
Ross' Bentgrass	*Agrostis rossiae*	VHigh	S1
Small (Fremont County) Rockcress	*Boechera pusilla*	VHigh	S1
Smallheaded Townsend Daisy	*Townsendia microcephala*	VHigh	S1
Smooth Summer Milkvetch	*Astragalus hyalinus var. glabratus*	VHigh	S1
Winward's Goldenweed	*Ericameria winwardii*	VHigh	S1
Yellowstone Sand Verbena	*Abronia ammophila*	VHigh	S1
Sessileflower (Indian) Springparsley	*Cymopterus sessiliflorus*	High	S1
Slender Spiderflower	*Peritoma multicaulis*	High	S1
Thickleaf Bladderpod	*Physaria pachyphylla*	High	S1
Thickleaf Pepperweed	*Lepidium integrifolium*	High	S1
Barneby's Clover	*Trifolium barnebyi*	VHigh	S1S2
Long-awned Alkali Wildrye	*Leymus simplex var. luxurians*	VHigh	S1S2
Alkali Wildrye	*Leymus simplex var. simplex*	VHigh	S2
Blowout Beardtongue	*Penstemon haydenii*	VHigh	S2
Desert Glandular Phacelia	*Phacelia glandulosa var. deserta*	VHigh	S2
Dorn's (Tunp Range) Twinpod	*Physaria dornii*	VHigh	S2

Common name	Scientific name	WY Contribution	S-rank
Dubois (Plains) Milkvetch	*Astragalus gilviflorus var. purpureus*	VHigh	S2
Kirkpatrick's (Spiked) Ipomopsis	*Ipomopsis spicata var. robruthiorum*	VHigh	S2
Laramie (Alpine) Clover	*Trifolium dasyphyllum var. anemophilum*	VHigh	S2
Large-fruited Bladderpod	*Physaria macrocarpa*	VHigh	S2
Precocious Milkvetch	*Astragalus proimanthus*	VHigh	S2
Teton Wirelettuce	*Stephanomeria fluminea*	VHigh	S2
Wyoming Tansymustard	*Descurainia torulosa*	VHigh	S2
Colorado Tansyaster	*Xanthisma coloradoense*	High	S2
Dropleaf Buckwheat	*Eriogonum exilifolium*	High	S2
Foothill Milkvetch	*Astragalus tridactylicus*	High	S2
Grassyslope Sedge	*Carex oreocharis*	High	S2
Meadow Milkvetch	*Astragalus diversifolius*	High	S2
Parasol Bladderpod	*Physaria subumbellata*	High	S2
Payson's Milkvetch	*Astragalus paysonii*	High	S2
Prostrate (Low) Bladderpod	*Physaria prostrata*	High	S2
Stemless Beardtongue	*Penstemon acaulis*	High	S2
Trelease's Milkvetch	*Astragalus racemosus var. treleasei*	High	S2
Ute Ladies' Tresses	*Spiranthes diluvialis*	High	S2
Woodrush Sedge	*Carex luzulina var. atropurpurea*	High	S2
Cedar Rim (Desert) Thistle	*Cirsium pulcherrimum var. aridum*	VHigh	S2?
Fremont Bladderpod	*Physaria fremontii*	VHigh	S2S3
Laramie Columbine	*Aquilegia laramiensis*	VHigh	S2S3
Shoshonea	*Shoshonea pulvinata*	VHigh	S2S3

Common name	Scientific name	WY Contribution	S-rank
Snow Indian Paintbrush	*Castilleja nivea*	VHigh	S2S3
Woolly (Common) Twinpod	*Physaria didymocarpa var. lanata*	VHigh	S2S3
Colorado Butterfly Plant	*Oenothera coloradensis*	High	S2S3
Payson's Draba	*Draba paysonii*	High	S2S3
Tapertip Desertparsley	*Lomatium attenuatum*	High	S2S3
Whitebark Pine	*Pinus albicaulis*	Med	S4

Identifying SGCN

Eligible species: wildlife and fish

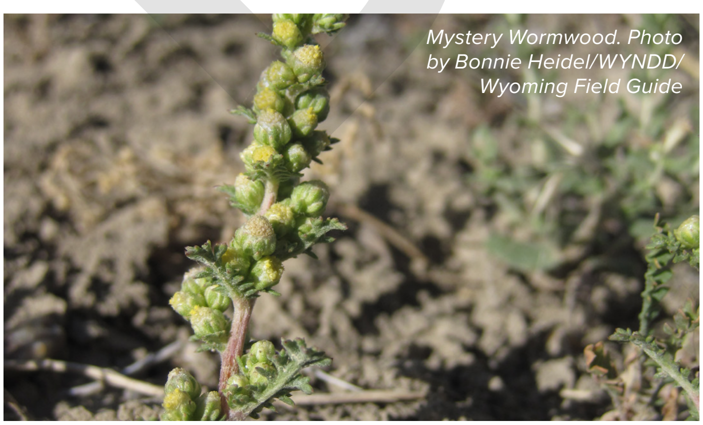
Species that are legally considered wildlife in Wyoming and are thought to breed within the state were evaluated for SGCN status. Wyoming Statute 23-1-101 (a) (xii) defines “wildlife” as “all wild mammals, birds, fish, amphibians, reptiles, crustaceans and mollusks, and wild bison designated by the Wyoming Game and Fish Commission and the Wyoming Livestock Board within Wyoming.” Throughout the remainder of the plan, the term “wildlife” encompasses these categories. Over 700 species of wildlife were eligible for consideration as SGCN. Terrestrial invertebrates (excluding crustaceans and mollusks) do not fall within the jurisdiction of the Wyoming Game and Fish Department (WGFD) and were not considered for inclusion in the 2027 SWAP.

Identifying SGCN and conservation priority: wildlife and fish

To identify SGCN, all eligible wildlife species were ranked using the Native Species Status (NSS) system. The NSS system has been used since the 2005 SWAP, and it provides a numerical ranking that combines population status and the degree of severity of limiting factors (*Table 2*). Population status ranges from population or distribution size that is restricted or declining to population or distribution size that is widely distributed or expanding. The severity of limiting factors ranges from extreme to minimal, and limiting factors include habitat, human activity, genetics, invasive species, and others (*Table 3*).

The intersection of population status (A – D) and degree of severity of limiting factors (a – d) provides a cell ranking (e.g., Aa) and the corresponding NSS rank (e.g., NSS1; *Table 2*). This ranking system meets the component of the eight required elements to provide and make use of information regarding abundance and distribution. Some combinations of population status and limiting factors are unlikely to occur and are not assigned an NSS rank.

Species that are lacking information to complete the ranking exercise were placed in a separate category: Unknown (NSSU). NSSU species were recommended to receive the SGCN designation because obtaining a greater under-



Mystery Wormwood. Photo by Bonnie Heidel/WYNDD/ Wyoming Field Guide

Owl Creek Miner's Candle.Photo by Bonnie Heidel/WYNDD/ Wyoming Field Guide standing regarding population numbers and distributions of these species is necessary in determining their conservation status, including responding to petitions for listing under the Endangered Species Act. Species with rankings of NSS1, NSS2, NSS3, NSS4, or NSSU were considered SGCN.

Time and funding are scarce resources, and it is not possible to provide equal attention to all of Wyoming's SGCN and achieve quantifiable conservation results. To guide conservation efforts across Wyoming, each SGCN receives a prioritization tier score. This prioritization system represents a transparent mechanism to focus efforts towards species where there is the greatest likelihood of preventing future listings under the Endangered Species Act and for which conservation activities will provide the greatest benefits for native species, natural habitats, and the state.

Species are evaluated on a series of variables relevant to prioritization, and the sum of their scores indicates their conservation tier. Species with an NSS ranking between NSS1 and NSS4 can receive a maximum of 54 points. SGCN within Tier I (54 – 37) are considered highest priority, Tier II (36 – 19 points) moderate priority, and Tier III (18 – 1) lowest priority. Variables for NSS1 – NSS4 species are:

A) **NSS rank:** The NSS rank is subtracted from 5 and multiplied by 6; NSS1 = 24, NSS2 = 18, NSS3 = 12, and NSS4 = 6.

B) **Wyoming's contribution to the species' overall conservation:** The species is assigned a score of 1 – 10, with 10 being the highest contribution and 1 being the lowest contribution. This score was assigned based on a combination of: Wyoming Natural Diversity Database (WYNDD) G-rank and Wyoming Conservation Contribution score; the proportion of the species' overall range that is in Wyoming; the health and size of the species' population in Wyoming compared to those in other portions of its range; and population status and level of conservation activity in surrounding states and other portions of the species range.

C) **Regulatory/monetary impacts of the species' listing under the Endangered Species Act:** The species is assigned a score of 1 – 5, with 5 being highest and 1 being lowest. The score was assigned based on a combination of: species' range size and overlap with other land uses; current economic contribution of the species (both consumptive and non-consumptive); and the type of restrictions necessary to address the species' conservation needs.

D) **Urgency of conservation action**: The species is assigned a score of 1 – 5, with 5 being highest and 1 being lowest. The score was assigned based on a combination of: new threats; increases in severity of existing threats; new data that show a significant, persistent decline in the species' population, distribution, or habitat; likelihood and immediacy of potential listing under Endangered Species Act; and funding or partnership opportunities that are time limited.

E) **Ability to implement effective conservation actions**: The species is assigned a score of 1 – 5, with 5 being highest and 1 being lowest.The score was assigned based on an evaluation of statutory, scientific, or technological limitations in reversing leading population and habitat threats.

F) **The species' ecological or management role as keystone, indicator, or umbrella species**: The species is assigned a score of 1 – 5, with 5 being highest and 1 being lowest. Indicator species are those species whose population status is a good indicator of the overall health of the habitat it occupies. A keystone species is a species that plays a significant role in shaping and defining the habitat in which it lives. Umbrella species are species selected for making conservation-related decisions, typically because protecting these species indirectly protects the many other species that make up the ecological community of its habitat.

Species with an NSS ranking of NSSU can receive a maximum of 24 points. SGCN within Tier I (24 – 17 points) are considered highest priority, Tier II (16 – 9) moderate priority, and Tier III (8 – 1) lowest priority. Variables for NSSU species are:

A) **Wyoming's contribution to the species' overall conservation:** The species is assigned a score of 1 – 12, with 12 being the highest contribution and 1 being the lowest contribution.

B) **Regulatory/monetary impacts of the species' listing under the Endangered Species Act:** The species is assigned a score of 1 – 6, with 6 being highest and 1 being lowest.

C) **Urgency of conservation action**: The species is assigned a score of 1 – 6, with 6 being highest and 1 being lowest.

Taxonomic experts at the WGFD used information from harvest reports, occurrence records, the literature, and their professional expertise to assess each species' population status, summarize the limiting factors facing them, and determine the priority for their conservation.

Table 2. Native Species Status matrix.

Population Status	Limiting factors			
	Extreme (a) Limiting factors are severe and continue to increase in severity	**Severe (b)** Limiting factors are severe and not increasing significantly	**Moderate (c)** Limiting factors are moderate and appear likely to increase in severity	**Minimal (d)** Limiting factors are moderate and not likely to increase in severity
Imperiled (A) Population size or distribution is restricted or declining and extirpation is possible	**Aa** **NSS1**	**Ab** **NSS2**	Ac NA	Ad NA
Vulnerable (B) Population size or distribution is restricted or declining but extirpation is not imminent	**Ba** **NSS2**	**Bb** **NSS3**	**Bc** **NSS4**	Bd NA
Stable (C) Population size and distribution is stable and the species is widely distributed	Ca NA	**Cb** **NSS4**	Cc NSS5	Cd NSS6
Expanding (D) Populations are expanding in number and/or distribution and the species is widely distributed	Da NA	Db NA	Dc NSS6	Dd NSS7

The Native Species Status (NSS) matrix, which indicates whether a species is identified as a Species of Greatest Conservation Need (SGCN) for Wyoming's 2027 State Wildlife Action Plan (SWAP). Species with rankings of NSS1, NSS2, NSS3, NSS4 (in bold), or NSSU were considered to be SGCN.

Table 3. Native Species Status limiting factors matrix.

The matrix used to assess the "limiting factors" portion of the Native Species Status ranking (*Table 2*).

	Extreme (a) Limiting factors are severe and continue to increase in severity	**Severe (b)** Limiting factors are severe and not increasing significantly	**Moderate (c)** Limiting factors are moderate and appear likely to increase in severity	**Minimal (d)** Limiting factors are moderate and not likely to increase in severity
Habitat	Deteriorating: Significant ongoing and increasing loss of habitat or extremely limited habitat	Restricted: Significant loss of habitat	Vulnerable: Habitat is vulnerable but not currently restricted; increases in habitat loss likely	Stable: Habitat is secure and/or widespread
Human activity	Highly sensitive: Disturbance significantly and increasingly impacting populations	Sensitive: Disturbance significantly impacting populations	Adaptive: Disturbance currently results in moderate population reductions; additional losses likely	Tolerant: Species routinely occupies disturbed environments and habitats closely associated with humans
Genetics	Deteriorating: Species significantly declining in genetic purity or ongoing hybridizations	Restricted: Unaltered genetic base is severely restricted geographically or genetically	Vulnerable: Unaltered genetic base is currently stable but vulnerable to hybridization or loss of genetic diversity	Stable: Desired genetic base is secure and widespread
Invasive species	Deteriorating: Invasive species causing significant and increasing population impacts and loss of habitat	Restricted: Invasive species causing significant population impacts or loss of habitat	Vulnerable: Invasive species impacts moderate but expected to increase in severity	Stable: No current or expected impacts from invasive species
Others: Disease Contaminants Climate change				

Identifying SGCN: plants

Plants were included in the 2027 SWAP because of their close connection to wildlife conservation and because including plants could open up additional funding opportunities. WGFD does not possess statutory jurisdiction or management authority over plants, and including plants in the SWAP does not change WGFD's role. Taxonomic experts at WYNDD created a ranking system to identify species of concern, which was used to inform the SGCN identification process. Experts ranked the approximately 4,000 species in Wyoming that are native, vascular, and occur regularly in the state.

Each species was assessed based on Wyoming's contribution to the species' rangewide persistence (Wyoming Contribution Rank) and the species' state rank (S-rank). The Wyoming Contribution Rank ranges from "very high," where populations in Wyoming are critical to the species' rangewide persistence (e.g., local endemics), to "low" where Wyoming populations contribute minimally to the species' rangewide persistence (e.g., widespread species), as well as an "unknown" category. The S-rank is a standardized ranking system used by natural heritage programs, including WYNDD, to assess abundance and probability of extinction for each species within the state. The S-rank includes measures of rarity, range extent, abundance, population trends, threats, and habitat specificity. S-rank ranges from 1 – 5, where 1 represents species that are critically imperiled and 5 represents species that are secure. Additional details about the ranking process are available in Heidel (2024).

Species were identified as SGCN if the Wyoming Contribution Rank was Very High or High and if their state rank was S1 or S2 (*Table 4*). Any plant species that are listed as threatened or endangered under the Endangered Species Act, even if they were not included in the designation process outlined above, were also included.

Table 4. Species of Greatest Conservation Need plant ranking matrix.

The matrix used to identify which plant species were considered Species of Greatest Conservation Need.

Wyoming Contribution Rank	State rank (S-rank)		
	S1 Critically imperiled because of extreme rarity	**S2** Imperiled because of rarity	**S3** Rare or local throughout its range or found locally in a restricted range
Very High State endemic	**SGCN**	**SGCN**	—
High Regional endemic	**SGCN**	**SGCN**	—
Medium Disjuncts, regional endemics at edge of range	—	—	—
Low Peripherals	—	—	—

Taxonomy and nomenclature

The SGCN designation was applied at the most appropriate taxonomic level based on current management practices. This was usually the species level. Examples of exceptions at the subspecies level included the Preble's meadow jumping mouse, four subspecies of Cutthroat Trout, two subspecies of Sharp-tailed Grouse, a number of reptiles and amphibians, and a number of plants. Basic life history information, survey methods, and identification techniques are lacking for many mollusks and crustaceans. When addressing conservation of these species at a lower taxonomic level was impractical, mollusks and crustaceans were grouped at the genus, family, or order level based on shared morphology, habitats, threats, and limited information.

Wyoming's SWAP uses the taxonomy and nomenclature designations that are recognized by professional societies and other relevant scientific authorities. These scientific authorities consider evidence as it emerges and incorporate revisions as necessary. Wyoming's SWAP uses AviList as the taxonomy authority for birds, with scientific names from AviList and common from the Clements Checklist available through AviList (AviList Core Team 2025). American Fisheries Society (AFS) Common and Scientific Names of Fishes from the United States, Canada, and Mexico is used for fish scientific names, common names, and subspecies delineations (Page et al. 2023). The official names list of the Society for the Study of Amphibians and Reptiles is used for common names, scientific names, and subspecies delineations for amphibians and reptiles (Nicholson 2025). Scientific names and taxonomic concepts for plants follow the usage of the regional authority, the Rocky Mountain Herbarium (Nelson and Legler 2024). Scientific and common names for mammals, mollusks, and crustaceans follow those recognized by WYNDD. For consistency throughout the document and across taxonomic groups, the common names of all SGCN are capitalized.

For ease of reference, species and subspecies are collectively referred to as "species" throughout the document. SGCN tabulations include the number of both species and subspecies. For some mollusks and crustaceans, scant information was available or considerable taxonomic uncertainty remained. In these instances, species were combined into groups and referred to as a single species.

Distribution

SWAPs are required to provide and make use of information on the distribution of SGCN. In addition to incorporating distribution into the SGCN identification processes described above, this requirement is met by reporting habitat associations of all SGCN in *Appendix D*.

For amphibians, birds, mammals, and reptiles, associations with each of the terrestrial habitat types were determined via GIS analysis by overlaying SGCN ranges with the terrestrial habitat layer. For plants, technical experts used a combination of expert knowledge and historical and contemporary data and observations to identify presence or absence in each of the 11 terrestrial habitat types. For crustaceans, fish, and mollusks, technical experts used a combination of expert knowledge and historical and contemporary data and observations to identify presence or absence in each of the aquatic basins. To visualize distributions of each SGCN, please visit resources such as WYNDD's Online Field Guide (*fieldguide.wyndd.org*), All About Birds (*allaboutbirds.org*), and NatureServe (*natureserve.org*).

Challenges and actions

From residential development to vehicle collisions to floods, SGCN and their habitats face a suite of challenges that may affect species persistence. The SWAP is an opportunity for the conservation community in Wyoming to identify the most significant challenges facing SGCN and their habitats, as well as identify priority actions that, if pursued collectively, could meaningfully contribute to species and habitat conservation.

Wyoming's SWAP serves as a roadmap for conservation work across the entire state. The voluntary, non-regulatory actions listed in the SWAP are options that agencies, organizations, and individuals may pursue to support conservation of SGCN. Private landowners, individual wildlife enthusiasts, non-governmental organizations, and agencies all play an important role in the conservation of SGCN. Many actions recommended in the SWAP would benefit from a collaborative approach that recognizes the unique resources, network, and information that each party could contribute.

Challenges were considered by experts at WGFD and WYNDD during the SGCN identification processes outlined above. Challenges are reported in taxon-specific chapters. Challenges identified in the 2027 SWAP: 1) align with the categories listed in the International Union for Conservation of Nature–Conservation Measures Partnership Classification of Direct Threats to Ecosystems and Species version 4.0 (Salafsky et al. 2024), 2) affect an SGCN throughout most or all of its range in Wyoming, and 3) could affect SGCN in a way that could reduce its population or distribution significantly over the next 10 years if mitigated. Notably, the challenges identified in the SWAP are known, priority challenges facing SGCN. The identified challenges are not inclusive of all potential challenges these species may face, but instead are the priority challenges for their conservation. Additionally, relevant challenges may change over the next 10 years.

Priority actions were then identified by experts at WGFD and WYNDD. Actions identified in the 2027 SWAP: 1) align with one of the categories in the Conservation Measures Partnership Action Classification v. 2.0, 2) are specific enough to be useful in providing guidance, 3) are measurable, 4) are achievable within the next 10 years under realistic social and economic scenarios, and 5) are connected to an identified challenge. Priority actions include monitoring, survey, and research needs, as well as species management, habitat management, and more (*Appendix F*). These actions are non-regulatory and are voluntary. There are a diversity of actions, representing the diverse players that are necessary for conservation. These priority actions are examples and may change or be supplemented over the next 10 years as new information emerges and circumstances change.

After taxonomic experts at WGFD and WYNDD identified challenges and actions, experts from agencies and organizations throughout the state were invited to review and provide recommendations. The challenges and priority actions represent the collective insight of conservation professionals from across institutions and backgrounds.

Overarching descriptions of the challenges are provided in *Appendix E*, and overarching descriptions of actions are provided in *Appendix F*. For additional details about the ecological context for each species, please refer to the online Field Guide available through the Wyoming Natural Diversity Database (*https://fieldguide.wyndd.org/*).

Chapter 4: Amphibians

There are 11 native species of amphibians in Wyoming, and 9 of them are considered Species of Greatest Conservation Need (SGCN; *Table 1*). Wyoming's SGCN amphibians consist of frogs, toads, and one species of salamander. Although amphibians are often cryptic, they help shape the structure and function of their environments, as well as provide multiple direct and indirect benefits to humans (Hocking and Babbitt 2014). They eat insects and contribute to pest control, serve as a prey source for many species throughout the food web, affect the amount and community composition of vegetation, contribute to nutrient cycling, and connect aquatic and terrestrial ecosystems (Davic and Welsh 2004). From a cultural standpoint, children often build connections to the natural world through interactions with amphibians, and the species remain a cultural fixture as they are featured in high school science labs, regional art, and more (Wake and Koo 2018). Additionally, amphibians can be important sources for developing medicines and other biomedical advances. In short, maintaining amphibian biodiversity in Wyoming will provide numerous benefits to both landscapes and people.

There are nearly 9,000 species of amphibians globally, although Wyoming has relatively low species richness because the climate and environmental conditions are not favorable for these ectothermic (so-called "cold-blooded") and water-reliant species (Buckley and Jetz 2007). Amphibians are closely tied to water sources for reproduction and early life, although Wyoming's SGCN amphibians can be found in habitat types ranging from sand dunes (e.g., Great Basin Spadefoot) to shrub steppe (e.g., Great Plains Toad) to the alpine (e.g., Western Toad) so long as suitable water sources are available (Baxter and Stone 1985). Reproduction and larval stages occur in ephemeral and permanent water sources including beaver ponds, stock ponds, playas, oxbows, and wetlands. Larval amphibians metamorphose into juveniles and move onto land, seeking out species-specific habitat features. Depending on environmental conditions, Western Tiger Salamanders can forgo metamorphosis and remain in water in their larval stage, a strategy known as paedomorphosis (Whiteman et al. 1996). All SGCN amphibians brumate overwinter, with most species finding or creating burrows below frost line or burrowing into sediment at the bottom of ponds or lakes. The Wood Frog is unique in its ability to freeze overwinter and is able to use shallow hibernacula under woody debris or leaf litter (Costanzo 2019). Diets primarily consist of invertebrates, although some species will also eat vegetation, small fish, and other amphibians. Movements tend to be short-distance, but some species will travel longer distances to reach hibernation sites or during seasonal migrations (Browne and Paszkowski et al. 2010). For additional details about the ecology of individual species, please refer to the online Field Guide available through the Wyoming Natural Diversity Database (https://fieldguide.wyndd.org/).

Globally, amphibians are considered the most imperiled vertebrate group, and habitat loss, modification, and fragmentation, as well as disease, are leading challenges (Adams et al. 2013, Luedtke et al. 2023). Amphibians have specific habitat requirements for different parts of their life cycle, and habitat disturbances that affect one part of their life cycle or reduce connectivity can influence broader population dynamics (Barrile et al. 2022, Cushman 2005). Climate change may result in changes to the amount, timing, and distribution of water and increased evapotranspiration from rising temperatures, which can alter phenology and negatively affect reproduction, survival, and distribution (Arietta et al. 2020, Blaustein et al. 2010, Lawler et al. 2010, McMenamin et al. 2008). Beavers create high-quality habitat for many amphibians, but historic and continued loss of beavers due to changes in habitat and lack of recovery from historic unregulated trapping can limit suitable amphibian habitat (Hossak et al. 2015, Zero and Murphy 2016). Diseases such as those caused by *Batrachochytrium dendrobatidis* (*Bd*; chytrid fungus) and viruses in *Ranavirus* genus can have devastating population ramifications and can interact with climate change and habitat modifications (Barrile et al. 2021, Bartlett et al. 2021, Erdmann et al. 2018). In addition to these challenges, basic information of life history, ecology, and abundance of many amphibians is lacking, which can hinder conservation efforts (Olson and Pilliod 2022, Womack et al. 2022). To overcome these challenges, conservation actions such as long-term monitoring, habitat restoration or treatments, and reintroductions can support the conservation of SGCN amphibians (Estes-Zumpf et al. 2022, Polasik et al. 2015, Swartz et al. 2020).

Challenges and actions

Wyoming's SWAP identifies the significant challenges facing SGCN in the state, as well as priority conservation actions to support their conservation. Species-specific challenges and actions are identified in *Table 5*. Please refer to *Chapter 3* for descriptions of how challenges and actions were identified and categorized. Notably, the identified challenges and actions are not inclusive of all potential challenges these species may face; instead this list summarizes the priority challenges and actions at this time, although they may change over the next 10 years.

Table 5. Challenges and actions for Species of Greatest Conservation Need amphibians.

Priority challenges and actions relevant to Species of Greatest Conservation Need amphibians.

Common Name	Challenges	Voluntary actions
Columbia Spotted Frog	Disease, including chytrid fungus (*Batrachochytrium dendrobatis*; Bd) and pathogens in genus *Ranavirus*. Loss, fragmentation, or degradation of wetlands, beaver ponds, and riparian areas, as well as changes to structure and composition of vegetation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Due to predation, stocking fish at breeding sites can reduce successful breeding and recruitment. Glacial relict populations could have lower genetic diversity and reduced capacity to adapt to changes from disease and climate change (e.g., shifting temperatures, altered hydroperiods). Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, disease status, susceptibility to disease, genetic diversity and differentiation, and response to challenges such as climate change, aquatic predators, and habitat fragmentation. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Continue efforts to educate the public through outreach programs about the importance of amphibians. Identify vital habitats to inform conservation efforts. Enhance/restore breeding habitat to maintain or extend wetland hydroperiod and improve survival of eggs and larvae. Consider using techniques such as beaver translocations and installation of beaver dam analogs. Explore and/or develop alternative funding options to maintain conservation efforts.
Great Basin Spadefoot	May be susceptible to chytrid fungus (*Batrachochytrium dendrobatis*; Bd). Loss, fragmentation, or degradation of habitat because of changes in water availability and timing, as well as soil compaction and disturbance. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Sensitive to environmental contaminants and pollutants. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to disease, and response to challenges such as habitat loss, reduced water quality, climate change, and altered hydrologic regimes. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Continue efforts to educate the public through outreach programs about the importance of amphibians. Identify vital habitats to inform conservation efforts. Enhance/restore breeding habitat to maintain or extend wetland hydroperiod and improve survival of eggs and larvae. Consider using techniques such as beaver translocations and installation of beaver dam analogs. Explore and/or develop alternative funding options to maintain conservation efforts. Develop techniques to improve species detection.

Common Name	Challenges	Voluntary actions
Great Plains Toad	May be susceptible to chytrid fungus (*Batrachochytrium dendrobatis*; Bd). Loss, fragmentation, or degradation of habitat due to changes in water availability and timing, soil compaction and disturbance, and changes to structure and composition of vegetation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Sensitive to environmental contaminants. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to disease, and response to challenges such as habitat loss, reduced water quality, climate change, and altered hydrologic regimes. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Continue efforts to educate the public through outreach programs about the importance of amphibians. Identify vital habitats to inform conservation efforts. Enhance/restore breeding habitat to maintain or extend wetland hydroperiod and improve survival of eggs and larvae. Consider using techniques such as beaver translocations and installation of beaver dam analogs. Explore and/or develop alternative funding options to maintain conservation efforts. Develop techniques to improve species detection.
Northern Leopard Frog	Loss, fragmentation, or degradation of wetlands, beaver ponds, and riparian areas, as well as changes to structure and composition of vegetation. Disease, including chytrid fungus (Batrachochytrium dendrobatis; Bd) and pathogens in genus Ranavirus. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Sensitive to environmental contaminants. North American Bullfrog and fish predate upon all life stages; North American Bullfrog can compete for resources. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to disease, mechanisms causing population declines, and response to challenges such as climate change and aquatic predators. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Continue efforts to educate the public through outreach programs about the importance of amphibians. Identify vital habitats to inform conservation efforts. Enhance/restore breeding habitat to maintain or extend wetland hydroperiod and improve survival of eggs and larvae. Consider using techniques such as beaver translocations and installation of beaver dam analogs. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Plains Spadefoot	May be susceptible to chytrid fungus (*Batrachochytrium dendrobatis*; Bd). Loss, fragmentation, or degradation of habitat because of changes in water availability and timing, as well as soil compaction and disturbance. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Sensitive to environmental contaminants. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to disease, and response to challenges such as habitat loss, reduced water quality, climate change and altered hydrologic regimes. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Continue efforts to educate the public through outreach programs about the importance of amphibians. Identify vital habitats to inform conservation efforts. Enhance/restore breeding habitat to maintain or extend wetland hydroperiod and improve survival of eggs and larvae. Consider using techniques such as beaver translocations and installation of beaver dam analogs. Explore and/or develop alternative funding options to maintain conservation efforts. Develop techniques to improve species detection.
Western (Boreal) Toad	Disease, including chytrid fungus (*Batrachochytrium dendrobatis*; Bd) and pathogens in genus *Ranavirus*. Loss, fragmentation, or degradation of wetlands, beaver ponds, and riparian areas, as well as changes to structure and composition of vegetation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Because limited genetic diversity reduces the species' capacity to adapt to changes, may be at risk of declines or extinction from disease and climate change (e.g., shifting temperatures, altered hydroperiods). Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, and susceptibility to chytrid of populations across the species' range in Wyoming. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Continue efforts to educate the public through outreach programs about the importance of amphibians. Identify vital habitats to inform conservation efforts. Enhance/restore breeding habitat to maintain or extend wetland hydroperiod and improve survival of eggs and larvae. Consider using techniques such as beaver translocations and installation of beaver dam analogs. Explore and/or develop alternative funding options to maintain conservation efforts. Improve species resilience through reintroductions. Develop and employ strategies to retain existing populations by improving resistance to chytrid fungus and increasing genetic diversity.

Common Name	Challenges	Voluntary actions
Western Tiger Salamander	Disease, including chytrid fungus (*Batrachochytrium dendrobatis*; Bd, and *Bactrachochytrium salamandrivorans*; Bsal) and pathogens in genus *Ranavirus*, especially *Ambystoma tigrinum* virus (ATV). Loss, fragmentation, or degradation of habitat due to changes in water availability and timing, as well as changes to structure and composition of vegetation. Factors that remove or disturb small mammal burrows, which this species relies on, will negatively affect survival. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Due to predation, stocking fish at breeding sites can reduce successful breeding and recruitment. Road mortality for populations where roads intersect dispersal and migration routes. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to disease, and response to challenges such as climate change and aquatic predators. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Continue efforts to educate the public through outreach programs about the importance of amphibians. Identify vital habitats to inform conservation efforts. Explore and/or develop alternative funding options to maintain conservation efforts. Research strategies to minimize mortalities during migration or dispersal events.
Wood Frog	Disease, including chytrid fungus (*Batrachochytrium dendrobatis*; Bd) and pathogens in genus *Ranavirus*. Loss, fragmentation, or degradation of wetlands, beaver ponds, and riparian areas, as well as changes to structure and composition of vegetation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Due to predation, stocking fish at breeding sites can reduce successful breeding and recruitment. Glacial relict populations could have lower genetic diversity and reduced capacity to adapt to changes from disease and climate change (e.g., shifting temperatures, altered hydroperiods). Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, disease status, susceptibility to disease, genetic diversity and differentiation, and response to challenges such as climate change, wildfire, and habitat fragmentation. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Continue efforts to educate the public through outreach programs about the importance of amphibians. Identify vital habitats to inform conservation efforts. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Wyoming Toad	Chytrid fungus (*Batrachochytrium dendrobatis*; Bd). Because of limited population size, range, and genetic diversity, may be at risk of declines or extinction from stochastic events (e.g., extreme weather events), diseases, and climate change. Loss, fragmentation, or degradation of wetlands and riparian areas, changes to the amount and timing of water, and changes to structure and composition of vegetation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Sensitive to environmental contaminants. Factors that remove or disturb small mammal burrows, which this species relies on, will negatively affect survival. Individuals bred and reared in captivity could become adapted to captivity, which can lead to reduced resiliency to stressors in the wild (e.g., predators). Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, disease mitigation research, monitoring, captive breeding and reintroduction programs).	Continue implementing the USFWS Wyoming Toad Recovery Plan. Continue to secure reintroduction sites to expand and improve reintroduction success. Research strategies to improve success of captive breeding and release program (including maximizing genetic diversity), and to decrease susceptibility to chytrid (e.g., "vaccination" or manipulating skin microbiomes). Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Continue monitoring of population status and disease status. Increase public awareness of the species and challenges to recovery through outreach programs about the importance of amphibians. Improve breeding habitat quality and water distribution and retention at reintroduction sites to buffer fluctuating water availability. Consider using techniques such as beaver translocations and installation of beaver dam analogs. Explore and/or develop alternative funding options to maintain conservation efforts. Monitor predator populations and adapt release strategies to improve Wyoming toad survival outcomes. Identify and establish protections for additional suitable reintroduction sites within the species' historic range. Develop techniques to improve species detection during population monitoring efforts.

Chapter 5: Birds

Over 400 native bird species are known to occur in Wyoming. Among the 246 species confirmed or suspected to reproduce in the state, 89 are considered Species of Greatest Conservation Need (SGCN; *Table 1*). Wyoming's SGCN birds reflect the avian diversity of the state, including songbirds, raptors, hummingbirds, waterbirds, and more. The diverse bird assemblage helps support the natural communities and economy of the state. Birds provide numerous ecosystem services, including pest control, seed dispersal, pollination, nutrient cycling, and disease regulation (Whelan et al. 2015). Birds are among the most readily observable wildlife in Wyoming, which leads many to develop or deepen a connection with the natural world through birds. Conserving SGCN birds in Wyoming has broad benefits that inspire widespread public support. In addition to cultural values, the estimated 96 million birders in the U. S. make significant economic contributions that have direct and indirect effects to local economies and beyond (U. S. Fish and Wildlife Service 2024). Additionally, some SGCN species are hunted or taken for use in falconry, both of which provide economic and cultural value.

Wyoming's SGCN birds occur in all habitat types throughout the state (*Appendix D*). Within these habitats, birds select a wide range of nesting sites including cliffs (e.g., Peregrine Falcon), trees (e.g., Great Blue Heron), shrubs (e.g., Sagebrush Sparrow), burrows created by mammals (e.g., Burrowing Owl), tree cavities (e.g., Pygmy Nuthatch), islands in lakes (e.g., Caspian Tern), wetlands with emergent vegetation (e.g., American Bittern), and the ground (e.g., Mountain Plover, Bobolink). Some species have restricted distributions (e.g., Yellow-billed Cuckoo), while others are relatively more widespread (e.g., American Kestrel). Some species are near the edge of their range in Wyoming (e.g., Great Gray Owl, Scott's Oriole), while the state comprises the core of the range for others (e.g., Black Rosy-Finch, Greater Sage-Grouse). Most SGCN are habitat specialists (e.g., Brewer's Sparrow), but some are habitat generalists that specialize in other aspects of their ecology, like diet (e.g., Common Nighthawk). Feeding habits of SGCN birds include insectivory (e.g., Purple Martin), nectivory (e.g., Calliope Hummingbird), carnivory (e.g., Boreal Owl), piscivory (e.g., Common Loon), and granivory (e.g., Evening Grosbeak); however, most species are omnivorous, with diets that include insects during some life stages or seasons. SGCN birds employ a variety of migratory strategies, but most species breed in Wyoming during spring and summer, then migrate south to non-breeding areas in the winter (e.g., Virginia's Warbler, Swainson's Hawk). Grassland and sagebrush SGCN have especially strong migratory connections to the southwestern U. S. and northern Mexico, while other species migrate to different parts of Latin America or coastal and interior North America. A smaller number of SGCN birds are year-round residents (e.g., Pinyon Jay) that may migrate short distances during winter to lower elevations (e.g., Canyon Wren) or areas with more favorable food and shelter (e.g., Greater Sage-Grouse). Populations of some resident breeding species increase in size during the non-breeding season as migrants from northern populations winter in Wyoming (e.g., Trumpeter Swan, Golden Eagle), while other species make nomadic movements to areas with better conditions for breeding in a given year (e.g., Lark Bunting, Short-eared Owl). For additional details about the ecology of individual species, please refer to the online Field Guide available through the Wyoming Natural Diversity Database (*https://fieldguide.wyndd.org/*).

Human activities have contributed to the declines of many bird species in Wyoming and globally (Lees et al. 2022). Habitat loss, modification, and degradation are among the most pervasive challenges facing birds, including Wyoming's SGCN (Lees et al. 2022, North American Bird Conservation Initiative 2025). In addition to the indirect effects of habitat loss, direct mortality caused by human activities has contributed to bird population declines across species. These include predation by free-ranging domestic cats; collisions with vehicles, windows, powerlines, wind turbines, and other infrastructure; and exposure to contaminants such as pesticides and lead. Direct and indirect impacts of humans affect bird populations by reducing survival and reproduction, leading to declines in abundance, shifts in range, and changes in community composition (Basile et al. 2022, Douglas et al. 2023). Declines are most pervasive for grassland birds, but severe losses have occurred across taxa and habitats (Rosenberg et al. 2019), including non-SGCN birds that are currently common in Wyoming (e.g., Chipping Sparrow, Dark-eyed Junco, Mountain Bluebird). Characteristics such as functional group and degree of specialization can contribute to a species' vulnerability (Sekercioglu et al. 2004, Rosenberg et al. 2019). Some species are impacted by factors that affect their food source; for example, scavengers (e.g., Golden Eagle) can be poisoned by consuming carcasses that were shot with lead ammunition (Katzner et al. 2024) and insectivores can be affected by changes in abundance and phenology of invertebrate populations. Climate change is a challenge in and of itself and can exacerbate other challenges (Bateman et al. 2020). Changes in temperature, availability of food and water, increased frequency of extreme weather, and numerous other results of climate change can reduce survival and productivity of birds. Finally, although birds are among the most well-studied wildlife species, the large number of avian SGCN and the challenge of monitoring some species leaves key gaps in knowledge regarding population status and response to challenges for many birds. Conservation actions that can address these challenges consist of habitat conservation and restoration, avoidance and mitigation measures to reduce mortality, and increased monitoring of population response to challenges and management (Pavlacky et al. 2017, Pavlacky et al. 2022).

Challenges and actions

Wyoming's SWAP identifies the significant challenges facing SGCN in the state, as well as priority conservation actions to support their conservation. Species-specific challenges and actions are identified in *Table 6*. Please refer to *Chapter 3* for descriptions of how challenges and actions were identified and categorized. Notably, the identified challenges and actions are not inclusive of all potential challenges these species may face; instead this list summarizes the priority challenges and actions at this time, although they may change over the next 10 years.

Table 6. Challenges and actions for Species of Greatest Conservation Need birds.

Priority challenges and actions relevant to Species of Greatest Conservation Need birds.

Common Name	Challenges	Voluntary actions
American Barn Owl	Loss, fragmentation, and degradation of habitat in native grasslands and agricultural areas. Mortality from collisions (vehicles, power lines, wind turbines), illegal shooting, and exposure to pesticides; reduced productivity from human activity near nests; effects of climate change, pesticides, and habitat alteration on prey (small mammals). Insufficient information on population distribution, abundance, and trend; habitat associations; response to land use practices; mortality sources (vehicle collisions, pesticides); influence of nonbreeding phases of the annual cycle on population status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve habitat in native grasslands and agricultural areas using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, beneficial management practices on agricultural lands where the species occurs to maintain and improve nesting and small mammal prey habitat; use nest boxes where cavities and human made structures (barns) are unavailable; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas; avoid use of second-generation anti-coagulant rodenticides. Research and monitor population distribution, abundance, and trend; habitat associations; response to land use practices; mortality sources (vehicle collisions, pesticides); and influence of nonbreeding phases of the annual cycle on population status, including loss and degradation of wintering habitat in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
American Bittern	Loss, fragmentation, and degradation (drying, siltation, eutrophication, removal of vegetation) of large, shallow wetlands with emergent vegetation and adjacent upland habitats. Pollution from herbicide and pesticide application that reduces abundance of prey, including amphibians and aquatic invertebrates. Insufficient information on population distribution, abundance, and trend; response to land use and water management practices; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore nesting habitat in large, shallow water wetlands with emergent vegetation and adjacent uplands using tools such as land acquisition, conservation easements, habitat improvements, water management to stabilize water levels during the breeding season, and wildlife-friendly agricultural practices; control invasive species; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to wetland and water management and land use and water management practices; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
American Goshawk	Loss, fragmentation, and degradation of mature montane coniferous and quaking aspen forests with high (60–90%) canopy closure. Vegetation removal, development, and other human activities in nesting habitat during the breeding season can cause reduced productivity and survival. Insufficient information on response to forest disturbance and climate change, influence of nonbreeding phases of the annual cycle on population status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore mature, older, and contiguous forest stands, particularly those with high canopy cover, large trees, and relatively open understories for nesting and foraging; avoid timber harvest methods that create large areas of reduced (< 35–40%) forest canopy cover; avoid development and management activities during the breeding season or conduct clearance surveys and avoid active and alternate nest trees, stands, and post-fledging habitat. Research and monitor occupancy, population abundance, nest success, and productivity; response to alteration (especially mountain pine beetle, forest management) and large-scale disturbance (fire, climate change) of habitat, and direct disturbance (recreation); migratory movements; prey populations; locations of climate and wildlife refugia and focus areas for conservation and restoration; model and map high-quality nesting and foraging habitats; influence of nonbreeding phases of the annual cycle on population status, including loss and degradation of wintering habitat. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
American Kestrel	Loss, fragmentation, and degradation of open grassland, shrubland, and woodland habitats with nesting cavities and prey. Mortality from disease (West Nile virus); collisions with vehicles and infrastructure; predation by synanthropic raptors; and exposure to contaminants and pesticides; reduced productivity from human activity near nests (e.g., recreation, construction), effects of climate change and pesticides on prey (invertebrates, small mammals). Insufficient information on recent population trends; causes of long-term decline; influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve suitable habitats with abundant prey and mature trees. Provide nest boxes where availability of nesting cavities is limiting. Minimize nest disturbance with spatial-seasonal closures to human activities (e.g., recreation, construction); avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population trends; causes of long-term decline (habitat loss, nest site availability, predation, declining prey abundance, toxins); influence of nonbreeding phases of the annual cycle on population status in Wyoming; collaborate with partners to develop coordinated monitoring program, including nest boxes. Develop improved survey protocols to increase detections of smaller and cavity-nesting raptors in clearance for development. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
American Pipit	Loss, fragmentation, and degradation of alpine meadow habitat. Climate change may lead to reduced snowpack, changes in precipitation, increased temperatures, and woody encroachment in alpine environments, shrinking available habitat for breeding and foraging, and reducing abundance or shifting phenology of food sources. Insufficient information on population abundance and trend; climate change effects on food abundance and phenology; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend; climate change effects on productivity, habitat, food abundance and phenology; locations of climate refugia and focus areas for conservation and restoration; effects of human recreation, herbivory, and woody encroachment; and influence of nonbreeding phases of the annual cycle on population status in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
American White Pelican	High water levels in lakes and reservoirs may flood nests, and low water levels may cause breeding failure and facilitate nest predation. Human intrusions into colony sites and boat traffic may cause nest failure. Bioaccumulation of environmental contaminants from feeding in polluted aquatic habitat. Insufficient information on colony locations and status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve habitat by maintaining large lakes, riparian systems, and wetland complexes; protecting known and suitable breeding colony locations from human disturbance; maintaining stable water levels throughout the nesting season; improving or constructing nesting islands where needed; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Inventory nesting colonies locations and monitor productivity at known colonies, research diet relative to consumption of stocked fish and potential impacts to fisheries. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Ash-throated Flycatcher	Loss, fragmentation, and degradation of juniper woodland habitat. Insufficient information on population distribution, abundance, and trend; response to land use practices and habitat management; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore mature Utah juniper woodlands using tools such as land acquisition, conservation easements, habitat improvements, prescribed and natural fire management, habitat management that provides a mosaic of juniper conditions, invasive species control, avoidance and minimization measures for development, and best practices for reclamation; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Increase availability of nest cavities by providing wooden nest boxes in areas where snags and natural cavities are limited. Research and monitor population distribution, abundance, and trend; whether breeding occurs in Natrona and Fremont county populations; response to land use practices and habitat management; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Baird's Sparrow	Loss, fragmentation, and degradation of native mixed-grass prairie habitat. Habitat disturbance during nesting period can cause nest failure and mortality. Insufficient information on population distribution, abundance, and trend; response to land use practices and pesticides; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore native mixed-grass prairie habitats that include species' preferred vegetation structure (medium grass height, high forb cover, moderate litter depth, low shrub cover) using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, control of invasive species and woody encroachment, avoidance and minimization measures for development, and best practices for reclamation. Work with landowners to defer haying and mowing until after the breeding period in areas where species nests are detected in agricultural fields; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to energy development; effects of agricultural practices and pesticides; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Bald Eagle	Loss, fragmentation, and degradation of riparian and lacustrine habitats with nesting substrates and prey. Mortality from illegal shooting, contaminants (lead, pesticides), disease (avian influenza, West Nile virus), collisions (vehicles, power lines, wind turbines), and electrocution. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to maintain nesting habitat and reduce disturbance of known nest sites through implementation of spatial-seasonal buffers; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas; avoid winter roosting areas. Implement available mitigation techniques, including avian-safe design standards and power pole retrofits to prevent electrocution, voluntary use of non-lead ammunition and fishing tackle to prevent lead poisoning, moving roadkill to prevent collisions, avoidance of siting wind energy developments and other sources of mortality and disturbance in high-use areas. Monitor breeding territory occupancy and productivity in coordination with partners; population expansion in Wyoming; effects of disease (HPAI) and severe spring weather on population. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Bewick's Wren	Loss, fragmentation, and degradation of juniper woodland habitat. Insufficient information on population abundance and trend; response to land use practices and habitat management; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Increase availability of nest cavities by providing wooden nest boxes in areas where snags and natural cavities are limited. Collaborate with partners to conserve and restore juniper woodlands using tools such as land acquisition, conservation easements, habitat improvements, prescribed and natural fire management, habitat management that provides a mosaic of juniper conditions, invasive species control, avoidance and minimization measures for development, and best practices for reclamation; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend; response to land use practices and habitat management; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Black Rosy-Finch	Loss, fragmentation, and degradation of alpine habitats, including meadows and snowfields. Climate change may lead to reduced snowpack, changes in precipitation, increased temperatures, and woody encroachment in alpine environments, shrinking available habitat for breeding and foraging, and reducing abundance or shifting phenology of food sources. Insufficient information on population abundance and trend; response to loss of snowpack, fish stocking, and climate change effects on food abundance and phenology; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Research and monitor population abundance and trend; response to loss of snowpack, fish stocking, woody encroachment, herbivory, and human recreation; climate change effects on productivity, habitat, food abundance and phenology; locations of climate refugia and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle on population status, including loss and degradation of wintering habitat in Wyoming. Avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Black Tern	Loss, fragmentation, and degradation (drying, siltation, eutrophication, removal of vegetation) of large, shallow wetlands with emergent vegetation. High water levels may flood nests, and low water levels may cause breeding failure and facilitate nest predation. Insufficient information on population distribution, abundance, and trend; response to land use practices, water management practices, and pesticides; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore nesting habitat in ponds, lakes, and marshes with semi-marsh stage vegetation (50% emergent vegetation, 50% open water) using tools such as land acquisition, conservation easements, habitat improvements, water management to stabilize water levels during the breeding season, wildlife-friendly agricultural practices, installation of artificial nesting platforms, minimizing direct human disturbance of nesting colonies, and avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use and water management practices; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Black-backed Woodpecker	Loss, fragmentation, and degradation of mature forests, particularly those dominated by spruce, Douglas-fir, ponderosa pine, and lodgepole pine, and containing decadent trees, snags, and fallen logs resulting from natural disturbances, forest management practices, and fire suppression. Insufficient information on population distribution, abundance, and trend; status of Black Hills population; response to forest management (salvage logging, thinning); and influence of nonbreeding phases of the annual cycle on population status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore habitat in mature coniferous forests with disturbed areas; encourage natural fire regimes; and conduct salvage logging in a mosaic to retain nesting snags and stands; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active and alternate nest trees, stands, and post-fledging habitat. Research and monitor population distribution, abundance, and trend; demography; habitat associations; dispersal from fire- and beetle-killed forests; status of Black Hills population; locations of climate refugia and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle on population status. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Black-billed Cuckoo	Loss, fragmentation, and degradation of dense, contiguous riparian corridors, especially those with mature cottonwood or quaking aspen trees and dense understories. Climate change may lead to changes in temperature and precipitation which can affect the timing of insect emergence (impacting food availability); affect surface and groundwater availability (including quantity, quality, temperature, and timing); and alter riparian vegetation (species diversity, plant growth, etc.) leading to reduction in amount and quality of habitat. Insufficient information on population abundance and trend; effects of land use and water management practices, pesticides, and collisions with infrastructure; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore large, unfragmented riparian woodlands, particularly those with mature trees, dense understory vegetation, and a diverse mix of native plant species, using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, invasive species control, limited use of insecticides in riparian areas, and avoidance measures for development; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend; habitat associations; effects of vegetation and water management; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Black-chinned Hummingbird	Insufficient information on population distribution, abundance, and trend; habitat associations; effects of climate change on food sources; effects of land use practices; locations of climate refugia and focus areas for conservation/restoration; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve habitats where species is known to occur (potentially including canyons with deciduous riparian forests and shrublands, and juniper woodlands) by managing for multilayered native vegetation structure and using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, invasive species control, and avoidance measures for development; reduce impacts of herbivory on flowering plants favored by this species; use best practices for feeding where species occurs in suburban areas; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; habitat associations; effects of climate change on food sources; locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Black-crowned Night Heron	Loss, fragmentation, and degradation (drying, siltation, eutrophication, removal of vegetation) of large, shallow wetlands with emergent vegetation caused by changes in water availability. Human intrusions into colony sites and boat traffic may cause nest failure. Insufficient information on colony locations and status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore nesting habitat in ponds, lakes, and marshes using tools such as land acquisition, conservation easements, habitat improvements, water management to stabilize water levels during the breeding season, wildlife-friendly agricultural practices, installation of artificial nesting platforms, and minimizing direct human disturbance of nesting colonies; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to wetland and water management, land use and water management practices, and pesticides; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Black-throated Gray Warbler	Loss, fragmentation, and degradation of juniper woodland habitat. Insufficient information on population abundance and trend; response to land use practices and habitat management; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore juniper woodlands using tools such as land acquisition, conservation easements, habitat improvements, prescribed and natural fire management, habitat management that provides a mosaic of juniper conditions, invasive species control, avoidance and minimization measures for development, and best practices for reclamation; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend; response to land use practices and habitat management; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Blue Grosbeak	Loss, fragmentation, and degradation of riparian areas, especially those dominated by cottonwoods and containing shrubby understories. Insufficient information on population distribution, abundance, trend, and habitat requirements; response to land use practices and climate change; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Research and monitor population distribution, abundance, and trend; response to land use practices and climate change; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Blue-gray Gnatcatcher	Loss, fragmentation, and degradation of juniper woodland habitat. Insufficient information on population abundance and trend; response to land use practices, habitat management, and fire; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore juniper woodlands using tools such as land acquisition, conservation easements, habitat improvements, prescribed and natural fire management, habitat management that provides a mosaic of juniper conditions, invasive species control, avoidance and minimization measures for development, and best practices for reclamation; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend; response to land use practices and habitat management; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Bobolink	Loss, fragmentation, and degradation of native mixed-grass prairie, hayfields, and irrigated meadow habitat. Habitat disturbance during nesting period can cause nest failure and mortality. Insufficient information on population distribution, abundance, and trend; effects of land use practices and pesticides; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore native mixed-grass prairie, hayfields, and irrigated meadow habitat that include species' preferred vegetation structure (medium to tall grass height, high forb cover, moderate litter depth, low shrub cover, and moist soil) using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, control of invasive species and woody encroachment, avoidance and minimization measures for development, and best practices for reclamation. Work with landowners to defer haying and mowing until after the breeding period in areas where species nests are detected in agricultural fields; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; effects of land use practices and pesticides; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Boreal Owl	Loss, fragmentation, and degradation of mature spruce-fir and mixed-conifer forests, including trees with nesting cavities. Alteration of small mammal prey abundance. Vegetation removal, development, and other human activities in nesting habitat during the breeding season can cause reduced productivity and survival. Insufficient information on population distribution, abundance, and trend; response to forest management and climate change; locations of climate refugia and focus areas for conservation/restoration. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore mature spruce-fir, mixed-conifer, and quaking aspen forests; avoid removal and fragmentation of mature and old growth forests by timber harvest and human development; encourage natural fire regimes; retain known nesting trees and stands, large-diameter snags, trees with cavities, and mature and decadent trees for snag recruitment; avoid clearcutting, except where needed for quaking aspen regeneration; use forest management practices, such as uneven-aged management and small patch cuts with long rotations; avoid development and management activities during the breeding season or conduct clearance surveys and avoid active and alternate nest trees, stands, and post-fledging habitat; control invasive species; and mitigate loss of nesting cavities with nest boxes; avoid use of second-generation anti-coagulant rodenticides. Research and monitor population distribution, abundance, and trend; response to forest management and climate change; locations of climate and wildfire refugia, and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle on population status. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Brewer's Sparrow	Loss, fragmentation, and degradation of dense (> 20% cover), mature sagebrush. Insufficient information on response to climate change, locations of climate refugia and focus areas for conservation/restoration, and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore large, unfragmented sagebrush stands, particularly those with high canopy cover and densities of taller shrubs, using tools such as land acquisition, conservation easements, habitat improvements, invasive species control, wildlife-friendly agricultural practices, avoidance and minimization measures for development, and best practices for reclamation. Complement ongoing sagebrush conservation efforts by targeting management actions at appropriate scales in areas where the species' habitat requirements do not overlap those other focal species (e.g., Greater Sage-Grouse, Mule Deer). Avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor locations of climate refugia and focus areas for conservation and restoration, influence of nonbreeding phases of the annual cycle on population status in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Brown-capped Rosy-Finch	Loss, fragmentation, and degradation of alpine habitats, including meadows and snowfields. Climate change may lead to reduced snowpack, changes in precipitation, increased temperatures, and woody encroachment in alpine environments, shrinking available habitat for breeding and foraging, and reducing abundance or shifting phenology of food sources. Insufficient information on population distribution, abundance, and trend; response to loss of snowpack, fish stocking, and climate change effects on food abundance and phenology; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Research and monitor population distribution, abundance and trend; response to loss of snowpack, fish stocking, woody encroachment, herbivory, and human recreation; climate change effects on productivity, habitat, food abundance and phenology; locations of climate refugia and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle on population status, including loss and degradation of wintering habitat in Wyoming. Avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Burrowing Owl	Loss, fragmentation, and degradation of habitat in grasslands, shrublands, and reduction of prairie dog colonies. Mortality from illegal shooting, collisions (vehicles, power lines, wind turbines), and exposure to pesticides; reduced productivity from human activity near nests (e.g., recreation, construction); effects of climate change, pesticides, and habitat alteration on prey (invertebrates, small mammals). Insufficient information on population distribution, abundance, and trend; causes of long-term declines; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore habitat in grassland and shrubland habitat, and promote sustainable prairie dog management using tools such as land acquisition, conservation easements, habitat improvements, control of invasive species and woody encroachment, wildlife-friendly agricultural practices, avoidance and minimization measures for development, and best practices for reclamation; minimize nest disturbance with spatial-seasonal closures to human activities (e.g., recreation, construction); mitigate loss of nest sites with artificial burrows; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; causes of long-term declines; response to challenges (energy development, pesticides); locations of climate refugia and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle on population status in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Bushtit	Loss, fragmentation, and degradation of juniper woodland habitat. Insufficient information on population distribution, abundance, and trend; response to land use practices and habitat management; and influence of nonbreeding phases of the annual cycle on population status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore juniper woodlands using tools such as land acquisition, conservation easements, habitat improvements, prescribed and natural fire management, habitat management that provides a mosaic of juniper conditions, invasive species control, avoidance and minimization measures for development, and best practices for reclamation; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use practices and habitat management; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Calliope Hummingbird	Loss, fragmentation, and degradation of nesting habitat in montane riparian corridors and adjacent mid-elevation conifer forests. Climate change can affect abundance and timing of food sources (flower nectar, small insects). Insufficient information on population distribution, abundance, and trend; habitat associations and effects of riparian management; effects of climate change and pesticides on food sources; locations of climate refugia and focus areas for conservation/restoration; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore montane and wide valley-bottom riparian habitats using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, reintroduction of beavers, invasive species control, and avoidance measures for development; manage forests for open to intermediate canopy cover and a variety of seral stages, including early successional plant communities that support growth of flowering plants as a food source; reduce impacts of herbivory on flowering plants favored by this species; use best practices for feeding where species occurs in suburban areas; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; habitat associations and effects of riparian management; effects of climate change and pesticides on food sources; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Canyon Wren	Loss, fragmentation, and degradation of rocky outcrop, cliff, and canyon habitats. Insufficient information on population abundance, recent trends, and causes of long-term decline; effects of climate change, recreation, and over-winter conditions. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve integrity of canyons and rock outcrops by protecting known nesting areas from development and recreation, minimizing pesticide use, and avoiding land conversion; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend; causes of long-term decline; effects of climate change and recreation; locations of climate refugia and focus areas for conservation and restoration; winter ecology and influence of nonbreeding phases of the annual cycle on population status. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Caspian Tern	High water levels in lakes and reservoirs may flood nests, and low water levels may cause breeding failure and facilitate nest predation. Insufficient information on population distribution, abundance, and trend; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve habitat by maintaining large lakes and reservoirs, protecting known and suitable breeding colony locations from human disturbance with spatial-season buffers, maintaining stable water levels throughout the nesting season, improving or constructing nesting islands where needed, and avoiding development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to factors that affect water levels and pesticide exposure; and influence of nonbreeding phases of the annual cycle on population status; inventory colony locations. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Chestnut-collared Longspur	Loss, fragmentation, and degradation of native short- and mixed-grass prairie habitat. Insufficient information on population abundance and trend, response to land use practices and pesticides, and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore native short- and mixed-grass prairie habitat that include species' preferred vegetation structure (short to medium grass height, low litter cover, and low shrub cover) using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, control of invasive species and woody encroachment, avoidance and minimization measures for development, best practices for reclamation; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend, response to energy development, effects of agricultural practices and pesticides, influence of nonbreeding phases of the annual cycle on population status, and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Clark's Grebe	Loss, fragmentation, and degradation (drying, siltation, eutrophication, removal of vegetation) of large wetlands with emergent vegetation. Human intrusions into colony sites and boat traffic may cause nest failure. Insufficient information on population distribution, abundance, and trend; response to land use and water management practices; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore nesting habitat in large, emergent marshes using tools such as land acquisition, conservation easements, habitat improvements, water management to stabilize water levels during the breeding season, wildlife-friendly agricultural practices, installation of artificial nesting platforms, minimizing direct human disturbance of nesting colonies, and avoiding development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to wetland and water management and land use practices; locations of climate refugia and focus areas for conservation and restoration; influence of nonbreeding phases of the annual cycle on population status; inventory colony locations. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Clark's Nutcracker	Loss, fragmentation, and degradation of mature subalpine conifer forests, especially those containing whitebark pine and limber pine. Insufficient information on population abundance, trend, and response to variations in cone crop; habitat selection and space use; influence of nonbreeding phases of the annual cycle on population status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore five-needle pine ecosystems using forest management techniques that favor healthy, mature stands, including breeding and planting of white pine blister rust-resistant seedlings, prescribed fire, and thinning treatments; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend in different habitat types across the state; demographic effects of food availability and climate change; nutcracker-pine mutualism; locations of climate and wildfire refugia, and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Columbian Sharp-tailed Grouse	Loss, fragmentation, and degradation of high mountain shrub-grassland communities and associated edges. During winter, riparian areas, shrubs, and trees can provide food and cover. Competition and hybridization with Greater Sage-Grouse. Insufficient information on response to various land use practices.	Collaborate with partners to conserve and restore important habitats using a variety of conservation tools. Research and monitor response to land use practices, distribution, and seasonal habitat use. Codify monitoring standards and protocols. Survey and monitor demographics, genetic identity of Little Snake River population, and response to land use practices. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs.
Common Loon	Recreational activities such as boating, hiking, and fishing may cause nest abandonment or failure. Exposure to pollutants and contaminants such as lead, heavy metals, synthetic chemicals, and cyanotoxins. Entanglement in gillnets. High water levels in lakes and reservoirs may flood nests and low water or drying of lakes and wetlands may cause breeding failure and facilitate nest predation. Climate change may reduce water level and reliability, affecting wetland habitat. Insufficient information on distribution, abundance, survival, recruitment, population viability, effects of disturbance, and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve nesting habitat by protecting lakes and wetlands used by the species, manage water levels to minimize risk of flooding or drying, and mitigate flooding with nest rafts. Minimize disturbance by recreationists through education and seasonal closures around nest sites. Avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Continue to coordinate with partners including the Greater Yellowstone Common Loon Working Group on monitoring efforts and developing region-wide management strategies. Research and monitor nesting population distribution, abundance, survival, recruitment, population viability and limiting factors, effects of disturbance, and influence of nonbreeding phases of the annual cycle on population status in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Common Nighthawk	Loss, fragmentation, and degradation of habitat in grassland, shrubland, open forest, rock outcrop, suburban and agricultural areas with abundant insect prey. Insufficient information on population abundance and trend; effects of land use change, pesticides, and climate change on prey of aerial insectivores; impact of anthropogenic habitat use (nesting on roofs, foraging in artificial light); and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve food sources for aerial insectivores by maintaining native habitats and minimizing insecticide use; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend; effects of land use practices, pesticides, and climate change on prey of aerial insectivores; impact of anthropogenic habitat use (nesting on roofs, foraging in artificial light); locations of climate refugia and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle on population status in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Common Yellowthroat	Loss, fragmentation, and degradation of densely vegetated riparian areas, thickets, and marshes, especially those containing willow, bulrush, and cattail. Climate change may lead to changes in temperature and precipitation which can affect the timing of insect emergence (impacting food availability); affect surface and groundwater availability (including quantity, quality, temperature, and timing), and alter riparian vegetation (species diversity, plant growth, etc.) leading to reduction in quantity and quality of habitat. Insufficient information on population abundance, trend, and demography; effects of pesticides and land use and riparian management practices; response to current and future challenges such as climate change and nest parasitism by Brown-headed Cowbird. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore marshes, thickets, wide valley-bottoms, and other riparian habitats with dense shrubs and diverse vegetation heights; restoring native riparian vegetation, limiting herbivory, and increasing microhabitat cover and understory density may reduce the potential for cowbird parasitism and improve overall habitat quality; minimize the loss of wet areas in preferred habitat; limit use of insecticides in riparian areas to ensure a food source exists for this and other insectivorous species; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance, and trend; effects of land use and riparian management practices and pesticides; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Dickcissel	Habitat disturbance during nesting period can cause nest failure and mortality. Insufficient information on population distribution, abundance, and trend; habitat selection in Wyoming; effects of land use practices and pesticides; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation/restoration; influence of nonbreeding phases of the annual cycle on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Work with landowners to defer haying and mowing until after the breeding period in areas where species nests are detected in agricultural fields; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; habitat selection in Wyoming; effects of land use practices;; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Evening Grosbeak	Loss, fragmentation, and degradation of mature, mixed spruce-fir and quaking aspen forests, especially those containing Douglas-fir and/or subalpine fir stands with open canopies and high structural diversity. Insufficient information on population distribution, abundance, and trend; causes of steep, range-wide declines; breeding biology (number of broods/season); drivers of irruptive breeding behavior; response to current/future forest management, including control of spruce budworm outbreaks, land use practices, and climate change; influence of nonbreeding phases of the annual cycle on population status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore mature coniferous and mixed-conifer forests, particularly those containing spruce and fir; promote structural diversity and wildfire refugia within stands through thinning, prescribed fire, and encouraging natural disturbance regimes, while maintaining high canopy cover and retaining snags; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; causes of decline; breeding biology; response to forest management, including control of spruce budworm outbreaks, land use practices, and climate change; locations of climate and wildfire refugia, and focus areas for conservation and restoration; influence of nonbreeding phases of the annual cycle on population status, including loss and degradation of wintering habitat in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Ferruginous Hawk	Loss, fragmentation, and degradation of native grassland and shrubland habitats. Mortality from illegal shooting, lead poisoning, disease (avian influenza, West Nile virus), collisions (vehicles, power lines, wind turbines), and electrocution; reduced productivity from human activity near nests (e.g., recreation, construction). Insufficient information on population trend, impacts of land use practices, status of prey populations, potential impacts of climate change on habitat and prey, influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore native grassland and shrubland habitats with abundant mammalian prey (prairie dogs, ground squirrels, cottontails) using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, control of invasive species, and avoidance and minimization measures for development. Implement available mitigation techniques, including avian-safe design standards and power pole retrofits to prevent electrocution, voluntary use of non-lead ammunition to prevent lead poisoning, moving roadkill to prevent collisions, avoidance of siting wind energy developments and other sources of mortality and disturbance in high-use areas identified by seasonal habitat models, artificial nest platforms to replace lost natural substrates and mitigate disturbance, spatial seasonal buffers to reduce nest disturbance; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population trend, impacts of energy development (conventional, renewable), status of prey populations, potential impacts of climate change on habitat and prey, locations of climate refugia and focus areas for conservation and restoration, influence of nonbreeding phases of the annual cycle on population status in Wyoming, migratory movements and connectivity to other populations, and effects of anthropogenic structures on productivity. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Field Sparrow	Loss, fragmentation, and degradation of habitat in open grasslands and fields with scattered woody vegetation. Insufficient information on population distribution, abundance, and trend; response to land use practices and pesticides, and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore habitat in native grasslands scattered shrubs using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, control of invasive species, avoidance and minimization measures for development, and best practices for reclamation; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use practices and pesticides, locations of climate refugia and focus areas for conservation and restoration, and influence of nonbreeding phases of the annual cycle on population status in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Flammulated Owl	Loss, fragmentation, and degradation of mature ponderosa pine, quaking aspen, and mixed-conifer forests. Insufficient information on population distribution, abundance, and trend; response to forest management and pesticides; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore mature ponderosa pine, quaking aspen, and mixed-conifer forests with nesting cavities and understory vegetation that supports moths and other invertebrate prey; avoid removal and fragmentation of mature forests by timber harvest and human development; encourage natural fire regimes; retain known nesting trees and stands, large-diameter snags, trees with cavities, and mature and decadent trees for snag recruitment; avoid clearcutting, except where needed for quaking aspen regeneration; use forest management practices, such as uneven-aged management and small patch cuts with long rotations; avoid development and management activities during the breeding season or conduct clearance surveys and avoid active and alternate nest trees, stands, and post-fledging habitat; control invasive species; and mitigate loss of nesting cavities with nest boxes. Research and monitor population distribution, abundance, and trend; habitat selection in different regions and forest types; response to forest management and pesticides; locations of climate and wildfire refugia, and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Forster's Tern	Loss, fragmentation, and degradation (drying, siltation, eutrophication, removal of vegetation) of emergent marsh habitat with open water. Insufficient information on population distribution, abundance, and trend; response to land use and water management practices; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore nesting habitat wetlands using tools such as land acquisition, conservation easements, habitat improvements, water management to stabilize water levels during the breeding season, wildlife-friendly agricultural practices, installation of artificial nesting platforms, minimizing direct human disturbance of nesting colonies, and avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use and water management practices and pesticides; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Franklin's Gull	Loss, fragmentation, and degradation (drying, siltation, eutrophication, removal of vegetation) of emergent marsh habitat with open water. Human intrusions into colony sites and boat traffic may cause nest failure. Insufficient information on population distribution, abundance, and trend; response to land use and water management practices; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore nesting habitat in emergent marsh habitat with open water using tools such as land acquisition, conservation easements, habitat improvements, water management to stabilize water levels during the breeding season, wildlife-friendly agricultural practices, and minimizing direct human disturbance of nesting colonies; maintain foraging habitat in flooded agricultural fields; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use and water management practices; influence of nonbreeding phases of the annual cycle on population status; inventory colony locations; describe habitat characteristics of nesting colonies. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Golden Eagle	Loss, fragmentation, and degradation native grassland, shrubland, and montane habitats. Mortality from illegal shooting, lead poisoning, disease (avian influenza, West Nile virus), collisions (vehicles, power lines, wind turbines), and electrocution; reduced productivity from human activity near nests (e.g., recreation, construction). Insufficient information on effectiveness of mitigation measures for energy development, status of prey populations, potential impacts of climate change on habitat and prey, impacts of recreation and other disturbances on reproduction, implications of demographic composition (age, geographic origin, breeding status) on population level consequences of human-caused mortality. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore native habitats with abundant mammalian prey (jackrabbits, cottontails, prairie dogs) using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, management of diseases in prey populations, and avoidance and minimization measures for development; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Implement available mitigation techniques, including avian-safe design standards and power pole retrofits to prevent electrocution, voluntary use of non-lead ammunition to prevent lead poisoning, moving roadkill to prevent collisions, avoidance of siting wind energy developments and other sources of mortality and disturbance in high-use areas identified by seasonal habitat models and developed decision support tools (e.g., raptormapper.com), artificial nest platforms to replace lost natural substrates and mitigate disturbance, spatial seasonal buffers to reduce nest disturbance, and rehabilitation of injured eagles. Research and monitor population trend, effectiveness of mitigation measures for energy development, status of prey populations, potential impacts of climate change on habitat and prey, impacts of recreation and other disturbances on reproduction, implications of demographic composition (age, geographic origin, breeding status) on population level consequences of human-caused mortality. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Grasshopper Sparrow	Loss, fragmentation, and degradation of native grassland, hayfield, and meadow habitat. Habitat disturbance during nesting period can cause nest failure and mortality. Insufficient information on population trend, response to land use practices and pesticides, and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore native grassland, hayfield, and meadow habitat that include species' preferred vegetation structure (medium grass height, low litter cover, low shrub cover) using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, control of invasive species and woody encroachment, avoidance and minimization measures for development, and best practices for reclamation. Work with landowners to defer haying and mowing until after the breeding period in areas where species nests are detected in agricultural fields; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend, response to land use practices and pesticides, influence of nonbreeding phases of the annual cycle on population status, and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Gray Vireo	Insufficient information on population distribution, abundance, and trend; response to land use practices and habitat management; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore juniper woodlands in areas where the species is known to occur using tools such as land acquisition, conservation easements, habitat improvements, prescribed and natural fire management, habitat management that provides a mosaic of juniper conditions, invasive species control, avoidance and minimization measures for development, and best practices for reclamation; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance and trend; response to land use practices and habitat management; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Great Blue Heron	Loss, fragmentation, and degradation of riparian and wetland habitats. Insufficient information on colony locations and status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore riparian and wetland habitat using tools such as land acquisition, conservation easements, habitat improvements, water management, and wildlife-friendly agricultural practices, and minimizing direct human disturbance of known nesting colonies during the breeding season; avoid development and management activities in known nesting areas during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use and water management practices, and pesticides; influence of nonbreeding phases of the annual cycle on population status; inventory colony locations; effective deterrents to prevent depredation at fish hatcheries. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Great Gray Owl	Loss, fragmentation, and degradation of mature spruce-fir, mixed-conifer, quaking aspen, and cottonwood forests with high canopy cover and interspersed meadows. Direct mortality from vehicle collisions. Insufficient information on population distribution, abundance, and trend; nest site characteristics; response to forest management and climate change; locations of climate refugia and focus areas for conservation/restoration; potential competitive exclusion by Barred Owls. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore mature mixed-conifer, spruce-fir, quaking aspen, and cottonwood forests with high canopy cover and interspersed meadows; avoid removal and fragmentation of mature and old growth forests by timber harvest and human development; encourage natural fire regimes; retain known nesting trees and stands, trees with nests built by other raptor species, large-diameter snags, and mature and decadent trees for snag recruitment; avoid clearcutting, except where needed for quaking aspen regeneration; use forest management practices, such as uneven-aged management and small patch cuts with long rotations; conserve wet and montane meadow foraging habitat, including by preventing encroachment of woody vegetation, while retaining intermittent deadfall and lone live trees or snags for perches; manage invasive species and land use practices to maintain high herbaceous cover in meadow habitat used by primary prey (voles). Avoid development and management activities during the breeding season or conduct clearance surveys and avoid active, alternate, and historical nest trees and territories, and post-fledging habitat; mitigate loss of nest sites with artificial platforms; deter owls from roadways by removing perches and lowering speed limits in collision hot spot areas and known breeding and wintering areas; avoid use of second-generation anti-coagulant rodenticides. Research and monitor population distribution and abundance (outside the Jackson area), and trend; nest site characteristics; response to forest management, habitat alteration, and climate change; locations of climate and wildfire refugia, and focus areas for conservation/restoration; potential competitive exclusion by Barred Owls. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Greater Sage-Grouse	Habitat loss, fragmentation, or degradation of the sagebrush steppe associated with anthropogenic disturbances, changing land use practices, wildfire, climate change, and invasive annual grasses. Increased anthropogenic sound levels in the sagebrush steppe that interfere with the relationship between acoustic signaling and mating success. Chronic anthropogenic noise in the sagebrush steppe leading to heightened stress in sage-grouse as measured from fecal corticosterone hormones. Disease (West Nile virus). Barriers to movements include fences, roadways, and residential or industrial development. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore important habitats using a variety of tools, including the Governor's Sage-Grouse Executive Order. Continue to support integrating sage-grouse conservation into statewide conservation efforts, including land use planning, county planning, forest plan revisions, resource management plans, siting infrastructure, etc. Monitor population distribution, size, and response to land use practices. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Research relationship between habitat quality, quantity, and population levels; response to changing land use practices; impacts of different types and levels of disturbance on all life cycles, and the efficacy of conservation actions such as habitat modifications, conservation easements, fence markers/ modifications, and invasive annual grass management. Continue to support knowledge sharing by participating in WAWFA's Sage and Columbian Sharp-tailed Grouse Technical Committee and WAWFA's Sagebrush Conservation Initiative. Develop additional funding options and collaborative efforts to support conservation.
Harlequin Duck	Loss and degradation of breeding habitat in rocky, fast flowing, montane streams and adjacent forest and riparian vegetation. Insufficient information on nesting ecology and habitat; response to disturbance of forest and riparian habitats, altered river flows, impacts of predation and human disturbance, and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore known and potential breeding habitat by using best practices for forest and stream management; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; nesting ecology and habitat; connectivity to populations breeding in neighboring states; response to disturbance of forest and riparian habitats, altered river flows, impacts of predation and human disturbance, and influence of nonbreeding phases of the annual cycle on population status. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Juniper Titmouse	Loss, fragmentation, and degradation of juniper woodland habitat. Insufficient information on population abundance and trend; response to land use practices and habitat management; and influence of nonbreeding phases of the annual cycle on population status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore juniper woodlands using tools such as land acquisition, conservation easements, habitat improvements, prescribed and natural fire management, habitat management that provides a mosaic of juniper conditions, invasive species control, avoidance and minimization measures for development, and best practices for reclamation; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend; response to land use practices and habitat management; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Lark Bunting	Loss, fragmentation, and degradation of native mixed- and short-grass prairie, sagebrush steppe, hayfield, and meadow habitat. Habitat disturbance during nesting period can cause nest failure and mortality. Insufficient information on response to energy development, effects of land use practices and pesticides, and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore native mixed- and short-grass prairie, sagebrush steppe, hayfield, and meadow habitat that include species' preferred vegetation structure (medium to short grass height, low to moderate shrub cover, moderate forb cover) using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, control of invasive species and woody encroachment, avoidance and minimization measures for development, and best practices for reclamation. Work with landowners to defer haying and mowing until after the breeding period in areas where species nests are detected in agricultural fields; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend, response to land use practices and pesticides, influence of nonbreeding phases of the annual cycle on population status, and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Lewis's Woodpecker	Loss, fragmentation, and degradation of forests dominated by ponderosa pine and open riparian woodlands dominated by cottonwood with patches of recently logged or burned trees, brushy understories, and open canopies. Insufficient information on population distribution, abundance, and trend; demography and population performance in different habitat types; response to timber, fire, and water management; migratory movements and wintering areas; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore cottonwood galleries, other riparian forests, and mature ponderosa pine forests; ensure that large snags are available, avoiding salvage logging in mature forests where the species is known to occur; manage understory to support invertebrate prey; avoid development and management activities during the breeding season or conduct clearance surveys and avoid active and alternate nest trees, stands, and post-fledging habitat. Research and monitoring population distribution, abundance, and trend; demography and population performance in different habitat types; response to timber, fire, and water management; migratory movements and wintering areas; locations of climate refugia and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle on population status in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Loggerhead Shrike	Loss, fragmentation, and degradation of open grasslands with scattered trees and shrubs, sagebrush steppe, and greasewood shrubland habitats. Insufficient information on causes of population declines; response to land use practices, pesticides, and climate change; locations of climate refugia and focus areas for conservation/restoration; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore open grasslands with scattered trees and shrubs; areas in sagebrush steppe with tall, high-cover structure, such as along dry washes; and greasewood shrubland using tools such as land acquisition, conservation easements, habitat improvements, invasive species control, prescribed fire, wildlife-friendly agricultural practices, avoidance and minimization measures for development, and best practices for reclamation. Complement ongoing sagebrush conservation efforts by targeting management actions at appropriate scales in areas where the species' habitat requirements do not overlap those other focal species (e.g., Greater Sage-Grouse, mule deer). Avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research causes of population declines, recent trends; response to land use practices, pesticides, and climate change; locations of climate refugia and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle on population status in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Long-billed Curlew	Loss, fragmentation, and degradation of native mixed- and short-grass prairie, sagebrush steppe, hayfield, and meadow habitat. Habitat disturbance during nesting period can cause nest failure and mortality. Insufficient information on population abundance and trend, response to land use practices, and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore native mixed- and short-grass prairie, sagebrush steppe, hayfield, and meadow habitat that include species' preferred vegetation structure (short grass height, low shrub cover, proximity to water) using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, control of invasive species and woody encroachment, avoidance and minimization measures for development, and best practices for reclamation; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance, trend, nest success, and fledgling survival; response to energy development; effects of agricultural practices and pesticides; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
MacGillivray's Warbler	Loss, fragmentation, and degradation of montane riparian habitats with willow, alder, and other shrubs. Insufficient information on response to climate change; locations of climate refugia and focus areas for conservation/restoration; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore montane riparian habitats using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, reintroduction of beavers, invasive species control, and avoidance measures for development; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor response to climate change, land use and riparian management practices, herbivory, and recreation; locations of climate refugia and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle on population status in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Merlin	Insufficient information on population distribution, abundance, and trend; demography and population performance in different habitat types; response to land management; migratory movements and wintering areas; and influence of nonbreeding phases of the annual cycle on population status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Reduce nest disturbance with spatial-seasonal closures to human activities (e.g., recreation, construction). Avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; demography and population performance in different habitat types; response to land management; migratory movements and wintering areas; and influence of nonbreeding phases of the annual cycle on population status, including loss and degradation of wintering habitat in Wyoming. Develop improved survey protocols to increase detections of smaller raptors in clearance for development. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Mountain Plover	Loss, fragmentation, and degradation of native short-stature grassland and shrubland habitats, and prairie dog colonies. Tillage and planting of fields during the nesting season can cause nest failure or mortality in areas where the species nests in fallow or freshly plowed fields. Insufficient information on population abundance and trend, response to land use practices, reliance on prairie dog colonies, and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore native short-stature grassland and shrubland habitats that include species' preferred vegetation structure (sparse, short vegetation, extensive bare ground) using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, control of invasive species and woody encroachment, avoidance and minimization measures for development, and conservation of prairie dog colonies. Delay or conduct clearance surveys before tillage and planting of agricultural fields during the nesting season in areas where the species nests in fallow or freshly plowed fields; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, trend, nest success, and fledgling survival; response to land use practices, development, and pesticides; influence of nonbreeding phases of the annual cycle on population status; locations of climate refugia and focus areas for conservation and restoration; and relationship to prairie dog colonies. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Northern Pintail	Loss, fragmentation, and degradation of native and introduced shortgrass grasslands (breeding habitat) and shallow emergent wetlands (brooding and post-breeding habitat). Insufficient information at a state level on the amount of breeding that occurs in Wyoming, nest success, and fledgling survival. Limited funding and resources are available for conservation of this species (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and protect shortgrass grassland habitat, especially near or adjacent to shallow emergent wetlands and where future changes to land use practices is likely. Research and monitor the amount of breeding that occurs in Wyoming, nest success, and fledgling survival. Collaborate with partners to conserve and restore important breeding and postbreeding habitats using a variety of conservation tools such as the Conservation Reserve Program, Wetlands Reserve Program, conservation easements on privately owned lands, and the North American Wetlands Conservation Act. Maintain and restore shallow emergent wetlands; limit significant water fluctuations during the breeding season; protect wetlands from degradation and pollution. Develop additional funding options and collaborative efforts to support conservation of this species.
Northern Pygmy-Owl	Loss, fragmentation, and degradation of mature spruce-fir and mixed-conifer forests. Insufficient information on population distribution, abundance, and trend; response to forest management and climate change; locations of climate refugia and focus areas for conservation/restoration; influence of nonbreeding phases of the annual cycle on population status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore mature spruce-fir and mixed-conifer forests; avoid removal and fragmentation of mature and old growth forests by timber harvest and human development; encourage natural fire regimes; retain known nesting trees and stands, large-diameter snags, trees with cavities, and mature and decadent trees for snag recruitment; use forest management practices, such as uneven-aged management and small patch cuts with long rotations; avoid use of second-generation anti-coagulant rodenticides; avoid development and management activities during the breeding season or conduct clearance surveys and avoid active and alternate nest trees, stands, and post-fledging habitat; control invasive species. Research and monitor population distribution, abundance, and trend; response to forest management and climate change; locations of climate and wildfire refugia, and focus areas for conservation and restoration; influence of nonbreeding phases of the annual cycle on population status. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Peregrine Falcon	Reduced productivity can be caused by disturbance of nests by human activities (e.g., recreation, construction) and severe spring weather and drought exacerbated by climate change. Mortality can be caused by diseases (avian influenza) and contaminants (pesticides). Insufficient information on wintering population distribution and ecology. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Reduce nest disturbance with spatial-seasonal closures to human activities (e.g., recreation, construction). Avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor winter ecology (abundance during winter, distribution of winter range, and changes in winter population over time), response to challenges (especially pesticides and avian influenza). Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Pinyon Jay	Loss, fragmentation, and degradation of juniper and pinyon-juniper woodland habitat. Insufficient information on population distribution, abundance, and trend; habitat associations and diet; seasonal movements and space use; response to land use practices and habitat management; causes of declines rangewide and in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore low-elevation juniper and pinyon-juniper woodlands, and adjacent sagebrush rangelands using tools such as land acquisition, conservation easements, habitat improvements, prescribed and natural fire management, habitat management that provides a mosaic of woodland conditions, invasive species control, avoidance and minimization measures for development, and best practices for reclamation; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; habitat associations and diet; seasonal movements and space use; response to land use practices and habitat management; causes of declines in Wyoming; locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Plains Sharp-tailed Grouse	Loss, fragmentation, and degradation of mixed, medium and tall grass prairies, Conservation Reserve Program grasslands, brushy draws, and scattered trees and shrubs. Lek sites are often characterized by shorter vegetation and grasslands that are highly visible to surrounding areas. Competition and hybridization with Greater Sage-Grouse. Insufficient information on response to various land use practices.	Collaborate with partners to conserve and restore important habitats using a variety of conservation tools. Research and monitor response to land use practices, distribution, and seasonal habitat use. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs.
Purple Martin	Insufficient information on population distribution, abundance, and trend; habitat associations; effects of forest and water management; effects of land use and water management practices, pesticides, and climate change on prey of aerial insectivores; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore habitat in mature quaking aspen stands near water within limited known range of the species using tools such as prescribed fire, thinning of encroaching conifers, browsing exclosures, control of invasive species, water management, and wildlife-friendly agricultural practices; install nest boxes in habitat lacking cavities; protect known nesting trees and stands; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; habitat associations; effects of forest and water management; effects of land use and water management practices, pesticides, and climate change on prey of aerial insectivores; and influence of nonbreeding phases of the annual cycle on population status in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Pygmy Nuthatch	Loss, fragmentation, and degradation of mature ponderosa pine forests. Insufficient information on population abundance and trend; response to forest management and climate change; influence of nonbreeding phases of the annual cycle on population status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore mature ponderosa pine forests; ensure that large snags are available; avoid salvage logging in mature forests where the species is known to occur; use prescribed fire to increase resilience of dry forests to wildfire; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population trends; response to forest management and climate change, locations of climate refugia and focus areas for conservation and restoration; influence of nonbreeding phases of the annual cycle on population status. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Red Crossbill	Loss, fragmentation, and degradation of mature coniferous forests, particularly those containing ponderosa pine, lodgepole pine, and Douglas-fir. Insufficient information on population range, distribution, abundance, trend, and breeding status of specific Red Crossbill call types within Wyoming; response to forest management, conifer disease, pine beetle outbreaks, and effects of climate change on conifer mast cycles; influence of nonbreeding phases of the annual cycle on population status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore large tracts of mature forest; reduce frequency of logging to encourage older growth in forests; use thinning and prescribed fire to increase resilience of existing mature forest patches to fire and climate change; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor distribution of call types, breeding status, population trends, and response to forest management, climate change, fire suppression, conifer disease, pine beetle outbreaks; locations of climate and wildfire refugia, and focus areas for conservation and restoration; influence of nonbreeding phases of the annual cycle on population status, including loss and degradation lower-elevation wintering habitat in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Red-eyed Vireo	Loss, fragmentation, and degradation of low elevation deciduous forests. Insufficient information on population abundance and trend; response to forest and water management, climate change; influence of nonbreeding phases of the annual cycle on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore low-elevation deciduous forests using tools such as land acquisition, conservation easements, prescribed fire, thinning of encroaching conifers, browsing exclosures, invasive species control, water management, wildlife-friendly agricultural practices, and avoidance measures for development; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend; response to forest management and climate change; effects of pesticides and nest predation; influence of nonbreeding phases of the annual cycle on population status; locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Red-headed Woodpecker	Loss, fragmentation, and degradation of forests dominated by ponderosa pine and open riparian woodlands dominated by cottonwood with patches of recently logged or burned trees, brushy understories, and open canopies. Insufficient information on population distribution, abundance, and trend; demography and population performance in different habitat types, including susceptibility to ecological traps; response to timber, fire, and water management; migratory movements and wintering areas; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore open riparian and ponderosa pine woodland habitats, particularly those with mature trees; manage for a mosaic of large trees with open canopies and clusters of snags; retain mature and decadent trees for future snag production; use forestry practices, such as prescribed fire and staggered planting, to maintain open stands of forests and woodlands; manage insecticide use in woodland habitats to sustain abundance of invertebrate prey; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Control European Starling where Red-headed Woodpecker occurs to eliminate competition for cavity nests. Research and monitor population distribution, abundance, and trend; demography and population performance in different habitat types; response to timber, fire, and water management; migratory movements and wintering areas; and influence of nonbreeding phases of the annual cycle on population status; locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Rufous Hummingbird	Loss, fragmentation, and degradation of nesting habitat in riparian shrublands, mountain-foothills grasslands, and wet-moist meadows within montane forests and shrublands. Climate change can affect abundance and timing of food sources (flower nectar, small insects). Insufficient information on population breeding status, distribution, abundance, and trend; habitat associations; effects of climate change and pesticides on food sources; locations of climate refugia and focus areas for conservation/restoration; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve habitats where species is known to occur (including riparian shrublands, mountain-foothills grasslands, and wet-moist meadows within montane forests and shrublands) by managing for multilayered native vegetation structure and using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, invasive species control, and avoidance measures for development; reduce impacts of herbivory on flowering plants favored by this species; use best practices for feeding where species occurs in suburban areas; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor breeding status; population distribution, abundance, and trend; habitat associations and effects of land management; effects of climate change and pesticides on food sources; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Sage Thrasher	Loss, fragmentation, and degradation of tall, mature, high-cover, sagebrush. Insufficient information on response to climate change, locations of climate refugia and focus areas for conservation/restoration, and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore large, unfragmented sagebrush stands, particularly those with high densities of taller shrubs (>20% cover), using tools such as land acquisition, conservation easements, habitat improvements, invasive species control, wildlife-friendly agricultural practices, avoidance and minimization measures for development, and best practices for reclamation. Complement ongoing sagebrush conservation efforts by targeting management actions at appropriate scales in areas where the species' habitat requirements do not overlap those other focal species (e.g., Greater Sage-Grouse, mule deer). Avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor response to climate change, locations of climate refugia and focus areas for conservation and restoration, influence of nonbreeding phases of the annual cycle on population status in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Sagebrush Sparrow	Loss, fragmentation, and degradation of dense, mature sagebrush and mixed shrublands that are interspersed with open areas. Insufficient information on response to climate change, locations of climate refugia and focus areas for conservation/restoration, and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore large, unfragmented sagebrush stands, with varying shrub heights and bare ground, using tools such as land acquisition, conservation easements, habitat improvements, invasive species control, wildlife-friendly agricultural practices, avoidance and minimization measures for development, and best practices for reclamation. Complement ongoing sagebrush conservation efforts by targeting management actions at appropriate scales in areas where the species' habitat requirements do not overlap those other focal species (e.g., Greater Sage-Grouse, mule deer). Avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor response to climate change, locations of climate refugia and focus areas for conservation and restoration, influence of nonbreeding phases of the annual cycle on population status in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Scott's Oriole	Insufficient information on population distribution, abundance, and trend; response to land use practices and habitat management; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore juniper woodlands in areas where the species is known to occur using tools such as land acquisition, conservation easements, habitat improvements, prescribed and natural fire management, habitat management that provides a mosaic of juniper conditions, control of invasive species, avoidance and minimization measures for development, and best practices for reclamation; avoid development and management activities in known nesting areas during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use practices and habitat management; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Short-eared Owl	Loss, fragmentation, and degradation of low-elevation grasslands, meadows, hayfields, marshes, and sagebrush steppe. Insufficient information on site fidelity and nomadic movements, and effects of climate change and development, and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore low-elevation grasslands, meadows, hayfields, marshes, and sagebrush steppe that include species' preferred vegetation structure (tall, dense herbaceous cover) using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, control of invasive species and woody encroachment, avoidance and minimization measures for development, and best practices for reclamation; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Work with landowners to defer haying and mowing until after the breeding period in areas where species nests in agricultural fields. Research and monitor population distribution, abundance, and trend, causes of long-term decline, drivers of site fidelity and nomadic movements, effects of climate change and land use practices, locations of climate refugia and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle on population status, including loss and degradation of wintering habitat in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Snowy Egret	Loss, fragmentation, and degradation (drying, siltation, eutrophication, removal of vegetation) of habitats in low-elevation wetlands, flooded pastures, and shores of ponds, lakes, reservoirs, and rivers. Insufficient information on population abundance and trend; response to land use and water management practices; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore nesting habitat using tools such as land acquisition, conservation easements, habitat improvements, water management to stabilize water levels during the breeding season, wildlife-friendly agricultural practices, minimizing direct human disturbance of nesting colonies, and avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use and water management practices; influence of nonbreeding phases of the annual cycle on population status; locations of climate refugia and focus areas for conservation and restoration; inventory colony locations; inventory colony locations. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Snowy Plover	Loss and degradation of small, sparsely vegetated, alkaline or saline lakes. Insufficient information on population distribution, abundance, and trend; response to land use and water management practices, climate change, invasive species, and predators; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore nesting habitat in small, sparsely vegetated alkaline or saline lakes using tools such as land acquisition, conservation easements, habitat improvements, water management, and wildlife-friendly agricultural practices; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use and water management practices, climate change, invasive species, predators, and energy development; locations of climate refugia and focus areas for conservation and restoration; influence of nonbreeding phases of the annual cycle on population status. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Swainson's Hawk	Loss, fragmentation, and degradation of native grassland and shrubland and agricultural habitats. Mortality from illegal shooting, disease (avian influenza, West Nile virus), collisions (vehicles, power lines, wind turbines), electrocution, and contaminants (pesticides). Insufficient information on population trend, impacts of land use practices, status of prey populations, potential impacts of climate change on habitat and prey, impacts of pesticide use on prey abundance and direct mortality, influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore habitats where the species occurs, including agricultural pastures, using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, and avoidance and minimization measures for development; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population trend, status of prey populations, potential impacts of climate change on habitat and prey, impacts of pesticide use on prey abundance and direct mortality, impacts of land use practices and development, locations of climate refugia and focus areas for conservation and restoration, influence of nonbreeding phases of the annual cycle on population status in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Thick-billed Longspur	Loss, fragmentation, and degradation of native short-stature grassland and shrubland habitats, and reduction of prairie dog colonies. Insufficient information on population trend, response to land use practices, and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore native grassland and shrubland habitats that include species' preferred vegetation structure (sparse, short vegetation, extensive bare ground, low litter cover) using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, control of invasive species and woody encroachment, avoidance and minimization measures for development, and conservation of prairie dog colonies; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend, response to land use practices, influence of nonbreeding phases of the annual cycle on population status, locations of climate refugia and focus areas for conservation and restoration, and relationship to prairie dog colonies. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Trumpeter Swan	Loss, fragmentation, and degradation of wetland, riparian, and lacustrine habitats. Disease (avian influenza, West Nile, avian cholera, botulism). Increasing recreational activities (e.g., fishing, boating) can cause appropriate habitat to be abandoned or unused. Collisions with power lines, fences, or bridges. Lead poisoning through the ingestion of lead shot and fishing tackle can cause significant mortality. Increasing number of over-wintering migrants may be depleting forage especially in late winter and early spring for the Wyoming resident, breeding population. Insufficient information on population demography and trends; response to land use and water management practices, climate change, disease, and human disturbance; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore known nest sites and unoccupied habitat by installing nesting platforms and islands, reintroducing beavers, enhancing aquatic vegetation; collaborate with land trusts, county conservation districts, and other partners to prioritize and implement wetland conservation strategies identified in the state and regional Wetland Conservation Plans. Avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Conduct educational programs, wetland seminars, and field trips to involve the public in swan and wetland conservation; continue efforts to educate waterfowl hunters on swan identification to avoid accidental shooting due to confusion with light geese; engage private landowners, municipalities, industry, and other partners in voluntary habitat conservation programs. Reintroduce captive-bred swans to the Big Sandy Trumpeter Swan Restoration Project area, Yellowstone National Park, and other areas, as needed to maintain and expand breeding and wintering distributions. Research and monitor nesting population distribution, abundance, survival, recruitment, sources of mortality, population viability and limiting factors, seasonal habitat requirements, and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Continue to coordinate with the Greater Yellowstone Trumpeter Swan Working Group and the Pacific Flyway on monitoring efforts and developing region-wide management strategies. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Upland Sandpiper	Loss, fragmentation, and degradation of native mixed-grass prairie, hayfield, and meadow habitat. Habitat disturbance during nesting period can cause nest failure and mortality. Insufficient information on population abundance, and trend; response to land use practices and climate change; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore native mixed-grass prairie, hayfields, and irrigated meadow habitats that include species' preferred vegetation structure (medium to tall grass height, moderate forb cover, moderate litter depth, low shrub cover) using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, control of invasive species and woody encroachment, avoidance and minimization measures for development, and best practices for reclamation. Work with landowners to defer haying and mowing until after the breeding period in areas where species nests are detected in agricultural fields; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend, response to land use practices, influence of nonbreeding phases of the annual cycle on population status, locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Virginia Rail	Loss, fragmentation, and degradation of shallow emergent wetland habitat. Residue and runoff resulting from nearby/adjacent herbicide and pesticide application potentially reduces prey abundance, including amphibians and aquatic insects. Active nests can be affected by surface disturbance and fluctuating water levels within shallow emergent wetlands. Insufficient information at a state level on abundance, nest success, and fledgling survival. Limited funding and resources are available for conservation of this species (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore nesting habitat in large, shallow water wetlands with emergent vegetation and adjacent mudflats using tools such as land acquisition, conservation easements, habitat improvements, water management to stabilize water levels during the breeding season, and wildlife-friendly agricultural practices; avoid development and management activities in nesting habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas; prevent degradation and pollution of wetlands. Research and monitor distribution, abundance, location and habitat characteristics of breeding sites, nest success, fledgling survival, and response to challenges. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of this species.

Common Name	Challenges	Voluntary actions
Virginia's Warbler	Loss, fragmentation, and degradation of mid-elevation, arid, shrubland habitat. Insufficient information on population distribution, abundance, and trend; response to land use practices and climate change; influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore mid-elevation, arid, shrubland habitats, particularly dense thickets of mountain mahogany or other shrubs, juniper, and oak woodlands using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, avoidance and minimization measures for development, best practices for reclamation, and avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use practices and climate change; locations of climate refugia and focus areas for conservation and restoration; influence of nonbreeding phases of the annual cycle on population status. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Western Cattle-Egret	Loss, fragmentation, and degradation (drying, siltation, eutrophication, removal of vegetation) of low-elevation emergent marsh habitats. Insufficient information on population abundance and trend; response to land use and water management practices; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore nesting habitat using tools such as land acquisition, conservation easements, habitat improvements, water management to stabilize water levels during the breeding season, wildlife-friendly agricultural practices, and minimizing direct human disturbance of nesting colonies; maintain foraging habitat in upland areas adjacent to wetlands; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use and water management practices; influence of nonbreeding phases of the annual cycle on population status; inventory colony locations. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Western Grebe	Loss, fragmentation, and degradation (drying, siltation, eutrophication, removal of vegetation) of large wetlands with emergent vegetation. Human intrusions into colony sites and boat traffic may cause nest failure. Insufficient information on population distribution, abundance, and trend; response to land use and water management practices; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore nesting habitat in large, emergent marshes using tools such as land acquisition, conservation easements, habitat improvements, water management to stabilize water levels during the breeding season, wildlife-friendly agricultural practices, installation of artificial nesting platforms, minimizing direct human disturbance of nesting colonies, and avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use and water management practices; locations of climate refugia and focus areas for conservation and restoration; influence of nonbreeding phases of the annual cycle on population status; inventory colony locations. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
White-faced Ibis	Loss, fragmentation, and degradation (drying, siltation, eutrophication, removal of vegetation) of large wetlands with emergent vegetation. Insufficient information on population distribution, abundance, and trend; response to land use and water management practices; hybridization with Glossy Ibis; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore nesting habitat in large, emergent marshes using tools such as land acquisition, conservation easements, habitat improvements, water management to stabilize water levels during the breeding season, wildlife-friendly agricultural practices, and minimizing direct human disturbance of nesting colonies; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use and water management practices; locations of climate refugia and focus areas for conservation and restoration; influence of nonbreeding phases of the annual cycle on population status; inventory colony locations. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
White-winged Crossbill	Loss, fragmentation, and degradation of mature forest habitat. Insufficient information on population abundance and trend; basic demography and life history; causes and patterns of nomadic movements; response to forest management and disturbance, and climate change; influence of nonbreeding phases of the annual cycle on population status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore large tracts of mature, boreal forest where species is known to occur; reduce frequency of logging to encourage older growth in forests; use thinning and prescribed fire to increase resilience of existing mature forest patches to fire and climate change; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, trend, demography, and life history; extent and connectivity of required habitat; response to challenges, especially climate change and other factors affecting habitat; locations of climate and wildfire refugia, and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle on population status, including loss and degradation of wintering habitat in Wyoming. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Williamson's Sapsucker	Loss, fragmentation, and degradation of contiguous, high-elevation forest stands dominated by mature ponderosa pine, Douglas-fir, and quaking aspen, and containing relatively open canopies/understories and large-diameter snags. Insufficient information on population abundance and trend; habitat requirements in the state (preferred nest trees, sap trees, and diet); and the impacts of climate change on habitat and food sources; and influence of nonbreeding phases of the annual cycle on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore open riparian and ponderosa pine woodland habitats, particularly those with mature trees; manage for a mosaic of large trees with open canopies and clusters of snags; retain mature and decadent trees for future snag production; use forestry practices, such as prescribed fire and staggered planting, to maintain open stands of forests and woodlands; limit pesticide use in woodland habitats to ensure a food source; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population abundance and trend; habitat requirements (preferred nest trees, sap trees, and diet); impacts of climate change on habitat and food sources; locations of climate and wildfire refugia, and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle on population status. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Willow Flycatcher	Loss, fragmentation, and degradation of riparian thickets with willow, alder, and cottonwood. Insufficient information on population trend; response to climate change; locations of climate refugia and focus areas for conservation/ restoration; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore riparian thickets and wide valley-bottom riparian habitats with willow and alder using tools such as land acquisition, conservation easements, habitat improvements, wildlife-friendly agricultural practices, reintroduction of beavers, invasive species control, and avoidance measures for development; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population trend; response to climate change; locations of climate refugia and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle on population status. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Wilson's Phalarope	Loss, fragmentation, and degradation of nesting habitat in wet meadows, wetlands, shallow lakes, ponds, and sloughs. Insufficient information on population distribution, abundance, and trend; response to land use and water management practices; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore nesting habitat in wet meadows, wetlands, shallow lakes, ponds, and sloughs using tools such as land acquisition, conservation easements, habitat improvements, water management to stabilize water levels during the breeding season, wildlife-friendly agricultural practices, and minimizing direct human disturbance of nesting areas; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use and water management practices; locations of climate refugia and focus areas for conservation and restoration; and influence of nonbreeding phases of the annual cycle on population status. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Common Name	Challenges	Voluntary actions
Woodhouse's Scrub-Jay	Loss, fragmentation, and degradation of juniper woodland habitat. Insufficient information on population abundance and trend; response to land use practices and habitat management; and influence of nonbreeding phases of the annual cycle on population status. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore juniper woodlands using tools such as land acquisition, conservation easements, habitat improvements, prescribed and natural fire management, habitat management that provides a mosaic of juniper conditions, control of invasive species, avoidance and minimization measures for development, and best practices for reclamation; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Research and monitor population distribution, abundance, and trend; response to land use practices and habitat management; influence of nonbreeding phases of the annual cycle on population status; and locations of climate refugia and focus areas for conservation and restoration. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.
Yellow-billed Cuckoo	Loss, fragmentation, and degradation of contiguous riparian woodlands containing mature trees and dense understories. Climate change may lead to changes in temperature and precipitation which can affect the timing of insect emergence (impacting food availability); affect surface and groundwater availability (including quantity, quality, temperature, and timing), and alter riparian vegetation (species diversity, productivity) leading to reduction in quantity and quality of habitat. Insufficient information on population distribution, abundance, and trend; response to land use and water management practices; and influence of nonbreeding phases of the annual cycle (migration, wintering) on population status in Wyoming. Insufficient funding and resources available for conservation of nongame birds (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to conserve and restore large, contiguous riparian woodlands, particularly those with mature trees, dense understory vegetation, and a diverse mix of native plant species; control invasive species in riparian areas; use best practices to minimize impacts of water control and agricultural activities in preferred habitat; limit use of insecticides in riparian areas to ensure a food source exists for this and other insectivorous species; avoid development and management activities in habitat during the breeding season or conduct clearance surveys and avoid active nests and surrounding areas. Continue to collaborate with USFWS and partners on recovery planning. Research and monitor population distribution, abundance, and trend; response to land use and water management practices; influence of nonbreeding phases of the annual cycle on population status. Conduct education and outreach to inform the public of actions to address major sources of human-caused bird mortality and best practices to conserve bird habitat; engage private landowners, municipalities, industry, and other partners in voluntary bird conservation programs. Develop additional funding options and collaborative efforts to support conservation of nongame birds.

Chapter 6: Crustaceans

There currently is not a robust assessment of the number of native crustaceans in Wyoming, but Wyoming has designated 8 species and 1 group as Species of Greatest Conservation Need (SGCN; *Table 1*). The group includes 17 species where scant information is available. Wyoming's SGCN crustaceans include crayfish, fairy shrimp, clam shrimp, and tadpole shrimp. Crustaceans provide important ecosystem services within Wyoming and beyond by consuming algae, detritus, and small animals such as fish and mollusks; serving as a food source for many species (including humans); supporting nutrient cycling; shaping community composition and morphologies of other species; and being useful as indicators of environmental contaminants (Covich et al. 2010).

Globally, there are over 68,000 crustacean species, and these invertebrates vary widely in their ecology and morphology (Covich et al. 2010, VanHook and Patel 2008). All Wyoming's SGCN crustaceans are aquatic and have restricted distributions within the state (*Appendix D*). Crayfish have exoskeletons made of chitin and possess pincers. Wyoming's SGCN crayfish can be up to 5 inches long, depending on the species. Crayfish live in lakes, reservoirs, streams, and rivers (Hubert 1988). Some species (e.g., Ringed Crayfish) construct and live in burrows. Fairy, clam, and tadpole shrimp live in temporary aquatic habitats, such as rock pools, vernal pools, playas, and roadside ditches. Their habitat suitability is shaped by species-specific thresholds for salinity, temperature, and oxygen levels (Dodson et al. 2010). SGCN fairy shrimp are translucent, swim upside down, and can grow up to 2 inches long. Tadpole shrimp have shield-like carapaces, resemble horseshoe crabs, and can grow up to 2 inches long. Clam shrimp have 2 carapaces that resemble the shells of a small clam and can grow to ¾ of an inch. Fairy, clam, and tadpole shrimp typically emerge from eggs, mature and reproduce in the few weeks while the temporary aquatic habitat exists. Eggs then enter a state of dormancy called diapause, where eggs can survive unfavorable environmental conditions and are dispersed by the wind and in droppings of animals that consumed them. Although they are often overlooked, the unique ecology of crustaceans make them important and interesting components of Wyoming's ecosystems. For additional details about the ecology of individual species, please refer to the online Wyoming Field Guide available through the Wyoming Natural Diversity Database (*https://fieldguide.wyndd.org/*).

Multiple factors pose conservation challenges for Wyoming's SGCN crustaceans. Due to their dependence on water, factors that affect water quality, availability, and flow dynamics can negatively affect crustaceans (Denton 1998, Taylor et al. 2007). Some species are vulnerable to habitat disturbance. For example, the eggs (cysts) of fairy shrimp are easily crushed, which can make them vulnerable to trampling from many sources (Hathaway et al. 1996). Community composition and ecosystem services can change with the presence of certain species, such as Virile Crayfish and nonnative crayfish (Lodge et al. 2012, Newkirk et al. 2023). The absence of information about crustaceans in Wyoming presents a challenge for conservation efforts. Conservation actions to address these challenges include researching ecology and distribution, as well as habitat restoration and conservation.

Challenges and actions

Wyoming's SWAP identifies the significant challenges facing SGCN in the state, as well as priority conservation actions to support their conservation. Species-specific challenges and actions are identified in *Table 7*. Please refer to *Chapter 3* for descriptions of how challenges and actions were identified and categorized. Notably, the identified challenges and actions are not inclusive of all potential challenges these species may face; instead this list summarizes the priority challenges and actions at this time, although they may change over the next 10 years.

Table 7. Challenges and actions for Species of Greatest Conservation Need crustaceans.

Priority challenges and actions relevant to Species of Greatest Conservation Need crustaceans.

Common Name	Challenges	Voluntary actions
Crayfish		
Calico/Papershell Crayfish	Introduced crayfish and fish may displace or limit populations. Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Water withdrawal can reduce the amount of water in the stream resulting in individuals being stranded and altered water quality. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, reproductive success, ecology, and response to challenges in historical drainages. Work with local conservation districts and land managers to keep water in rivers and streams to support invertebrate communities as well as fish. Monitor for the presence of pathogens and invading nonnative species. Develop additional funding options and collaborative efforts to support conservation.
Devil Crayfish/Great Plains Mudbug	Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Water withdrawal can reduce the amount of water in the stream resulting in individuals being stranded and altered water quality. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Lack of knowledge of abundance, distribution, response to challenges, and ecology. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, reproductive success, ecology, and response to challenges in historical drainages. Work with local conservation districts and land managers to keep water in rivers and streams to support invertebrate communities as well as fish. Monitor for the presence of pathogens and invading nonnative species. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Pilose Crayfish	Introduced crayfish and fish may displace or limit populations. Porcelain disease may affect growth and feeding. Increased turbidity, siltation, and pollution can degrade water quality. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, reproductive success, ecology, and response to challenges in historical drainages. Work with local conservation districts and land managers to keep water in rivers and streams to support invertebrate communities as well as fish. Monitor for the presence of pathogens and invading non-native species. Develop additional funding options and collaborative efforts to support conservation.
Ringed Crayfish	Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Water withdrawal can reduce the amount of water in the stream resulting in individuals being stranded and altered water quality. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, reproductive success, ecology, and response to challenges in historical drainages. Work with local conservation districts and land managers to keep water in rivers and streams to support invertebrate communities as well as fish. Monitor for the presence of pathogens and invading non-native species. Develop additional funding options and collaborative efforts to support conservation.
Shrimp		
Beavertail Fairy Shrimp	Lack of knowledge of abundance, distribution, response to challenges, and ecology. Less precipitation and higher air temperatures can reduce the quantity and quality of water in temporary aquatic habitats. Pollution. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, reproductive success, ecology, and response to challenges in historical drainages. Work with State Engineer's Office and Wyoming Department of Environmental Quality to reduce or prevent pollution to maintain water quality. Develop additional funding options and collaborative efforts to support conservation.
Constricted Fairy Shrimp, Fairy Shrimp, Mackin Fairy Shrimp *Note: all species had the same challenges and actions, so they are listed in one row to save space.*	Lack of knowledge of abundance, distribution, response to challenges, and ecology. Less precipitation and higher air temperatures can reduce the quantity and quality of water in temporary aquatic habitats. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, reproductive success, ecology, and response to challenges in historical drainages. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Other shrimp group (*Branchinecta coloradensis, Branchinecta lateralis, Branchinecta lindahli, Branchinecta packardi, Branchinecta paludosa, Cyzicus belfragei, Cyzicus californicus, Eulimnadia diversa, Lepidurus bilobatus, Lepidurus couesii, Lepidurus lemmoni, Leptestheria compleximanus, Lynceus brachyurus, Lynceus brevifrons, Streptocephalus coloradensis, Streptocephalus texanus, Triops longicaudatus*)	Lack of knowledge of abundance, distribution, response to challenges, and ecology. Less precipitation and higher air temperatures can reduce the quantity and quality of water in temporary aquatic habitats. Insufficient funding and resources available for conservation of these species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, reproductive success, ecology, and response to challenges in historical drainages. Collect samples to determine what species live in WY and where they occur. Develop additional funding options and collaborative efforts to support conservation.

Chapter 7: Fish

There are over 50 native species of fishes in Wyoming, and 29 are considered Species of Greatest Conservation Need (SGCN; *Table 1*). Maintaining healthy, diverse fish populations helps support Wyoming’s culture, economy, and ecosystems. Fish provide important food resources and recreational opportunities for residents and nonresidents alike, and recreational activities generate substantial cultural value, jobs, and revenue for nearby communities (McCoy and Scott 2025). Fish also provide many ecosystem benefits, including sources of food for piscivorous fishes, mammals, birds, reptiles, and amphibians; as hosts for species dependent on fish to complete their life cycle (e.g., mussels); as consumers of vegetation; and through contributing to nutrient cycling, with ramifications in surrounding terrestrial ecosystems (Clancy et al. 2025, Holmlund and Hammer 1999, Lynch et al. 2023).

Wyoming’s SGCN fishes inhabit headwater tributaries, prairie streams, lakes, large rivers, anthropogenic water sources (e.g., reservoirs, stock ponds, ditches), and other aquatic habitats such as wetlands and ponds throughout the state (Baxter and Stone 1995). Some species have restricted distributions (e.g., Northern Pearl Dace), while others are more widespread (e.g., Flathead Chub), although no SGCN are widely distributed throughout the state (*Appendix D*). SGCN fishes represent many feeding guilds including herbivorous (e.g., Brassy Minnow, Plains Minnow), insectivorous (e.g., Bigmouth Shiner, Northern Leatherside), omnivorous (e.g., Flannelmouth Sucker, Roundtail Chub), or opportunistic feeders. Thermal conditions help shape where fish can persist (Booher and Walters 2021, Mandeville et al. 2019), and thermal preferences range from relatively warm water (e.g., Shovelnose Sturgeon, Suckermouth Minnow) to cold water (e.g., Cutthroat Trout). Spawning strategies include depositing eggs that flow downstream to suitable nursery habitat (e.g., Goldeye), migration to suitable spawning grounds (e.g., Sauger), and even mid-winter under ice (i.e., Burbot). Additional variation in fine-scale habitat preferences, community associations, behaviors, reproductive ecology, morphology, life history, and natural history contribute to Wyoming’s diverse fish assemblage. For additional details about the ecology of individual species, please refer to the species accounts hosted on the State Wildlife Action Plan page on the Wyoming Game and Fish Department's website.

Aspects of fish habitats and ecology mediate their vulnerability to human activities. The waterways and nearby terrestrial areas that are critical for fish lifecycles are often modified or degraded by human activities (Arthington et al. 2016, Fencl et al. 2015, Walker and Walters 2019). Fragmented waterways can negatively affect life history and demographics by interrupting migrations, preventing larval drift, and facilitating hybridization or genetic differentiation (Rosenthal et al. 2024, Siddons and Neebling 2023, Underwood et al. 2015, Walters et al. 2014). Changing thermal conditions, streamflow dynamics, water quality, and vegetation structure can affect abundance, community composition, distribution, and the establishment of nonnative species (Clancy et al. 2024, Coulter et al. 2024, Girard and Walters 2018, Kirk and Rahel 2023, Walters 2016). Nonnative species that are intentionally or unintentionally introduced by humans can reduce abundances of, reduce fitness of, predate upon, hybridize with, compete with, or displace native species (Gerrity and Glaid 2022, Hickerson et al. 2019, Hogberg 2024, Mandeville et al. 2017, Perry et al. 2002, Rosenthal et al. 2022, Ruthven et al. 2023). Species that have limited distribution and small population size, such as Kendall Warm Springs Dace, could face severe consequences from otherwise minimal, stochastic disturbances. Conservation actions such as translocations, fish passage structures, altering flow levels, habitat management, and management of nonnative species are often used to address these challenges (Edwards et al. 2024, Glassic et al. 2024, Harter 2023, Schultz 2020, Sexauer 2021).

Challenges and actions

Wyoming's SWAP identifies the significant challenges facing SGCN in the state, as well as priority conservation actions to support their conservation. Species-specific challenges and actions are identified in *Table 8*. Please refer to *Chapter 3* for descriptions of how challenges and actions were identified and categorized. Notably, the identified challenges and actions are not inclusive of all potential challenges these species may face; instead this list summarizes the priority challenges and actions at this time, although they may change over the next 10 years.

Table 8. Challenges and actions for Species of Greatest Conservation Need fishes.

Priority challenges and actions relevant to Species of Greatest Conservation Need fishes.

Common Name	Challenges	Voluntary actions
Bonneville Cutthroat Trout	Loss, degradation, or fragmentation of habitat associated with removal of riparian vegetation, roads, and impoundments. Competition with nonnative trout can negatively affect some populations. Fish survival and recruitment can be negatively impacted by barriers to passage and entrainment. Excess nutrients, sediment erosion, and chemicals entering waterways. Increasing water temperatures due to lower flow and climatic changes. Changes to precipitation and hydrological regimes have reduced peak flows, altered timing of peak flow, and reduced average and base flows. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work with land managers to conserve and manage riparian areas for native riparian vegetation by using riparian fencing, land use management, fire management, and invasive species control. Ensure that private landowners located within Bonneville Cutthroat Trout conservation waters only stock Department-approved species. Continue to partner with other agencies and private landowners to reduce entrainment. Evaluate fish passage problems throughout the Bear River, Thomas Fork, and Smith Fork watersheds. Continue efforts to maintain flow and connectivity by modifying diversions and culverts. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Translocate beaver to suitable areas to improve riparian function. Install beaver dam analogs (BDAs) to raise water tables and improve deep water refugia. Continue to work towards meeting the goals and objectives as identified in the Bonneville Cutthroat Trout Range-wide Conservation Agreement and Strategy (Oplinger and Birdsey 2019). Monitor abundance, habitat condition, and water temperature. Continue efforts to educate landowners and the public about the importance of native fish and their habitats. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Bigmouth Shiner	Habitat can be lost, fragmented, or degraded by diversions and withdrawals, as well as by erosion and siltation. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work with private landowners, irrigators, other agencies, and appropriate WGFD personnel to discuss and address maintaining sufficient water levels, nongame passage issues, and reduced entrainment. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Attempt to gain a better understanding of life history requirements. Continue efforts to educate landowners and the public about the importance of native fish and their habitats. Develop additional funding options and collaborative efforts to support conservation.
Bluehead Sucker	Hybridization with nonnative sucker species. Competition with and predation by nonnative species. Loss, degradation, or fragmentation of habitat associated with removal of riparian vegetation, roads, and impoundments. Increasing water temperatures due to lower flow and climate change. Changes to precipitation and hydrological regimes have reduced peak flows, altered timing of peak flow, and reduced average and base flows. Fish survival and recruitment can be negatively impacted by barriers to passage and entrainment. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Remove nonnative species through mechanical removal and chemical treatments of priority conservation waters. Work with land managers to conserve and manage riparian areas for native riparian vegetation by using riparian fencing and land use management. Conduct instream habitat restoration activities to improve river function. Continue efforts to improve fish passage by maintaining flow, modifying diversions, and removing perched culverts. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Research abundance and habitat use of juveniles. Continue with regular monitoring to track population trends, hybridization rates, and the distribution of nonnative species threats. Continue to develop and refine methods for spawning and rearing in captivity. Conduct monitoring before and after chemical treatments and transplants to determine the success of actions taken. Collect brood fish to propagate in captivity for release into conservation areas. Continue as a signatory to the "Rangewide Conservation Agreement for Roundtail Chub, Bluehead Sucker and Flannelmouth Sucker." Continue to coordinate with agency partners on the planning and implementation of conservation actions. Continue efforts to educate landowners and the public about the importance of native fish and their habitats. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Brassy Minnow	Habitat loss, fragmentation, or degradation can be caused by physical barriers (natural and man made), climate change, land use practices, and draining of wetlands or lentic habitats. Predation, competition, and displacement by introduced nonnative species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work with land managers to conserve and manage riparian areas for native riparian vegetation by using riparian fencing, land use management, and invasive species control. Continue efforts to maintain flow and connectivity. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Maintain policies that exclude the stocking of nonnative piscivores and remove piscivores when appropriate. Monitor abundance and trends in both lotic and lentic habitats, including at sites reported in Patton (1997), Barrineau et al. (2007), Bear and Barrineau (2007), McGree et al. (2010), and Moan et al. (2011). Conserve local genetics by transplanting Brassy Minnow to suitable lentic habitats without problematic nonnative fishes. Continue efforts to educate landowners and the public about the importance of native fish and their habitats. Develop additional funding options and collaborative efforts to support conservation.
Burbot	Competition with and predation by nonnative species. Increased anthropogenic water use and water development (e.g., dam construction) may lead to restricted movement ability, altered forage bases, and fragmentation of available habitat. Broad-scale changes in climatic conditions (e.g., warming temperatures, shorter winters) may further reduce suitable habitat for the species, affect forage bases, and/or alter its life history. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Continue efforts to ensure adequate streamflow, reservoir storage, and connectivity among populations in the Wind/Bighorn and Tongue/Powder river basins. Maintain access necessary to effectively manage the species in the Upper Wind River drainage. Continue research to enhance our understanding of factors which may affect Burbot populations, including population-specific life history traits and interspecific interactions. Continue to collaborate with the Shoshone and Arapaho tribes and the USFWS on research and monitoring to enhance our understanding of factors influencing Burbot populations within the Wind River drainage. Continue to conduct and refine established trend monitoring programs in the Wind/Bighorn River drainage. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Colorado River Cutthroat Trout	Nonnative species have contributed to the decline of this fish either through hybridization, competition for habitat, or competition for food and spawning sites. Habitat loss, fragmentation, or degradation can be caused by changes in water temperature and quantity. Whirling disease (WD), bacterial kidney disease (BKD), and other aquatic diseases threaten the persistence of wild populations and prohibit use of wild populations for captive brood development, streamside spawns, and translocations for Colorado River Cutthroat Trout restoration projects. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Prevent stocking with nonnative species that are likely to negatively influence populations. Work with land managers to conserve and improve watershed health by conserving riparian corridors and wetlands. Implement stream buffers and other best management practices to minimize negative impacts of land management actions. Implement best management practices for maximizing stream flow and connectivity. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Acquire instream flow rights on streams supporting Colorado River Cutthroat Trout populations. Continue to partner with other agencies and private landowners to reduce entrainment issues. Evaluate potential restoration opportunities on public and private lands. Identify populations of Colorado River Cutthroat Trout or habitat that will support Colorado River Cutthroat Trout that would benefit from isolation by a fish migration barrier and/ or chemical rehabilitation to remove nonnative species. Ensure that private landowners located within Colorado River Cutthroat Trout conservation waters only stock Department-approved species. Maintain North Piney Lake Colorado River Cutthroat Trout populations to be used for translocation, lakeside spawn, and milt infusion as necessary. Investigate other streams and lakes to be used for streamside/lakeside spawns, translocations, and/or development of a captive brood to be used for future restoration projects. Investigate options to use transplants or streamside spawning operations for future restoration projects. Continue to supplement some Colorado River Cutthroat Trout populations with hatchery fish as needed and continue to monitor the success of those stocks, including in the LaBarge Creek watershed. Conduct research that will support the conservation and management of Colorado River Cutthroat Trout. Specific research and survey needs include: • Conduct genetic analysis of all potential Colorado River Cutthroat Trout populations. • Complete disease samples and analysis for Colorado River Cutthroat Trout streams. • Model Colorado River Cutthroat Trout distribution, abundance, and genetic status under current and future environmental scenarios. • Survey abundance, distribution, and habitat. Work with other agencies with implementation of the Colorado River Cutthroat Trout Conservation Agreement and Strategy (CRCT Coordination Team 2022). Continue efforts to educate landowners and the public about the importance of native fish and their habitats. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Finescale Dace	Predation by invasive Northern Pike in the Niobrara River basin and introduced Brown Trout and Brook Trout in the Belle Fourche and Redwater. Stream diversion and surface water manipulation (such as check-dams) and groundwater withdrawal limits stream flow and reduces connectivity among aquatic habitats. Changes in stream temperature regimes will influence fish assemblage distributions including Finescale Dace. Drought, changes in rainfall amounts and timing, and decreased snowpack and duration of snow cover will alter streamflow and lentic habitat availability and quality. A loss of persistent beaver activity supporting lentic habitat where Finescale Dace thrive may occur. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Maintain policies that exclude the stocking of nonnative fish in the Niobrara drainage. Work with land managers to maintain and improve watershed health by conserving riparian corridors and wetlands. Implement stream buffers and other best management practices, primarily in the Niobrara. Implement best management practices for efficient use of surface and groundwater to maximize stream flow. Maintain appropriate fire management that supports natural fire ecology to conserve watershed and wetland health, primarily in the Black Hills National Forest. Restore and encourage beaver activity in the Belle Fourche and Redwater drainages to support lentic habitats where Finescale Dace thrive. Restore Finescale Dace populations to historic locations and establish refugia populations as recommended by Booher and Walters (2022). Evaluate the success of translocated populations to ensure that they remain viable and to identify new threats to persistence. Monitor known populations and their habitats to assess population status and trends. Coordinate with Nebraska Game and Parks Commission and the National Park Service to reduce the effects of Northern Pike on native fishes. Coordinate with the Black Hills National Forest and South Dakota Game, Fish, and Parks on Finescale Dace translocations, beaver introductions, and habitat treatments that affect Finescale Dace populations in the Belle Fourche and Redwater drainages. Promote awareness and appreciation for Finescale Dace populations and efforts to support them through appropriate media sources. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Flannelmouth Sucker	Hybridization with native and nonnative sucker species. Competition with and predation by nonnative species (i.e., *Catostomus* sp., Creek Chub, Redside Shiner, Burbot, Brown Trout, Lake Trout). Habitat loss or degradation can be caused by land use practices, roads, removal of riparian vegetation, and impoundments. Increasing water temperatures due to lower flow and climate changes. Changes to precipitation and hydrological regimes have reduced peak flows, altered timing of peak flow, and reduced average and base flows. Fish survival and recruitment can be negatively impacted by barriers to passage and entrainment caused by diversions, perched culverts, and impoundments. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Remove nonnative species through mechanical removal and chemical treatments on Little Sandy and Muddy creeks. Construct a barrier(s) on Little Sandy Creek in preparation for a chemical treatment to remove nonnative species. Continue efforts to improve fish passage by maintaining flow, modifying diversions, and removing perched culverts. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Work with land managers to conserve and manage riparian areas for native riparian vegetation by using riparian fencing and land use management. Conduct instream habitat restoration activities to improve river function. Pursue opportunities to maintain or increase flows in North Fork Little Muddy Creek. Continue to develop and refine methods for spawning and rearing in captivity. Collect Flannelmouth Sucker from Little Snake River to propagate at a rearing facility for stocking into Muddy Creek. Research abundance and habitat use of juveniles. Continue with regular monitoring of Flannelmouth Sucker to track population trends, hybridization rates, and the distribution of nonnative species threats. Conduct monitoring before and after chemical treatments and transplants to determine the success of actions taken. Continue as a signatory to the "Rangewide Conservation Agreement for Roundtail Chub, Bluehead Sucker and Flannelmouth Sucker." Continue to coordinate with agency partners on the planning and implementation of conservation actions. Continue efforts to educate landowners and the public about the importance of native fish and their habitats. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Flathead Chub	Dam construction and operations, including low-head diversions, disrupt the life history of Flathead Chub by inhibiting upstream migration to spawning habitats, truncating the development of drifting eggs, embryos, and larvae, and altering thermal and hydrologic cues and conditions upon which Flathead Chub rely. Inefficient and excessive diversion of stream flow impairs the navigation of upstream migrations of Flathead Chub. Changes in temperature regimes, such as increased variability and extremes outside of current norms, will diminish habitat suitability for the persistence of Flathead Chub populations. Headwater snowpack reductions and the timing and volumes of rains will reduce stream flow. Increased variability in stream flow and shifts in sustained high flow peaks and duration will be less favorable for Flathead Chub life history requirements. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work with dam managers to simulate natural hydrography that supports Flathead Chub life history. Maintain healthy watersheds, including stream corridors. Implement fish passage structures suitable for Flathead Chub where needed, feasible, and beneficial to supporting viable populations. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Reintroduce Flathead Chub to habitats where they were extirpated, such as the Sweetwater River upstream of Pathfinder Reservoir and the North Platte River between Dave Johnston Power Plant and Glendo Reservoir. Monitor fish communities for changes, particularly the Powder River drainage following fish passage improvements on the Yellowstone River in Montana. Research life history, habitat preferences, and migratory behaviors. Evaluate the effectiveness of passage at low head diversion dams on streams found throughout the historic range of Flathead Chub in Wyoming. Promote awareness and appreciation for Flathead Chub populations and efforts to support them through appropriate media sources. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Goldeye	Dam construction and operations, including low-head diversions, disrupt the life history of Goldeye by inhibiting upstream migration to spawning habitats, truncating the development of drifting eggs, embryos, and larvae, and altering thermal and hydrologic cues and conditions upon which Goldeye rely. Inefficient and excessive diversion of stream flow impairs the migrations of Goldeye. Changes in temperature regimes, such as increased variability and extremes outside of current norms, will diminish habitat suitability for the persistence of Goldeye populations. Headwater snowpack reductions and the timing and volumes of rains will reduce stream flow. Increased variability in stream flow and shifts in sustained high flow peaks and duration will be less favorable for Goldeye life history requirements. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work with dam managers to simulate natural hydrography that supports Goldeye life history. Maintain healthy watersheds, including stream corridors. Implement fish passage structures suitable for Goldeye where needed, feasible, and beneficial to supporting viable populations. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Reintroduce Goldeye to habitats where they were extirpated, such the North Platte River between Dave Johnston Power Plant and Glendo Reservoir and the Bighorn River below Boysen Reservoir. Monitor fish communities for changes, particularly the Powder River drainage following fish passage improvements on the Yellowstone River in Montana. Research life history, habitat preferences, and migratory behaviors. Evaluate the effectiveness of passage at low head diversion dams on streams found throughout the historic range of Goldeye in Wyoming. Promote awareness and appreciation for Goldeye populations and efforts to support them through appropriate media sources. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Green Sucker	Impacts of parasites are largely unknown but heavy infestations could be of concern to Green Sucker. Blackspot is present in the Snake River and Bear River populations. Lernea is present in the Bear River population. Competition with and predation by nonnative species (Brown Trout, Yellow Perch, Carp, and Lake Trout) pose a threat to Green Sucker. Increasing water temperatures due to lower flow and climate changes could threaten Green Sucker. Changes to precipitation and hydrological regimes have reduced peak flows, altered timing of peak flow, and reduced average and base flows. Survival and recruitment of Green Sucker can be negatively impacted by poor fish passage and entrainment caused by diversions, perched culverts, and impoundments. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work with land managers to conserve and manage riparian areas for native riparian vegetation by using riparian fencing and land use management. Conduct instream habitat restoration activities to improve river function. Evaluate and mitigate fish passage and entrainment issues. Continue to coordinate with agency partners on the planning and implementation of conservation actions. Continue involvement with Three Species Rangewide Conservation Team and the Northern Leatherside Conservation Team. Monitor Green Sucker populations for changes in abundance and size structure in the Snake and Bear rivers. More research is needed to better understand juvenile habitat needs. The impacts of parasites on Green Sucker populations are unknown and research is needed to determine if populations could be negatively affected. Continue efforts to educate landowners and the public about the importance of native fish and their habitats. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Hornyhead Chub	Habitat can be lost, fragmented, or degraded by diversions and withdrawals, as well as by erosion and siltation. Predation by nonnative game species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work with land managers to conserve and manage riparian areas for native riparian vegetation by using riparian fencing, land use management, fire management, and invasive species control. Conserve and maintain adequate stream flows through instream flow water rights, irrigation practices, and temporary water use agreements. Work with private landowners, irrigators, other agencies, and appropriate WGFD personnel to discuss nongame passage issues and entrainment. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Maintain policies that exclude the stocking of non-native species that are likely to negatively influence populations and remove piscivores when appropriate. Evaluate the potential for restoring populations within suitable portions of historic range that are currently uninhabited or where competing species can be removed. Develop monitoring protocols. Develop additional funding options and collaborative efforts to support conservation.
Iowa Darter	Predation, competition, and displacement by introduced nonnative species. Habitat loss, fragmentation, or degradation can be caused by climate change, land use practices, draining of wetlands, instream flow reduction, and dams. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work with private landowners, irrigators, other agencies, and appropriate WGFD personnel to discuss maintaining natural hydrology, nongame passage issues, and entrainment. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Evaluate the distribution and habitat associations of SGCN fish and mussel species in Lower Lodgepole Creek. Continue routine monitoring in Platte River Basin in both lentic and lotic systems to determine trends in Iowa Darter abundance and detect changes in the overall composition of fish communities. Investigate translocation in the Platte River Basin into suitable lentic or lotic habitats. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Kendall Warm Springs Dace	Changes in habitat, which may include the loss of ungulate traffic to keep streams wide and shallow, loss of water, and changes in water temperature caused by climate change. Diseases may threaten the persistence of wild populations and the two captive Kendall Warm Springs Dace populations. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Implement the most recent recovery plan. Investigate the potential to implement a short term and short duration grazing regime that would benefit the species. US Forest Service personnel conduct population monitoring for the USFWS. Include detailed habitat monitoring, water chemistry, and water temperature to the monitoring activities for this species. Investigate habitat and flow requirements, juvenile habitat requirements. Develop additional funding options and collaborative efforts to support conservation.
Northern Leatherside	Habitat loss, fragmentation, or degradation can occur because of water development and diversion, stream channelization, road and trail development, manipulation of natural flood regimes, land use practices, and changes to hydrologic conditions. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work with irrigators to maintain flows in arid systems, and continue working to improve passage at road crossings as opportunities arise. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Continue ongoing watershed habitat programs aimed at overall ecosystem function and fish passage. Collaborate with UDWR and Trout Unlimited to assess and mitigate impacts of water development to the Northern Leatherside population in Yellow Creek. Evaluate the potential to mechanically or chemically remove nonnative fishes from some streams occupied by Northern Leatherside. Maintain policies that exclude the stocking of non-native species that are likely to negatively influence populations, and remove nonnative piscivores when appropriate. Actively coordinate with and assist federal land managers in developing and implementing management plans. Monitor the success of any translocations of Northern Leatherside to currently unoccupied habitat. Monitor response to habitat restoration or degradation. Continue abundance and distribution monitoring in the Bear River drainage at LaChapelle Creek, Yellow Creek, Dry Fork, Muddy Creek, Twin Creek and similar systems and in the Upper Snake River drainage at Pacific Creek, Triangle X Spring, Gros Ventre River, and similar systems. Continue efforts to educate landowners and the public about the importance of native fish and their habitats. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Northern Pearl Dace	Predation by introduced nonnative species (especially Northern Pike). Habitat loss, fragmentation, or degradation can be caused by climate change and aquifer depletion. Small drainage is vulnerable to periodic localized drying and large stochastic events (flash floods) that cause disturbances for fish populations. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Continue to prevent stocking of nonnative fish in mainstem Niobrara River. Minimize the effects of nonnative fishes on the native fish assemblage in the Niobrara River basin. Establish refuge populations within the Niobrara River drainage away from nonnative piscivores. Coordinate with Nebraska Game and Parks Commission and the National Parks Service to reduce the effects of Northern Pike on native fishes. Monitor abundance and trends. Work to propagate the species in captivity for release back into the Niobrara drainage of Wyoming. Develop additional funding options and collaborative efforts to support conservation.
Northern Plains Killifish	Habitat loss, fragmentation, or degradation can be caused by physical barriers (natural and man made), climate change, land use practices, and draining of wetlands or lentic habitats. Predation and competition by introduced nonnative species including Largemouth Bass and Brook Stickleback. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Continue evaluation of fish passage at identified fish barriers in southeast Wyoming, and explore opportunities to improve water availability. Maintain policies that exclude the stocking of nonnative piscivores and remove piscivores when appropriate. Continue efforts to identify and record observations while conducting fisheries management sampling in both lentic and lotic habitats, prioritizing these efforts whenever possible. Utilize opportunities for translocations/reintroductions. Continue efforts to educate the public about the importance of native fish and their habitats. Develop additional funding options and collaborative efforts to support conservation.
Orangethroat Darter	Habitat loss, fragmentation, or degradation can be caused by climate change, land use practices, dams and diversions, and instream flow reduction. Predation, competition, and displacement by introduced nonnative species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work to maintain and/or enhance Orangethroat Darter habitat or distribution by decreasing habitat fragmentation, maintaining streamflows, and incorporating best land management practices. Develop long term monitoring plan to track distribution, abundance, and persistence. Identify needs for providing fish passage. Continue efforts to educate the public about the importance of native fish and their habitats. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Plains Minnow	Dam construction and operations, including low-head diversions, disrupt the life history of Plains Minnow by inhibiting upstream migration to spawning habitats, truncating the development of drifting eggs, embryos, and larvae, and altering thermal and hydrologic cues and conditions upon which Plains Minnow rely. Inefficient and excessive diversion of stream flow impairs the navigation of upstream migrations of Plains Minnow. Changes in temperature regimes, such as increased variability and extremes outside of current norms, will diminish habitat suitability for the persistence of Plains Minnow populations. Headwater snowpack reductions and the timing and volumes of rains will reduce stream flow. Increased variability in stream flow and shifts in sustained high flow peaks and duration will be less favorable for Plains Minnow life history requirements. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work with dam operators to simulate natural hydrography that supports Plains Minnow life history. Maintain healthy watersheds, including stream corridors. Implement fish passage structures suitable for Plains Minnow where needed, feasible, and beneficial to supporting viable populations. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Reintroduce Plains Minnow to habitats where they were extirpated, such the Sweetwater River upstream of Pathfinder Reservoir, the North Platte River between Dave Johnston Power Plant and Glendo Reservoir, and the Bighorn River below Boysen Reservoir. Monitor fish communities for changes, particularly the Powder River drainage following fish passage improvements on the Yellowstone River in Montana. Research life history, habitat preferences, and migratory behaviors. Evaluate the effectiveness of passage at low head diversion dams on streams found throughout the historic range of Plains Minnow in Wyoming. Promote awareness and appreciation for Plains Minnow populations and efforts to support them through appropriate media sources. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Plains Topminnow	Competition from Western Mosquitofish. Predation, competition, and displacement by introduced nonnative species. Habitat loss, fragmentation, or degradation can be caused by dewatering of lentic and lotic habitats, land use practices, climate change. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Minimize contact with piscivores through stocking guidance policy and piscivore removal when appropriate. Minimize effects of land use practices on stream health where possible. Continue efforts to maintain flow and connectivity. Continue monitoring occurrence and abundance at priority lentic and lotic locations. Utilize opportunities for translocations/reintroductions. Continue efforts to educate the public about the importance of native fish and their habitats. Develop additional funding options and collaborative efforts to support conservation.
Quillback	Lack of information regarding life history, recruitment, and population trends. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Investigate Quillback population dynamics and life history in the North Platte River basin. Life history traits to investigate include age, growth, recruitment, movement, and habitat use. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Roundtail Chub	Habitat loss or degradation can be caused by roads, removal of riparian vegetation, and impoundments. Competition with and predation by nonnative species. Fish survival and recruitment can be negatively impacted by barriers to passage and entrainment caused by diversions, perched culverts, and impoundments. Increasing water temperatures due to lower flow and climate changes. Changes to precipitation and hydrological regimes have reduced peak flows, altered timing of peak flow, and reduced average and base flows. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work with land managers to conserve and manage riparian areas for native riparian vegetation by using riparian fencing and land use management. Continue efforts to remove competing nonnative species to secure, enhance, and restore populations. This includes using rotenone for removing nonnatives from Muddy Creek before reintroducing native species. Continue efforts to improve fish passage by maintaining flow, modifying diversions, and removing perched culverts. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Pursue opportunities to maintain or increase flows in North Fork Little Muddy Creek. Continue to pursue actions to conserve the Roundtail Chub population in New Fork Lake. Use transplants as a means of establishing new lentic populations that are free from predatory threats. Evaluate the potential for restoring populations within suitable portions of historic range that are currently uninhabited or where competing species can be removed. Continue as a signatory to the "Rangewide Conservation Agreement for Roundtail Chub, Bluehead Sucker and Flannelmouth Sucker." Continue with regular monitoring of Roundtail Chub to track population trends and the distribution of nonnative species threats. Conduct monitoring before and after chemical treatments to remove fish and transplanting Roundtail Chub to determine success. Continue efforts to educate the public about the importance of native fish and their habitats. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Sauger	Increased anthropogenic water use and water development (e.g., dam construction) may lead to restricted movement ability, altered forage bases, and fragmentation of available habitat for Sauger. Potential for hybridization with nonnative Walleye. Potential for interspecific and/or intraspecific competition and predation. Broad-scale changes in climatic conditions (e.g., warming temperatures, shorter winters) may further reduce suitable habitat for the species, affect forage bases, and/or alter its life history. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Continue efforts to ensure adequate streamflow, reservoir storage, and connectivity among populations in the Wind/Bighorn and Tongue/Powder river basins. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Investigate the effectiveness of wild egg takes/progeny stocking on supplementing populations. Monitor populations for changes following any fish passage improvements, such as those on the Yellowstone River in Montana. Research life history, habitat preferences, and migratory behaviors. Monitor hybridization rates between Sauger and Walleye. Continue to collaborate with the Shoshone and Arapaho tribes and the USFWS on research and monitoring to enhance our understanding of factors influencing Sauger populations within the Wind River drainage. Continue to conduct and refine established trend monitoring programs in the Wind/Bighorn River drainage. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Shovelnose Sturgeon	Dam construction and operations, including low-head diversions, disrupt the life history of Shovelnose Sturgeon by inhibiting upstream migration to spawning habitats and truncating the development of drifting eggs, embryos, and larvae. Inefficient and excessive diversion of stream flow impairs the navigation of upstream migrations of Shovelnose Sturgeon. Changes in temperature regimes, such as increased variability and extremes outside of current norms, will diminish habitat suitability for the persistence of Shovelnose Sturgeon populations. Headwater snowpack reductions and the timing and volumes of rains will reduce stream flow. Increased variability in stream flow and shifts in sustained high flow peaks and duration will be less favorable for Shovelnose Sturgeon life history requirements. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work with dam managers to simulate natural hydrography that supports Shovelnose Sturgeon life history. Maintain healthy watersheds, including stream corridors. Implement fish passage structures suitable for Shovelnose Sturgeon where needed, feasible, and beneficial to supporting viable populations. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Reintroduce Shovelnose Sturgeon to the North Platte River between Dave Johnston Power Plant and Glendo Reservoir. Monitor the Powder River fish community for changes, including migrations of Shovelnose Sturgeon, to assess the effectiveness of fish passage improvements on the Yellowstone River in Montana. Research and implement effective design criteria required to facilitate Shovelnose Sturgeon passage and inventory passage characteristics of low head diversion dams on streams found throughout the historic range of Shovelnose Sturgeon in Wyoming. Coordinate with neighboring states and federal agencies to assist with research and monitoring. Promote awareness and appreciation for Shovelnose Sturgeon populations and efforts to support them through appropriate media sources. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Snake River Cutthroat Trout	Habitat loss, fragmentation, or degradation can be caused by dams, dewatering by diversions, impassable diversions, levee systems, and climate change. Competition and hybridization with nonnative trout are impacting some populations. Angling impacts could become detrimental if other factors such as environmental stressors increase. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Conserve and manage riparian areas for native riparian vegetation by using riparian fencing, land use management, fire management, and invasive species control. Work with irrigators to maintain flows, reduce entrainment, and continue working to improve passage as opportunities arise. Continue to work with partners to maintain minimum flows in the Snake River from Jackson Lake Dam. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Complete in-stream flow filings on prioritized streams within Snake River Cutthroat Trout native range. Continue efforts to restore populations within native ranges where opportunities to remove competing or hybridizing species exist. Prevent stocking of public or private waters with nonnative species that may impact conservation populations. Continue routine monitoring of abundance. Consider if additional angling regulations are needed to promote viability of Snake River Cutthroat Trout populations. Continue efforts to educate the public about the importance of native fish and their habitats. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Sturgeon Chub	Dam construction and operations, including low-head diversions, disrupt the life history of Sturgeon Chub by inhibiting upstream migration to spawning habitats, truncating the development of drifting eggs, embryos, and larvae, and altering thermal and hydrologic cues and conditions upon which Sturgeon Chub rely. Inefficient and excessive diversion of stream flow impairs the navigation of upstream migrations of Sturgeon Chub. Changes in temperature regimes, such as increased variability and extremes outside of current norms, will diminish habitat suitability for the persistence of Sturgeon Chub populations. Headwater snowpack reductions and the timing and volumes of rains will reduce stream flow. Increased variability in stream flow and shifts in sustained high flow peaks and duration will be less favorable for Sturgeon Chub life history requirements. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work with managers of dams to simulate natural hydrography that supports Sturgeon Chub life history. Maintain healthy watersheds, including stream corridors. Implement fish passage structures suitable for Sturgeon Chub where needed, feasible, and beneficial to supporting viable populations. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. Reintroduce Sturgeon Chub to habitats where they were extirpated, such the North Platte River between Dave Johnston Power Plant and Glendo Reservoir. Evaluate the effectiveness of passage at low head diversion dams on streams found throughout the historic range of Sturgeon Chub in Wyoming. Monitor fish communities for changes, particularly the Powder River drainage following fish passage improvements on the Yellowstone River in Montana. Research life history, habitat preferences, and migratory behaviors. Promote awareness and appreciation for Sturgeon Chub populations and efforts to support them through appropriate media sources. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Suckermouth Minnow	Habitat can be lost, fragmented, or degraded by diversions and withdrawals, as well as erosion and siltation. Predation by introduced nonnative species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Explore options for reintroducing Suckermouth Minnow to historically occupied range. Maintain policies that exclude the stocking of nonnative piscivores in Suckermouth Minnow occupied reaches and remove piscivores when appropriate. Attempt to gain a better understanding of life history to inform reintroduction efforts. Understand the streamflows and extent of connected habitat needed for Suckermouth Minnow to meet life history requirements. Develop long term monitoring plan, assess fish passage ability at fish passage structures, and monitor nonnative predators within Horse Creek. Evaluate the extent to which augmented flows from the Fort Laramie Canal contribute to the persistence of Suckermouth Minnow in Horse Creek, and whether water management strategies and fish passage in adjacent areas could be modified to extend Suckermouth Minnow range. Continue efforts to educate the public about the importance of native fish and their habitats. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Western Silvery Minnow	Dam construction and operations, including low-head diversions, disrupt the life history of Western Silvery Minnow by inhibiting upstream migration to spawning habitats, truncating the development of drifting eggs, embryos, and larvae, and altering thermal and hydrologic cues and conditions upon which Western Silvery Minnow rely. Inefficient and excessive diversion of stream flow impairs the migrations of Western Silvery Minnow. Changes in temperature regimes, such as increased variability and extremes outside of current norms, will diminish habitat suitability for the persistence of Western Silvery Minnow populations. Headwater snowpack reductions and the timing and volumes of rains will reduce stream flow. Increased variability in stream flow and shifts in sustained high flow peaks and duration will be less favorable for Western Silvery Minnow life history requirements. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Work with dam managers to simulate natural hydrography that supports Western Silvery Minnow life history. Maintain healthy watersheds, including stream corridors. Implement fish passage structures suitable for Western Silvery Minnow where needed, feasible, and beneficial to supporting viable populations. Monitor fish communities for changes, particularly the Powder River drainage following fish passage improvements on the Yellowstone River in Montana. Research life history, habitat preferences, and migratory behaviors. Evaluate the effectiveness of passage at low head diversion dams on streams found throughout the historic range of Western Silvery Minnow in Wyoming. Promote awareness and appreciation for Western Silvery Minnow populations and efforts to support them through appropriate media sources. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Yellowstone Cutthroat Trout	Nonnative salmonids introduced into waters with Yellowstone Cutthroat Trout often reduce or eliminate cutthroat populations over time through hybridization, predation, and/or competition. Habitat loss, fragmentation, or degradation can be caused by physical barriers (natural and man made), changes to stream flow and water temperature due to climate change, surface water diversions, land use practices, and road construction. Diseases including but not limited to whirling disease have been implicated in Yellowstone Cutthroat Trout declines. Vulnerable to fishing mortality and overharvest. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Construct in-channel barriers, where feasible, to prevent the invasion of nonnative fish. Continue efforts to remove competing and hybridizing nonnative species to secure, enhance, and restore populations. Prevent stocking of public or private waters with non-native species that may impact conservation populations. Restrict spread of disease and aquatic invasive species. Conduct aquatic habitat restoration projects that benefit Yellowstone Cutthroat Trout Conservation Populations. Specific efforts include: • Continue to remove anthropogenic barriers limiting gene flow and the expression of migratory life history strategies. Refer to the Aquatic Connectivity Areas in Wyoming Game and Fish Department's Statewide Habitat Plan (SHP) for priority actions and locations. • Conserve and maintain adequate stream flows through instream flow water rights, irrigation practices, and water use agreements. • Conserve and manage riparian areas for native riparian vegetation by using riparian fencing, land use management, fire management, and invasive species control. Consider if additional angling regulations are needed to promote viability of Yellowstone Cutthroat Trout populations. Continue to build and maintain rangewide database so that information can readily be shared between and among jurisdictions. Ensure coordination and information sharing among conservation partners. Maintain geographic management unit teams to oversee conservation actions and effectiveness of the Range-Wide Yellowstone Cutthroat Trout Team. Complete genetic analyses on known or potential populations to genetically characterize populations, detect hybridization, and build upon the reference collection of DNA across the range of Yellowstone Cutthroat Trout. Conduct genetic monitoring to assess connectivity, genetic diversity, and introgression. Identify and characterize all populations within their native range in Wyoming. Continue monitoring for abundance, response to challenges. Develop and maintain genetically unaltered sources in hatcheries or in designated lake and stream refugia. Reintroduce Yellowstone Cutthroat Trout to habitats where they were extirpated or establish populations within the broad historical native drainages. Expand the habitat occupied by Yellowstone Cutthroat Trout through the removal of competing or hybridizing nonnatives, constructing isolation barriers, stocking, and relocation. Develop and implement a public outreach effort specifically addressing Yellowstone Cutthroat Trout conservation in Wyoming utilizing the objectives in the Rangewide Conservation Strategy. Develop additional funding options and collaborative efforts to support conservation.

Chapter 8: Mammals

There are over 120 native species of mammals in Wyoming, and 55 are considered Species of Greatest Conservation Need (SGCN; *Table 1*). The health and diversity of mammals are interwoven with the culture, economy, and ecosystems of Wyoming. Residents and non-residents alike engage with mammals through wildlife watching and hunting, and mammals serve as important cultural symbols in Wyoming and beyond. Beyond these contributions, mammals provide vital ecosystem services that help maintain the ecological communities and landscapes of Wyoming. These services include shaping the vegetation community, nutrient cycling, ecosystem engineering, serving as a prey base for many species, consuming pests, and more (Lacher et al. 2019).

Wyoming's SGCN mammals live in a wide range of habitat types, ranging from the sparsely-vegetated desert shrublands (e.g., Great Basin Pocket Mouse), to bridges and other human-built spaces (e.g., Little Brown Myotis; Detweiler and Bernard 2023), to rugged mountains (e.g., Bighorn Sheep), and everywhere in between (Buskirk 2016; *Appendix D*). Their lifestyles include living in underground burrows (e.g., Idaho Pocket Gopher), moving between aquatic and terrestrial zones (e.g., Water Vole), and true flight (i.e., all bats). Some species are endemic and habitat specialists (e.g., Wyoming Pocket Gopher, Brito et al. 2023), while others can live in a wide range of habitat types across the state (e.g., Mule Deer). Wyoming's SGCN mammals contribute to the biodiversity of the state through an impressive array of behaviors, ecologies, life history strategies, and morphological adaptations. Species diets range from herbivorous (e.g., Pygmy Rabbit), granivorous (e.g., Silky Pocket Mouse), insectivorous (e.g., Spotted Bat), fungivorous (e.g., Northern Flying Squirrel), omnivorous (e.g., Western Spotted Skunk), and carnivorous (e.g., Canada Lynx). Mammals deal with the seasonal nature of Wyoming through hibernating or entering a state of torpor (e.g., Spotted Ground Squirrel), creating food stores (e.g., American Pika), and migrating to more suitable locations (e.g., Eastern Red Bat). For additional details about the ecology of individual species, please refer to the online Field Guide available through the Wyoming Natural Diversity Database (*https://fieldguide.wyndd.org/*).

Certain aspects of mammal ecology can influence how vulnerable a species is to human activities (Ceradini and Chalfoun 2017). Multiple SGCN are vulnerable to climate change and disease, and these issues can exacerbate other challenges (Festa et al. 2023). For example, bats that do not migrate during the winter months deal with resource shortages and extreme cold by entering torpor, often roosting in caves, mines, and other protective structures. White-nose syndrome, climate change, and human activity in their winter roosts all interact in ways that can lead to mortality, reproductive declines, and population declines in certain circumstances. Suitable habitat for SGCN can also be desirable for many human activities, and development and disturbance can result in reductions in habitat quality or connectivity, indirect habitat loss, direct mortality, or displacement for many species (Pierce et al. 2011, Heinemeyer et al. 2019). Negative effects associated with human activity can be especially problematic for species with narrow resource requirements, inflexible behaviors, or restricted ranges (Merkle et al. 2022). The life history characteristics of some species can either make them vulnerable to challenges or can exacerbate challenges. For example, many species of bats have low reproductive rates, where adult females give birth to only one pup per year (e.g., Northern Long-eared Myotis, Western Small-footed Myotis). Many species are hard to survey or require targeted surveys, leading to scant information on their abundance, distribution, ecology, and response to challenges, which can limit conservation efforts. Finally, the effects of human activities and other challenges are nuanced and can vary based on context; for example, wildfire and prescribed fire can cause direct mortality or displacement in the short-term, but lead to gains in forage in the mid- to long-term. Despite these challenges, actions such as surveys and research, habitat treatments, and conservation planning can all support conservation of SGCN mammals.

Challenges and actions

Wyoming's SWAP identifies the significant challenges facing SGCN in the state, as well as priority conservation actions to support their conservation. Species-specific challenges and actions are identified in *Table 9*. Please refer to *Chapter 3* for descriptions of how challenges and actions were identified and categorized. Notably, the identified challenges and actions are not inclusive of all potential challenges these species may face; instead this list summarizes the priority challenges and actions at this time, although they may change over the next 10 years.

Table 9. Challenges and actions for Species of Greatest Conservation Need mammals.

Priority challenges and actions relevant to Species of Greatest Conservation Need mammals.

Common Name	Challenges	Voluntary actions
Abert's Squirrel	Has narrow habitat requirements and limited range in the state, so habitat loss, fragmentation, or degradation can occur because of climate change, forest management practices, mountain pine beetle outbreaks, and wildfire. Insufficient knowledge of abundance and distribution in Wyoming. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, response to challenges (including bark beetle outbreaks, climate change, changing land use practices, and forestry practices), and relative contributions of dispersal and in-state reproduction to persistence. Develop additional funding options and collaborative efforts to support conservation.
American Pika	In Wyoming, the abundance of pikas is associated with the availability of spring/summer forage with which to construct haypiles and temperatures conducive to maintaining a consistent, insulative snowpack (Yandow et al. 2015, Jakopak et al. 2017). Changes to the growth and distribution of alpine vegetation associated with a changing climate will therefore likely affect food availability. Pikas become physiologically stressed at high temperatures (Otto et al. 2015) which can affect foraging, although behavioral plasticity can moderate effects (Hall and Chalfoun 2018, Hall and Chalfoun 2019). Upslope range expansions of other lower-elevation mammals could increase parasite and disease spillover and decrease fitness especially in combination with other stressors (Foley et al. 2017, Brinkerhoff et al. 2020). Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Monitor pika populations and preferred forage plants at different elevations and across variation in temperature and precipitation regimes (with lag effects). Investigate the effects of unknown potential stressors (predation, disease, herbivory) independently and in combination with other important factors such as temperature and precipitation to inform management decisions. Leverage recent snow modeling approaches that can characterize attributes at relevant spatial scales to pikas (e.g., Gura et al. 2025) to more directly investigate how changing temperature and precipitation regimes affect over-winter survival. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Bighorn Sheep	Climate change impacts on high-elevation alpine and mountain ecosystems are occurring rapidly (Parmesan 2007; Van de Kerk 2020; White et al. 2025). In northern latitudes, there is concern that changing climate (Olsen et al. 2011) and the corresponding severe weather events coupled with decreasing habitat suitability due to increased "shrubification" (Dial et al. 2016) could lead to population declines. Climate change may also affect forage quantity and quality, promote the spread of invasive species, lead to more rain on snow events that could affect access to forage, and increase frequency and intensity of avalanches. Pathogens causing pneumonia, especially *Mycoplasma ovipneumoniae* and the strains of *M. haemolytica* that cause all aged-die offs often in excess of 50% of the population (i.e., Whiskey Mtn., Devil's Canyon). Competition for forage and space with nonnative mountain goats, other wild herbivores, and domestic herbivores. Habitat loss, fragmentation, and degradation can be caused by fire suppression (promotes conifer encroachment, vegetative succession, diminished habitat quality, increased fire frequency and intensity), recreation (e.g., backcountry skiing, snowmachine use, hiking, biking, off-road vehicle use, antler hunting), and industrial and residential development. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Continue to design and implement habitat improvement projects, including prescribed burns, noxious weed treatments, water guzzler installation, and conifer removal/management. Continue statewide disease surveillance. Research disease dynamics, influence of herbivores including mountain goats and elk, and effect of climate change and invasive species on quantity and quality of habitat. Using WAFWA guidelines and best practices (e.g., disease prevention practices, matching migratory behavior between herds), translocate Bighorn Sheep to augment existing populations and establish new herds, where appropriate. Continue to pursue effective separation between Bighorn Sheep and domestic sheep and goats. Continue to implement and monitor, test, and remove programs to remove chronic pathogen carriers. Continue to scrutinize future translocations of Bighorn Sheep to ensure neighboring herds are kept relatively isolated to minimize risk of contact with domestic sheep/goats and pathogen transmission between Bighorn Sheep herds. Continue using hunter harvest tools, including ewe harvest and less than ¾ curl ram harvest, to effectively manage herds to their population objectives to prevent disease outbreaks. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Black-footed Ferret	Ferrets and prairie dogs are inexorably tied, and challenges for prairie dogs (see Black-tailed Prairie Dog and White-tailed Prairie Dog challenges within this chapter) can affect ferrets directly and indirectly. Habitat loss may be caused by changing land-use practices. Sylvatic plague and canine distemper can affect Black-footed Ferrets, and sylvatic plague can affect their prairie dog prey. Distribution of ferrets in Wyoming is limited to 2 reintroduction areas, making them more susceptible to stochastic events. Functional connectivity within and among habitats is critical to maintaining genetic diversity, but rates of gene flow are currently unknown. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Continue to implement the USFWS Black-footed Ferret Recovery Plan and Wyoming Black-footed Ferret Management Plan. Continue to participate in the USFWS Black-footed Ferret Recovery Implementation Team and Wyoming Black-footed Ferret Working Group. Continue to support genetic diversity of wild ferrets with strategic supplemental releases. Continue to collaborate in the development and implementation of novel molecular tools. Continue to conduct surveys to evaluate distribution, reproduction, survival, and abundance. Investigate the potential effects of changing land use practices. Identify and evaluate potential reintroduction sites. Continue to work with partners to mitigate sylvatic plague at reintroduction sites. Develop additional funding options and collaborative efforts to support conservation.
Black-tailed Prairie Dog	Mortality due to control methods (e.g., poisoning, shooting) Sylvatic plague. Invasive annual grasses. Habitat loss or degradation due to ground disturbance from changing land use practices. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Outreach and collaboration with private landowners to promote sustainable management of prairie dogs and prairie dog habitat. Continue active involvement with the interstate Prairie Dog Conservation Team and collaborate with the Western Association of Fish and Wildlife Agencies on the range-wide conservation needs for this species. Survey/research distribution, abundance, population dynamics, amount and distribution of poisoning, continued investigation of recreational shooting on population dynamics (Pauli and Buskirk 2007), the keystone ecological effects of the species, techniques to control sylvatic plague, and response to challenges. Localized on-the-ground colony mapping and population monitoring in support of Black-footed Ferret reintroduction efforts. Where possible, implement sylvatic plague control efforts. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
California Myotis	Human disturbance of hibernacula can lead to arousal events and subsequent energy expenditures that may lead to increased mortality. Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). This species is not yet known to have encountered white-nose syndrome. Although other bats in the genus are affected to various degrees, California Myotis is known to be fairly active during the winter which may serve to mitigate effects of white-nose syndrome. Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with governmental entities, members of the public, and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary. Coordinate with partners to continue implementing the North American Bat Monitoring Program. Maintain habitat by using best management practices implemented for other bat species (maintain diverse forest and clean water sources) and bat-friendly closures on abandoned mine structures. Survey, research, and monitor abundance, distribution (using DNA studies), population trends, diet preference, and disease ecology (especially white-nose syndrome). Develop additional funding options and collaborative efforts to support conservation.
Canada Lynx	Lynx are cold and snow adapted, and climate change is likely to alter where lynx can survive and effectively compete with other species less suited for snowy conditions (e.g., bobcat, coyote, fox). Habitat loss, fragmentation, and degradation can be caused by multiple activities, including climate change, clearcut timber harvesting, wildfire fuel reductions, changes to fire regimes, and increased recreation. Lynx observations are exceedingly rare in Wyoming, and the state may never have supported a permanent population (USFWS 2017, 2023). However, Wyoming may serve as a travel corridor between populations in Montana and Colorado. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Collaborate with partners to develop and implement a federal Recovery Plan. Survey/research snowshoe hare and Canada Lynx abundance, distribution, population trends (e.g., reproduction, immigration), Canada Lynx diet, and interaction between Canada Lynx and other carnivores in Wyoming. Evaluate areas modelled as high-quality habitat (Olson et al. 2021) and determine which forest management actions may improve habitat. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Canyon Deermouse	Has narrow habitat associations (areas near cliffs and with high rock cover; Rompola and Anderson 2004) and range in the state, so disturbances to habitat (e.g., changing land use practices, climate change, recreation) could negatively affect the species. The filling of Flaming Gorge reservoir in the 1960s and 1970s may have greatly reduced the geographic range in WY (Buskirk 2016). Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, habitat relationships, response to juniper removal and expansion, and responses to human activities and human-induced habitat alteration. Develop additional funding options and collaborative efforts to support conservation.
Cliff Chipmunk	Has narrow habitat associations (areas near cliffs and with high rock cover; Rompola and Anderson 2004) and range in the state, so disturbances to habitat (e.g., changing land use practices, climate change, recreation) could negatively affect the species. The filling of Flaming Gorge reservoir in the 1960s and 1970s may have greatly reduced the geographic range in WY (Buskirk 2016). Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, habitat relationships, response to juniper removal and expansion, and responses to human activities and human-induced habitat alteration. Develop additional funding options and collaborative efforts to support conservation.
Dwarf Shrew	Insufficient knowledge of abundance, distribution, natural history, and how challenges affect this rare species with limited distribution and records in the state. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, response to challenges, and basic ecology. Develop capture and identification techniques that do not require sacrificing individuals. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Eastern Red Bat	Collisions and barotrauma at wind facilities can cause direct mortality. Habitat loss, fragmentation, and degradation from changing land use practices and from tree removal operations that reduce the availability of suitable roost locations. Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with governmental entities, members of the public, and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary. Coordinate with partners to continue implementing the North American Bat Monitoring Program. Survey, research, and monitor abundance, distribution, population trends, reproductive phenology, migration routes, migration and presence timing, habitat associations, diet preferences, and disease ecology. Document and mitigate the effects of wind energy development on this species. Develop additional funding options and collaborative efforts to support conservation.
Fringed Myotis	Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). Human disturbance of hibernacula can lead to arousal events and subsequent energy expenditures that may lead to increased mortality. White-nose syndrome. Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with governmental entities, members of the public, and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary. Coordinate with partners to continue implementing the North American Bat Monitoring Program. Recommend and assist with bat-friendly closures of important caves and mines where appropriate. Survey, research, and monitor abundance, distribution (using acoustics and DNA to clarify), habitat associations, diet preferences, basic biology, and disease ecology (especially white-nose syndrome). Develop additional funding options and collaborative efforts to support conservation.
Great Basin Pocket Mouse	Insufficient knowledge of abundance, distribution, natural history, and how challenges affect this species. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, response to challenges (including invasive species, changing land use practices, and other anthropogenic factors), natural history, and habitat requirements. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Hayden's Shrew	Insufficient knowledge of abundance, distribution, natural history, and how challenges affect this rare species with limited distribution and records in the state. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, habitat relationships, response to challenges, dietary needs, and breeding phenology. Develop capture and identification techniques that do not require sacrificing individuals. Develop additional funding options and collaborative efforts to support conservation.
Hispid Pocket Mouse	Insufficient knowledge of abundance, distribution, and how challenges affect this species. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, response to challenges (including invasive species, changing land use practices, and other anthropogenic factors), natural history, and habitat requirements. Develop additional funding options and collaborative efforts to support conservation.
Hoary Bat	Habitat loss, fragmentation, and degradation may arise from changing land-use practices and from tree removal operations that reduces the availability of suitable roost locations. Collisions and barotrauma at wind facilities can cause direct mortality. Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with governmental entities, members of the public, and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary. Coordinate with partners to continue implementing the North American Bat Monitoring Program. Document and mitigate the effects of wind energy development on this species. Survey/research distribution, abundance, habitat associations, migration routes, migration and presence timing, response to forest habitat removal, diet preferences, and changes in water availability and quality. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Idaho Pocket Gopher	Because of limited population size and range, may be at risk of declines or extinction from stochastic events (e.g., extreme weather events such as high runoff or groundwater tables, late and early season freezes, weather-caused food and cover limitations). Habitat loss, fragmentation, and degradation can result from land use practices that result in soil compaction due to the fossorial habit of this species. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, population dynamics, habitat associations and use, response to challenges, basic biology, and response to Northern Pocket Gopher. Develop additional funding options and collaborative efforts to support conservation.
Least Weasel	Insufficient knowledge of abundance, distribution, and how challenges affect this species. Least Weasel is very rare in Wyoming, with isolated records east of the Bighorn Mountains (Buskirk 2016). There is very little information available on this species in North America. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population trends, response to challenges (including potential exposure to secondary poisoning from rodenticides, unintentional take, and mortality due to domestic cats), diet, and develop survey techniques. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Little Brown Myotis	Habitat loss, fragmentation, and degradation can be caused by changing land use practices and by stochastic forest events such as logging and wildfire. Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). Collisions and barotrauma at wind facilities can cause direct mortality. Human disturbance of hibernacula can lead to arousal events and subsequent energy expenditures that may lead to increased mortality. Commensal habits of this species can lead to increased chances of conflict with and persecution by humans, as well as predation by domestic animals, especially cats. White-nose syndrome is the primary threat to this species. Impacts from the disease over large portions of their range is the reason for listing consideration. Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with governmental entities, members of the public, and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary. Coordinate with partners to continue implementing the North American Bat Monitoring Program. Recommend and assist with bat-friendly closures of important caves and mines where needed. Standardize bat conflict response throughout the state. Coordinate responses with multiple entities (e.g., rabies districts, county health departments, nuisance wildlife control operators). Survey, research, and monitor abundance, population trends, habitat associations (especially maternity roosts), diet preferences, response to management practices, subspecies designation, phenology of reproduction, and disease status (especially white-nose syndrome). Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Long-eared Myotis	Human disturbance of hibernacula can lead to arousal events and subsequent energy expenditures that may lead to increased mortality. Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). White-nose syndrome. Habitat loss, fragmentation, and degradation can be caused by stochastic forest events such as logging and wildfire. Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with governmental entities, members of the public, and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary. Coordinate with partners to continue implementing the North American Bat Monitoring Program. Survey, research, and monitor abundance, distribution, population trends, habitat associations (especially maternity roosts), diet preferences, phenology of reproduction, and disease ecology (especially white-nose syndrome). Develop additional funding options and collaborative efforts to support conservation.
Long-legged Myotis	Habitat loss, fragmentation, and degradation can be caused by stochastic forest events such as logging and wildfire. Human disturbance of hibernacula can lead to arousal events and subsequent energy expenditures that may lead to increased mortality. Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). White-nose syndrome. Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with members of the public and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary. Coordinate with partners to continue implementing the North American Bat Monitoring Program. Recommend and assist with bat-friendly closures of important caves and mines where appropriate. Survey/research abundance, distribution, population trends, habitat requirements (including maternity roosts and hibernacula), phenology, and disease ecology (especially white-nose syndrome). Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Meadow Jumping Mouse	Increased predation by human-associated predators such as striped skunk, raccoon, and cats, as well as competition with house mice and deer mice. Because the species is a habitat specialist that relies on well-developed riparian ecosystems, habitat fragmentation, loss, and degradation can be caused by changing land use practices, herbivory, climate change, floods, and fire. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research distribution, population dynamics, response to challenges, and basic ecology. Implement genetic studies to evaluate findings that suggest the possibility of multiple species within Meadow Jumping Mouse in Wyoming (Malaney et al. 2013). Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Mule Deer	There are multiple, sometimes competing, public desires for mule deer conservation. Achieving a one-size-fits-all approach can be challenging, but not doing so can cause dissatisfaction among members of the public. Competition for resources with other herbivores. Chronic wasting disease (CWD) is a concern for many herds in Wyoming and may increase in prevalence in the coming years. Epizootic hemorrhagic disease (EHD), adenovirus, and other diseases have localized impacts. Extreme climatic patterns, including severe winters and droughts, negatively affect populations through direct mortality and habitat degradation. These patterns also exacerbate other challenges. Habitat loss, fragmentation, or degradation can be caused by changing land use practices, wildfire (especially immediately post-fire), lack of disturbance leading to older vegetation classes and late succession plant communities, climate change, and invasive species (especially invasive annual grasses). Barriers to daily, seasonal, and migratory movements include fences, roadways, and residential or industrial development. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach campaigns that highlight challenges affecting mule deer and possible actions to address the challenges. Examples include habitat improvement efforts that landowners, nonprofits, federal land managers, and other stakeholders can take to improve habitat quality; how proper carcass disposal can slow the spread of diseases like CWD; and the critical role that habitat quality plays in maintaining or growing populations. Continue to support integrating mule deer conservation into statewide conservation efforts, including land use planning, county planning, forest plan revisions, resource management plans, siting infrastructure, etc. Manage the spread of chronic wasting disease (CWD) through population management and other strategies outlined in the Department's Chronic Wasting Disease Management Plan. Continue to support knowledge sharing by participating in WAWFA's Mule Deer Working Group, WAWFA's Migration and Connectivity Working Group and other interstate groups. Continue to collaborate with partners to improve habitat quantity, quality, access, and connectivity through active habitat management practices, including conifer removal, prescribed fires, mechanical vegetation treatments, management of invasive annual grasses, securing conservation easements, developing highway crossing structures, modifying fences, etc. Survey/research relationship between habitat quality, quantity and population performance; response to changing land use practices; impacts of different types and levels of disturbance on connectivity and nutritional benefits of migration; and the efficacy of conservation actions such as conservation easements, fence modifications, cheatgrass management, and highway crossing projects. Continue to delineate migration corridors, important seasonal and daily movements and seasonal habitat selection through documentation of direct mule deer observations throughout the year as well as marked mule deer locations via existing and future research efforts. Where competition for forage negatively affects mule deer populations, pursue habitat improvements and management of competing ungulates. Discourage backyard feeding of wildlife by the public to slow the spread of CWD. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
North American Water Vole	Habitat loss, fragmentation, or degradation can be caused by climate change, herbivory, road development, and motorized recreation. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research fine-scale distribution (especially southern mountain ranges), responses to challenges, whether beavers could create habitat, and genetic differentiation between Bighorn Mountain and adjacent populations. Develop additional funding options and collaborative efforts to support conservation.
Northern Flying Squirrel	Habitat loss, fragmentation, and degradation can occur from clearcutting, thinning, wildfire, mountain pine beetle, and climate-induced changes in forest communities. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, habitat relationships, taxonomy, and response to challenges. Develop additional funding options and collaborative efforts to support conservation.
Northern Long-eared Myotis	Habitat loss, fragmentation, and degradation can be caused by stochastic forest events such as logging and wildfire. Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). Human disturbance of hibernacula can lead to arousal events and subsequent energy expenditures that may lead to increased mortality. White-nose syndrome. Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with governmental entities, members of the public, and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary, including participation in federal recovery efforts and planning Coordinate with partners to continue implementing the North American Bat Monitoring Program. Recommend and assist with bat-friendly closures of important caves and mines where appropriate. Survey, research, and monitor abundance, distribution, population trends, habitat associations (especially maternity roosts), phenology of reproduction, diet preferences, and disease ecology (especially white-nose syndrome). Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Northern River Otter	Habitat loss, fragmentation, or degradation can be caused by alteration of natural flow regimes due to dams and reservoirs, siltation of streams and rivers, and both habitat degradation and anthropogenic disturbance resulting from human development along waterways. Northern River Otter is high on the aquatic food chain, making it susceptible to reduced prey abundance and bioaccumulation of heavy metals and toxic compounds, as well as persecution by anglers based on perceived impacts on sport fisheries. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population trends, response to challenges (especially development and water contamination), response to declining cutthroat trout and identify barriers to dispersal. Educate private pond owners and the public on river otter ecology, diets, and nonlethal methods of exclusion. Develop additional funding options and collaborative efforts to support conservation.
Olive-backed Pocket Mouse	Insufficient knowledge of abundance, distribution, and how challenges affect this species. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, habitat relationships, response to challenges, and basic life history. Develop additional funding options and collaborative efforts to support conservation.
Pallid Bat	Because Pallid Bats forage and sometimes roost on the ground, they are vulnerable to ground disturbance, particularly disturbances resulting from changing land use practices. Human disturbance of hibernacula can lead to arousal events and subsequent energy expenditures that may lead to increased mortality. The effect of white-nose syndrome on Pallid Bats is unknown, as the species has yet to be documented with the disease. As a hibernating bat, mortality and reproductive effects cannot be ruled out. Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with governmental entities, members of the public, and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary. Coordinate with partners to continue implementing the North American Bat Monitoring Program. Survey, research, and monitor abundance and distribution, population trends, which subspecies are in Wyoming, habitat associations, identify maternity roosts and hibernacula, disease ecology (especially white-nose syndrome), overwinter ecology, diet preferences, and phenology. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Piñon Deermouse	Has narrow habitat associations (areas near cliffs and with high rock cover; Rompola and Anderson 2004) and range in the state, so disturbances to habitat (e.g., changing land use practices, climate change, recreation) could negatively affect the species. The filling of Flaming Gorge reservoir in the 1960s and 1970s may have greatly reduced the geographic range in WY (Buskirk 2016). Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, habitat relationships, response to juniper removal and expansion, and responses to human activities and human-induced habitat alteration. Develop additional funding options and collaborative efforts to support conservation.
Plains Harvest Mouse	Insufficient knowledge of how challenges affect this species. This species is tied to a narrow range of habitats, but responses to natural and anthropogenic disturbances to grasslands/plains habitats are unknown. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, response to challenges, habitat relationships, and basic life history. Develop additional funding options and collaborative efforts to support conservation.
Plains Pocket Mouse	Insufficient knowledge of abundance, distribution, and how challenges affect this species. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, response to challenges, habitat relationships, and basic life history. Develop additional funding options and collaborative efforts to support conservation.
Plains Spotted Skunk	Insufficient knowledge of abundance, distribution, and how challenges affect this species. Trapping, pest control, and other human-caused mortality that is not reported. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Reevaluate the current classification of both spotted skunks as predatory species. Survey/research abundance, distribution, population dynamics, habitat relationships, and response to challenges. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Preble's Meadow Jumping Mouse	Increased human presence near Preble's Meadow Jumping Mouse habitat may result in an increased level of predation by human-associated predators (e.g., striped skunk, raccoons, domestic cats; USFWS 2018), as well as competition with house mice and deer mice (Schorr 2012). Because Preble's Meadow Jumping Mouse is a habitat specialist that is restricted to areas adjacent to wetlands and rivers with dense shrub and herbaceous cover (Schorr and Mihlbachler 2018), habitat degradation, loss, and fragmentation can be caused by changing land use practices, herbivory, climate change, floods, and fire. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Work with collaborators, including private landowners, to implement the Preble's Meadow Jumping Mouse Recovery Plan. Survey/research distribution, population trends, response to challenges, and basic biology. Develop additional funding options and collaborative efforts to support conservation.
Preble's Shrew	Insufficient knowledge of abundance, distribution, natural history, and how challenges affect this rare species with limited distribution and records in the state. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, habitat relationships, response to challenges, dietary needs, and breeding phenology. Develop capture and identification techniques that do not require sacrificing individuals. Develop additional funding options and collaborative efforts to support conservation.
Pygmy Rabbit	Rabbit hemorrhagic disease virus 2 (RHDV2) is a quickly evolving RNA virus lethal to pygmy rabbits (Crowell et al. 2023), but prevalence and population effects remain unknown (Asin et al. 2024). Pygmy Rabbits are a year-round sagebrush habitat specialist. Habitat loss, fragmentation, and degradation can be caused by fire, invasive plant species, changing land use practices, herbivory, woodland encroachment, and climate change. Limiting population and habitat factors are still unclear and may vary throughout range (Rush et al. 2023). Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, and response to challenges. Coordinate with partners on recovery actions following federal listing decisions. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Ringtail	Insufficient knowledge of abundance, distribution, and how challenges affect this species. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population trends, habitat preferences, diet, breeding phenology, and response to challenges. Develop additional funding options and collaborative efforts to support conservation.
Sagebrush Vole	Because of close association with sagebrush habitat, processes that degrade or fragment sagebrush systems (e.g., fire, invasive annual grasses, changing land use practices, climate change) may also reduce habitat quality for Sagebrush Vole. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, habitat relationships (especially preference for particular characteristics of sagebrush shrublands), and response to challenges. Develop additional funding options and collaborative efforts to support conservation.
Sand Hills Pocket Gopher	Habitat loss, fragmentation, and degradation can be caused by activities that result in loss of forage and soil compaction (e.g., herbivory, changing land use practices), which may be particularly detrimental to this fossorial species. Because pocket gophers are sometimes considered pests, they can experience local extermination. Because of limited population size and range, may be at risk of declines or extinction from stochastic events (e.g., extreme weather events such as high runoff or groundwater tables, late and early season freezes, weather-caused food and cover limitations). Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, response to challenges, and habitat relationships. Develop additional funding options and collaborative efforts to support conservation.
Silky Pocket Mouse	Insufficient knowledge of abundance, distribution, and how challenges affect this species. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, response to challenges (including invasive species, changing land use practices, and other anthropogenic factors), natural history, and habitat requirements. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Silver-haired Bat	Habitat loss, fragmentation, and degradation can be caused by stochastic forest events such as logging, wildfire, and tree removal operations by reducing the availability of suitable roost locations. Collisions and barotrauma at wind facilities can cause direct mortality. Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with governmental entities, members of the public, and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary. Coordinate with partners to continue implementing the North American Bat Monitoring Program. Document and mitigate the effects of wind energy development on this species. Survey, research, and monitor distribution, abundance, habitat associations, diet preferences, migration routes, migration and presence timing, response to forest habitat removal, and response to changes in water availability and quality. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Spotted Bat	Habitat loss and degradation can be caused by many human activities, including recreational rock climbing, water impoundment projects, conversion of wetlands to more xeric sites, fires, urbanization, herbivory, timber harvest, and climate change. The effect of white-nose syndrome on Spotted Bats is unknown, as the species has yet to be documented with the disease. As a hibernating bat, mortality and reproductive effects cannot be ruled out. Because of limited population size and range, may be at risk of declines or extinction from stochastic events (e.g., extreme weather events, wildfire, climate change). Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient knowledge of the species in the state, including range and frequency of direct mortality due to collisions and barotrauma at wind energy facilities. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with governmental entities, members of the public, and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary. Coordinate with partners to continue implementing the North American Bat Monitoring Program. Survey/research abundance, distribution, population trends, response to challenges (especially wind development), basic biology (including reproductive habits), habitat requirements (including identifying roost locations), migratory behaviors, and disease status. Develop additional funding options and collaborative efforts to support conservation.
Spotted Ground Squirrel	Insufficient knowledge of abundance, distribution, and how challenges affect this rare species with limited distribution and records in the state. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, response to challenges, habitat relationships, and basic natural history. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Swift Fox	Poisoning and trapping efforts that target larger carnivores and rodents. Depends on large tracts of short-grass prairies, mid-grass prairies, and mixed shrublands, which makes the species sensitive to fragmentation of these ecosystems from changing land use practices and associated increased road density. Populations may be limited by primary sources of mortality: coyote depredation and vehicle collisions. Functional connectivity within and among habitats is critical to maintaining genetic diversity, but rates of gene flow are currently unknown. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Coordinate with landowners to promote information dissemination and conservation and management priorities. Continue active participation in the Swift Fox Conservation Team. Survey/research abundance, distribution, population trends, response to challenges, and the importance of prey items and prairie dog colonies to survival and reproduction. Develop additional funding options and collaborative efforts to support conservation.
Townsend's Big-eared Bat	Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). Human disturbance of hibernacula can lead to arousal events and subsequent energy expenditures that may lead to increased mortality. Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with governmental entities, members of the public, and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary. Coordinate with partners to continue implementing the North American Bat Monitoring Program. When mine closure is necessary, implement bat-friendly closures on abandoned mine structures. Survey, research, and monitor abundance, distribution, population trends, habitat associations (especially during hibernation and at maternity colonies), degree of disturbance at important roosts, diet preferences, and disease ecology. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Tricolored Bat	Collisions and barotrauma at wind facilities can cause direct mortality. White-nose syndrome has led to large population declines for this bat throughout its range. The only known roosts in Wyoming are hibernacula, and it is during hibernation that impacts from white-nose syndrome are seen. Human disturbance of hibernacula can lead to arousal events and subsequent energy expenditures that may lead to increased mortality. Mine reclamation can remove vital habitat used as roosts (hibernacula, maternity, transitional roosts when migrating). Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with governmental entities, members of the public, and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary, including participation in federal recovery and planning efforts. Coordinate with partners to continue implementing the North American Bat Monitoring Program. Bat-friendly, seasonal closures of hibernacula should be considered to minimize human traffic, to reduce potential for white-nose syndrome spread, and reduce human disturbance to bats in torpor. Continue to prioritize collaboration with private landowners to preserve known roosts and associated habitats. When mine closure is necessary, implement bat-friendly closures on abandoned mine structures. Survey, research, and monitor distribution (especially summer range and migration corridors), habitat associations, diet preferences, and disease ecology (especially white-nose syndrome). Develop additional funding options and collaborative efforts to support conservation.
Uinta Chipmunk	Habitat loss, fragmentation, or degradation can occur because of climate change, mountain pine beetle outbreaks, forest management practices, and wildfire. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, response to challenges, and basic natural history. Develop additional funding options and collaborative efforts to support conservation.
Western Pygmy Shrew	Insufficient knowledge of abundance, distribution, natural history, and how challenges affect this rare species with limited distribution and records in the state. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, habitat relationships, response to challenges, dietary needs, and breeding phenology. Develop capture and identification techniques that do not require sacrificing individuals. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Western Small-footed Myotis	Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). Human disturbance of hibernacula can lead to arousal events and subsequent energy expenditures that may lead to increased mortality. Effects of white-nose syndrome on Western Small-footed Myotis may be less significant than on other myotids, but research is underway. Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with governmental entities, members of the public, and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary. Coordinate with partners to continue implementing the North American Bat Monitoring Program. Survey, research, and monitor abundance, distribution, population trends, habitat associations (especially maternity roosts and hibernacula), clarification of range overlap with California Myotis using DNA, phenology, diet preferences, and disease ecology (especially white-nose syndrome). Develop additional funding options and collaborative efforts to support conservation.
Western Spotted Skunk	Trapping, pest control, and other human-caused mortality that is not reported. Insufficient knowledge of abundance, distribution, and how challenges affect this species. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Reevaluate the current classification of both spotted skunks as predatory species. Survey/research abundance, distribution, population dynamics, habitat relationships, and response to challenges. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
White-tailed Prairie Dog	Mortality due to control methods (e.g., poisoning, shooting) Sylvatic plague. Invasive annual grasses. Habitat loss or degradation due to ground disturbance from changing land use practices. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Outreach and collaboration with private landowners to promote sustainable management of prairie dogs and prairie dog habitat. Continue active involvement with the interstate Prairie Dog Conservation Team and collaborate with the Western Association of Fish and Wildlife Agencies on the range-wide conservation needs for this species. Survey/research abundance, population dynamics, causes of population fluctuations, difference in plague dynamics among prairie dog species, how populations respond to disease in enzootic and epizootic states as compared to other stochastic events, how habitat affects population trends, and response to challenges. Localized on-the-ground colony mapping and population monitoring in support of Black-footed Ferret reintroduction efforts. Where possible, implement sylvatic plague control efforts. Develop additional funding options and collaborative efforts to support conservation.
Wolverine	Human-caused mortality via illegal shooting, inadvertent trapping, and roadkill are exceptionally low but may have a functionally high impact due to the species' overall small population size, low density, and slow reproductive rate. Habitat loss, fragmentation, and degradation of core habitat can be caused by recreation (e.g., backcountry skiing, snowmobiling), timber harvesting, assorted development (e.g., ski area infrastructure or residential areas), and climate change. Dispersal habitat (e.g., interstitial valleys between mountain ranges) can be damaged or destroyed by changing land-use practices in addition to climate change. Functional connectivity within and among wolverine habitats is critical to maintaining genetic diversity, but rates of gene flow are currently unknown and Wolverine in the continental US are more homogenous than those in more northern latitudes. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Work with USFWS to develop and implement a Recovery Plan and continue to implement the Wyoming Wolverine Management Plan. Continued participation in Western Association of Fish and Wildlife Agencies Multistate Wolverine Working group and collaborating among states and agencies to promote Wolverine conservation, management and monitoring in the contiguous U.S. Survey/research the residency status of individuals in Wyoming, the relative dependence of the state population segment on immigrant vs. recruitment of individuals produced within the state, extent of breeding within the state, response to challenges, and reproduction (e.g., litter frequency and size, kit survival, den locations). Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Wyoming Pocket Gopher	Because of limited population size and range, may be at risk of declines or extinction from stochastic events (e.g., extreme weather events such as high runoff or groundwater tables, late and early season freezes, weather-caused food and cover limitations). Habitat loss, fragmentation, and degradation can result from activities that result in soil compaction (e.g.,changing land use practices, herbivory) which may be particularly detrimental to this fossorial species. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, response to challenges, basic biology, and interactions with Northern Pocket Gopher. Develop additional funding options and collaborative efforts to support conservation.
Yellow-pine Chipmunk	Habitat loss, fragmentation, or degradation can occur because of climate change, mountain pine beetle outbreaks, forest management practices, and wildfire. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Survey/research abundance, distribution, population dynamics, response to challenges (including mountain beetle outbreaks), and basic natural history. Develop additional funding options and collaborative efforts to support conservation.
Yuma Myotis	Human disturbance of hibernacula can lead to arousal events and subsequent energy expenditures that may lead to increased mortality. White-nose syndrome. Loss, fragmentation, and degradation of riparian habitat can be caused by processes that affect water amount and timing, including water diversions and ground water extractions. Where water is a limiting factor, climate change can affect reproduction, which decreases with below-average precipitation (Adams and Hayes 2008). Pesticides, herbicides, and heavy metals can influence primary food (insects) and toxins can accumulate in the organs of insectivorous bats with unknown effects. Yuma Myotis often roost in anthropogenic structures, especially during the breeding season, leaving maternity colonies vulnerable to disturbance by humans. Association with disease transmission (rabies) affects tolerance and appreciation for bats. Insufficient funding and resources available for conservation (e.g., habitat conservation and restoration, avoidance and mitigation of impacts, monitoring and research).	Conduct outreach and collaboration with governmental entities, members of the public, and private landowners regarding conservation of bats and bat habitat. Continue to update, revise, and implement management plans and monitoring plans as necessary. Coordinate with partners to continue implementing the North American Bat Monitoring Program. Survey, research, and monitor abundance, distribution using DNA and acoustic verification, population trends, response to changing riparian habitat, which subspecies occurs in Wyoming, habitat associations, hibernacula, roost locations, diet preferences, and disease ecology (especially white-nose syndrome). Develop additional funding options and collaborative efforts to support conservation.

Chapter 9: Mollusks

There are over 160 native mollusks within Wyoming, and Wyoming has designated 35 species and 2 groups as Species of Greatest Conservation Need (SGCN; *Table 1*). The 2 groups contain multiple species that are lumped together because their ecologies are similar or suspected to be similar, although significant uncertainties regarding taxonomy or ecology remain. Wyoming's mollusks include over 35 species of native aquatic snails, over 40 species of native land snails, 13 species of clams, and 7 species of native mussels (Beetle 1989, Tronstad and Andersen 2018, Tronstad and Tronstad 2022). Mollusks provide essential ecosystem services throughout the state and beyond (Atkinson et al. 2023). Mussels and clams filter water and improve water quality, contribute to nutrient cycling, serve as biological indicators, create substrate that is used for other species, and serve as food sources for a diversity of wildlife and fish (Zieritz et al. 2022). Similarly, aquatic and land snails contribute to nutrient cycling, shape algal abundance and communities, can be used to reconstruct paleoenvironments, and serve as food sources (Bronmark et al. 1992, Hill and Griffiths 2017, Yanes et al. 2012). Although mollusks are often overlooked, conserving these species will help support landscapes and provide numerous benefits to people in Wyoming.

Mollusks are globally diverse and exhibit remarkable variation in their morphology and ecology (Haszprunar and Wanninger 2012). Mollusk diversity in Wyoming is shaped by Wyoming's temperature extremes and limited water (Beetle 1989). All of Wyoming's SGCN mollusks are protected by a shell made of calcium carbonate. All of Wyoming's SGCN mussels and clams are restricted to aquatic ecosystems, while snails can be found in both aquatic and terrestrial ecosystems depending on the species. Ranges within Wyoming are restricted, even for species that have broader regional ranges; the Cave Physa, which is endemic to a single cave in Big Horn County, is an extreme example (*Appendix D*). Freshwater mussels typically live upwards of 10 years, and Western Pearlshells can live over 100 years. The life cycles of Wyoming's SGCN mussels are closely linked with fish and amphibian hosts (e.g., Western Tiger Salamander, Sauger); larvae (called glochidia) attach to hosts, spend up to a few weeks maturing and then juveniles drop into a new location to finish their life cycle. Most aquatic snails in Wyoming have lungs and live underwater in streams, springs, reservoirs, and lakes, coming to the surface to breathe. Land snails live, as their name suggests, on land, but they are closely tied to moisture. They tend to occur in cool, wet microhabitats and can seal their shells (aestivate) during dry or otherwise inhospitable periods. Beyond those generalities, Wyoming's SGCN mollusks exhibit heterogeneous ecologies and morphologies, including wide ranges in age, fecundity, shell shapes, reproductive ecology, and habitat preferences.

Globally, mollusks are among the most imperiled taxonomic groups, and an estimated 30% of species are considered threatened (Bohm et al. 2021). Due to many mollusks being closely tied to water sources, factors that affect water quality often affect mollusks in turn (Cushway et al. 2025, Haag and Warren 2008, Johnson et al. 2013, Lysne et al. 2008, Nicolai and Ansart 2017, Watters 1996). Information about ecology, abundance, and distribution is lacking for almost all mollusk species in Wyoming, which stems from a combination of lack of funding and the difficulty of studying species that are often hard to detect (Rodgers et al. 2022). Intrinsic factors, such as low reproductive success and obligate connections to hosts to carry out their life cycle, can affect demographics and distribution (Haag and Warren 1998) and make mollusks indirectly vulnerable to challenges facing other species. Multiple Aquatic Invasive Species threaten to change the structure and function of Wyoming's waterways if they become established, with likely negative implications for native mollusks. Additionally, most education and research efforts have focused on these problematic invasive mussels, with fewer resources and less attention devoted to the importance of native mussels. To address these challenges, actions to support the conservation of mollusks include research, surveys and monitoring, and reintroductions (Ferreira-Rodríguez et al. 2019, Freshwater Mollusk Conservation Society 2016; Mathias 2016, Peterson 2021).

Challenges and actions

Wyoming's SWAP identifies the significant challenges facing SGCN in the state, as well as priority conservation actions to support their conservation. Species-specific challenges and actions are identified in *Table 10*. Please refer to *Chapter 3* for descriptions of how challenges and actions were identified and categorized. Notably, the identified challenges and actions are not inclusive of all potential challenges these species may face; instead this list summarizes the priority challenges and actions at this time, although they may change over the next 10 years.

Table 10. Challenges and actions for Species of Greatest Conservation Need mollusks.

Priority challenges and actions relevant to Species of Greatest Conservation Need mollusks.

Common Name	Challenges	Voluntary actions
Mussels		
California Floater	Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Increased turbidity, siltation, and chemical pollution. Increased turbidity also limits the capability of many fishes to forage. Water withdrawal can reduce the amount of water in the stream resulting in individuals being stranded and altered water quality. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Predation by introduced nonnative fish and competition with native fish that serve as hosts for larval mussels may limit abundance and survival. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, reproductive success, and ecology. Improve habitat by reducing fragmentation, decrease input of fine sediments, and increase flushing flows to improve benthic habitats. Investigate possible hatchery propagation and release as a tool to bolster wild populations. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Cylindrical Papershell	Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Increased turbidity, siltation, and chemical pollution. Increased turbidity also limits the capability of many fishes to forage. Water withdrawal can reduce the amount of water in the stream resulting in individuals being stranded and altered water quality. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Predation by introduced nonnative fish and competition with native fish that serve as hosts for larval mussels may limit abundance and survival. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, reproductive success, and ecology. Reintroduce individuals from Wyoming and/or neighboring states to augment existing populations and establish new populations. Improve habitat by reducing fragmentation, decrease input of fine sediments, and increase flushing flows to improve benthic habitats. Develop additional funding options and collaborative efforts to support conservation.
Fatmucket	Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Increased turbidity, siltation, and chemical pollution. Increased turbidity also limits the capability of many fishes to forage. Water withdrawal can reduce the amount of water in the stream resulting in individuals being stranded and altered water quality. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, reproductive success, and ecology in historical drainages. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Giant Floater	Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Increased turbidity, siltation, and chemical pollution. Increased turbidity also limits the capability of many fishes to forage. Water withdrawal can reduce the amount of water in the stream resulting in individuals being stranded and altered water quality. Predation by introduced nonnative fish and competition with native fish that serve as hosts for larval mussels may limit abundance and survival. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, reproductive success, and ecology in historical drainages. Develop additional funding options and collaborative efforts to support conservation.
Plain Pocketbook	Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Increased turbidity, siltation, and chemical pollution. Increased turbidity also limits the capability of many fishes to forage. Water withdrawal can reduce the amount of water in the stream resulting in individuals being stranded and altered water quality. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Predation by introduced nonnative fish and competition with native fish that serve as hosts for larval mussels may limit abundance and survival. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, reproductive success, and ecology in the North Platte River drainage. Improve habitat by reducing fragmentation, decrease input of fine sediments, and increase flushing flows to improve benthic habitats. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Western Pearlshell	Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Predation by introduced nonnative fish and competition with native fish that serve as hosts for larval mussels may limit abundance and survival. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, reproductive success, and ecology in historical drainages. Improve habitat by reducing fragmentation, decrease input of fine sediments, and increase flushing flows to improve benthic habitats. Investigate possible hatchery propagation and release as a tool to bolster wild populations. Develop additional funding options and collaborative efforts to support conservation.
Snails and other mollusks		
Ambersnail	Factors that affect forest understory can contribute to habitat loss or degradation. Insufficient knowledge of abundance, distribution, and how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, and ecology. Maintain understory vegetation to keep microhabitat intact. Develop additional funding options and collaborative efforts to support conservation.
Bear Lake Springsnail	Insufficient knowledge of abundance, distribution, and how challenges affect this species. Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Invasive New Zealand mudsnails may outcompete. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, ecology, and response to challenges. Identify an effective means to control New Zealand mudsnails. Maintain minimum water levels for survival. Decrease input of fine sediments and increase flushing flows to improve benthic habitats. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Button Sprite, Fragile Ancylid, Glass Physa, Glossy Valvata, Marsh Pondsnail, Mossy Valvata, Obtuse Physa, Rotund Physa, Sharp Sprite, Star Gyro, Threeridge Valvata, Two-ridged Ramshorn, Woodland Pondsnail, Wrinkled Marshsnail Note: all species had the same challenges and actions, so they are listed in one row to save space.	Insufficient knowledge of abundance, distribution, and how challenges affect this species. Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Invasive New Zealand mudsnails may outcompete. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, ecology, and response to challenges. Identify an effective means to control New Zealand mudsnails. Maintain minimum water levels for survival. Develop additional funding options and collaborative efforts to support conservation.
Cave Physa	Factors that affect forest understory can contribute to habitat loss or degradation. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Maintain understory vegetation to keep microhabitat intact. Conduct research that supports taxonomic revision and clarification. Develop additional funding options and collaborative efforts to support conservation.
Creeping Ancylid	Insufficient knowledge of abundance, distribution, and how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, ecology, and response to challenges. Develop additional funding options and collaborative efforts to support conservation.
Great Basin Ramshorn	Insufficient knowledge of abundance, distribution, and how challenges affect this species. Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Fluctuating water levels in Jackson Lake may cause reduced survival. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Invasive New Zealand mudsnails may outcompete. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, ecology, and response to challenges. Identify an effective means to control New Zealand mudsnails. Work with the state agencies to reduce water fluctuations in Jackson Lake so the snails are not stranded by rapid water level drops. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Green River Pebblesnail, Jackson Lake Springsnail Note: both species had the same challenges and actions, so they are listed in one line to save space.	Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Invasive New Zealand mudsnails may outcompete. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, and ecology. Develop additional funding options and collaborative efforts to support conservation.
Pygmy Mountainsnail	Factors that affect forest understory can contribute to habitat loss or degradation. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Maintain understory vegetation to keep microhabitat intact. Conduct research that supports taxonomic revision and clarification. Develop additional funding options and collaborative efforts to support conservation.
Rocky Mountain Capshell, Rocky Mountain Duskysnail Note: both species had the same challenges and actions, so they are listed in one row to save space.	Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Invasive New Zealand mudsnails may outcompete. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, and ecology. Identify an effective means to control New Zealand mudsnails. Maintain minimum water levels for survival. Develop additional funding options and collaborative efforts to support conservation.
Swamp Lymnaea	Insufficient knowledge of abundance, distribution, and how challenges affect this species. Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, ecology, and response to challenges. Maintain minimum water levels for survival. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Umbilicate Sprite	Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Invasive New Zealand mudsnails may outcompete. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, and ecology. Identify an effective means to control New Zealand mudsnails. Maintain minimum water levels for survival. Develop additional funding options and collaborative efforts to support conservation.
Western Glass-snail	Insufficient knowledge of abundance, distribution, and how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, ecology, and response to challenges. Develop additional funding options and collaborative efforts to support conservation.
Yavapai Mountainsnail	Factors that affect forest understory can contribute to habitat loss or degradation. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Maintain understory vegetation to keep microhabitat intact. Conduct research that supports taxonomic revision and clarification. Develop additional funding options and collaborative efforts to support conservation.
Other aquatic mollusks group (*Aplexa elongata, Galba obrussa, Galba parva, Gyraulus circumstriatus, Gyraulus vermicularis, Planorbella subcrenata*, Pill/Fingernail Clams (family Sphaeriidae))	Insufficient knowledge of abundance, distribution, and how challenges affect this group of species. Climate change may lead to habitat loss by altering water availability, and warming water temperatures may affect ability to reproduce/grow/survive. Fragmentation caused by dams may isolate populations leading to decreased genetic exchange and declines or extinction from stochastic events (e.g., extreme weather events). Invasive New Zealand mudsnails and Corbicula may outcompete. Insufficient funding and resources available for conservation of these species (e.g., habitat improvement, research, monitoring).	Continue to survey/research abundance, distribution, population trends, ecology, and response to challenges. Identify an effective means to control New Zealand mudsnails. Maintain minimum water levels for survival. Develop additional funding options and collaborative efforts to support conservation.

Common Name	Challenges	Voluntary actions
Other land snails group (*Cochlicopa lubricella, Columella columella, Deroceras laeve, Discus catskillensis, Discus shimekii, Euconulus fulvus, Gastrocopta pentodon, Gastrocopta procera, Gastrocopta similis, Hawaiia minuscula, Mediappendix rehderi, Mediappendix stretchiana, Mediappendix vermeta, Nesovitrea binneyana, Nesovitrea electrina, Oxyloma decampi, Oxyloma retusum, Pupilla blandii, Pupilla hebes, Pupilla muscorum, Succinea grosvenori, Vallonia albula, Vallonia cyclophorella, Vallonia excentrica, Vallonia perspectiva, Vertigo arthuri, Vertigo binneyana, Vertigo modesta, Vertigo ventricosa, Zonitoides nitidus*)	Insufficient knowledge of abundance, distribution, and how challenges affect this group of species. Factors that affect forest understory can contribute to habitat loss or degradation. Insufficient funding and resources available for conservation of these species (e.g., habitat improvement, research, monitoring).	Survey/research abundance, distribution, population trends, ecology, and response to challenges. Maintain understory vegetation to keep microhabitat intact. Develop additional funding options and collaborative efforts to support conservation.

Chapter 10: Plants

There are nearly 4,000 native vascular plants that regularly occur in Wyoming (Nelson and Legler 2024), and 55 are considered Species of Greatest Conservation Need (SGCN; *Table 1*). SGCN plants include a diverse set of grasses, graminoids, forb, and one tree species. Wyoming's rare plants often occur in harsh or sparsely vegetated environments where they may contribute disproportionately to ecosystem services like nutrient cycling, soil stabilization, habitat provision, or pollinator resources that are otherwise scarce (Dee et al. 2019, Mouillot et al. 2013). For example, Whitebark Pine is a keystone species that provides critical food and habitat for many wildlife species while influencing the structure and function of forest ecosystems (Logan et al. 2010). Additionally, rare plants, such as unique state endemics, can spark curiosity and engage both scientists and the public with the study of local natural systems while fostering pride and a sense of responsibility that supports broader conservation efforts (Finch et al. 2022; Kraus et al. 2022). The prevention of local extirpation and extinction of rare plants is critical for the maintenance of diverse and functional plant communities, the preservation of Wyoming's rich natural heritage, and the conservation of wildlife species that depend on both.

SGCN plants occur throughout Wyoming, although most species are associated with Cliffs, Caves, Canyons, and Rocky Outcrops, Desert Shrublands, or Sagebrush Shrublands (*Appendix D*). Many species have narrow habitat requirements and are endemic to fine-scale habitat types such as alkaline wet meadows (e.g., Slender Spiderflower), calcareous substrates (e.g., Shoshonea), seleniferous shale (e.g., Trelease's Milkvetch), sand dunes (e.g., Long-awned Alkali Wildrye), or volcanic breccia (e.g., Wyoming Tansymustard). Approximately 40% of SGCN plants are found only in Wyoming; state endemics include Desert Yellowhead, Kirkpatrick's (Spiked) Ipomopsis, and Small (Fremont County) Rockcress. Reproductive ecology and strategies vary across species. For example, Laramie Columbine can self pollinate, Yellowstone Sand Verbena can be pollinated by many insect species, and Colorado Butterfly Plant uses seed banks to buffer against population declines (Chartier et al. 2025, Saunders and Sipes 2006, Stears et al. 2025). SGCN plants include annuals (e.g., Ross' Bentgrass), biennials (e.g., Desert Glandular Phacelia), and perennials (e.g., Meadow Milkvetch), although the majority of species are perennials. For additional details about the ecology of individual species, please refer to the online Wyoming Field Guide available through the Wyoming Natural Diversity Database (https://fieldguide.wyndd.org/).

The unique and often specialized ecology of SGCN plants can make them vulnerable to a suite of challenges. Many species have small population sizes and restricted ranges, which can make them vulnerable to extinction or extirpation from stochastic events or localized disturbances (Matthies et al. 2004). Surface disturbances can reduce habitat, lower genetic diversity, contribute to direct mortality of individuals, and contribute to pollinator declines (Honnay and Jacquemyn 2007, Pescott and Stewart 2014, Potts et al. 2010, Schemske et al. 1994). Efforts to control invasive plants, especially herbicide treatments, may be additionally harmful to rare plants and indirectly harmful to pollinators in the vicinity if not conducted with particular caution. Most flowering plants require pollinators for successful reproduction, and rare plants face higher pollination deficits (Lin et al. 2025). The capacity for habitat restoration is limited for some rare plant species, such as those with strict habitat requirements that are tied to underlying geology, which is not easily restored if degraded. Climate change may have pervasive implications for SGCN plants. Increases in drought severity across Wyoming are anticipated to negatively impact reproduction, survival, and persistence of many plant SGCN (Kelly and Goulden 2008, Still et al. 2015). Additionally, decreases in snowpack will compound growing season drought and shifts towards heavier spring rainfall may threaten several SGCN species occurring in highly erodible habitats (e.g. Precocious Milkvetch; Frankson et al. 2022). Lack of knowledge and limited funding for conservation efforts and monitoring are pervasive challenges for SGCN plants, hindering the ability to conserve these species. Conservation actions to overcome these challenges include researching plant ecology and responses to challenges, habitat restoration, community science monitoring efforts, and community outreach (Davidson et al. 2023, Finch et al. 2022, Havens et al. 2014, Schemske et al. 1994).

Challenges

Wyoming's SWAP identifies the significant challenges facing SGCN in the state, as well as priority conservation actions to support their conservation. Species-specific challenges are identified in *Table 11*. Please refer to *Chapter 3* for descriptions of how challenges were identified and categorized. Notably, the identified challenges are not inclusive of all potential challenges these species may face; instead this list summarizes the priority challenges at this time, although they may change over the next 10 years.

Table 11. Challenges for Species of Greatest Conservation Need plants.

Priority challenges relevant to Species of Greatest Conservation Need plants.

Common Name	Challenges
Alkali Wildrye	Insufficient knowledge of how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Barneby's Clover	Drought leads to low seed production, decreased pollination, and dieback and cover decreases with reduced precipitation (Handley and Tronstad 2021). Encroachment of nonnative plant species and associated herbicide treatment. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Blowout Beardtongue	Vegetation encroachment and dune stabilization, which can reduce habitat suitability if wind disturbance is not sufficient. Excessive herbivory. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Cedar Rim (Desert) Thistle	Herbicide treatments and release of biocontrol insects intended to control related nonnative plant species. Mechanical ground disturbance and associated crushing, and road development. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Colorado Butterfly Plant	Vegetation encroachment due to removal of natural disturbances. Habitat disturbance, including changes to hydrology, mechanical ground disturbance, and uprooting, and herbicide treatments in hay fields that support this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Colorado Tansyaster	Mechanical ground disturbance and associated crushing, trampling, introduction of nonnative plant species, and associated herbicide treatments. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Comb-hair Draba	Insufficient knowledge of how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Desert Glandular Phacelia	Mechanical ground disturbance and associated erosion and crushing, increased nonnative plant species, and associated herbicide treatments. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Desert Yellowhead	Mechanical ground disturbance and associated erosion and crushing, trampling, introduction of nonnative plant species, and associated herbicide treatments. Drought can lead to poor seed set. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).

Common Name	Challenges
Dorn's (Tunp Range) Twinpod	Mechanical ground disturbance and associated erosion and crushing, trampling, road maintenance, introduction of nonnative species, and associated herbicide treatment. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Dropleaf Buckwheat	Mechanical ground disturbance and associated crushing, trampling, introduction of nonnative plant species, and associated herbicide treatments. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Dubois (Plains) Milkvetch	Mechanical ground disturbance and associated crushing, herbicide treatment, and road expansion. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Farrar Moonwort	Increased canopy cover and shading in response to changing fire regimes. Mechanical ground disturbance and associated crushing, herbicide treatment, and road expansion/maintenance. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Foothill Milkvetch	Insufficient knowledge of how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Fremont Bladderpod	Mechanical ground disturbance and associated crushing, trampling, road development and maintenance, introduction of nonnative plant species, and associated herbicide treatment (Heidel and Handley 2004). Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Gibbens' Beardtongue	Trampling, herbivory, mechanical ground disturbance, road construction and use, habitat disturbance, invasion by nonnative plant species, and associated herbicide treatment. Prolonged droughts can lead to erosion in the species' habitat, population declines, and decreased seed germination. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Grassyslope Sedge	Trampling, herbivory, mechanical ground disturbance, road construction and use, habitat disturbance, invasion by nonnative plant species, and associated herbicide treatment. Prolonged droughts can lead to erosion in the species' habitat, population declines, and decreased seed germination. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Grassyslope Sedge	Drought leads to poor flowering and health. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Green River (Low) Greenthread	Mechanical ground disturbance, soil compaction, trampling, mortality from road widening, invasion by nonnative plant species, and associated herbicide treatment. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).

Common Name	Challenges
Hairy Greenthread	Mechanical ground disturbance, invasion by nonnative plant species, and associated herbicide treatment. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Hyattville (Starveling) Milkvetch	Mechanical ground disturbance and associated crushing and erosion, and road maintenance. Utah juniper is encroaching and degrading habitat. Population size declines with drought. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Kirkpatrick's (Spiked) Ipomopsis	Insufficient knowledge of how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Laramie (Alpine) Clover	Insufficient knowledge of how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Laramie Columbine	Insufficient knowledge of how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Large-fruited Bladderpod	Mechanical ground disturbance and associated crushing, and road maintenance. Drought impacts include decreased flowering, seed production, and recruitment and potential extirpation. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Long-awned Alkali Wildrye	Mechanical ground disturbance and crushing, and trampling. Factors that affect the water table of this species' dune habitat. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Meadow Milkvetch	Factors that impact the water table. Mechanical ground disturbance and associated crushing. Impacted by invasion of salt-tolerant nonnative plant species and associated herbicide treatment. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Mystery (Biennial) Wormwood	Trampling and grazing by feral horses. Loss, degradation, or fragmentation of habitat associated with hydrological changes, road development, changes to the plant community, and soil pollution. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Owl Creek Miner's Candle	Mechanical ground disturbance and associated crushing, and road development. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).

Common Name	Challenges
Parasol Bladderpod	Insufficient knowledge of how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Payson's Draba	Insufficient knowledge of how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Payson's Milkvetch	Vulnerable to invasion of nonnative plant species and associated herbicide treatment. Intolerant of increasing competition from grasses and sagebrush and changes in fire regimes. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Prairie Dodder	Dodders are mistakenly considered agricultural weeds as a group and may be vulnerable to eradication efforts. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Precocious Milkvetch	Mechanical ground disturbance and associated crushing, road maintenance, and habitat loss, degradation, and fragmentation. Vulnerable to erosion. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Prostrate (Low) Bladderpod	Mechanical ground disturbance and associated crushing, road construction, trampling, introduction of nonnative species, and associated herbicide treatment. Drought leads to fruit abortion and reduced vigor. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Ross' Bentgrass	Human trampling of vegetation may allow the native *Agrostis scabra* to outcompete this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Sessileflower (Indian) Springparsley	Insufficient knowledge of how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Shoshonea	Mechanical ground disturbance and associated crushing. Forest succession and changes to fire regimes from fire management and subsequent increases in bark beetle activity. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Slender Spiderflower	Invasion, plant community changes, and the replacement of this species with a more common congener after mechanical ground disturbance (Heidel 2015). Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Small (Fremont County) Rockcress	Insufficient knowledge of how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).

Common Name	Challenges
Smallheaded Townsend Daisy	Mechanical ground disturbance, human trampling, and road maintenance leading to soil compaction and habitat degradation or loss. Vulnerable to encroachment by native shrubs due to changes in fire regimes. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Smooth Summer Milkvetch	Mechanical ground disturbance and crushing and road maintenance activities such as herbicide treatment. Mortality increases in drought years. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Snow Indian Paintbrush	Insufficient knowledge of how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Stemless Beardtongue	Mechanical ground disturbance and associated crushing, invasion of nonnative plant species, and road maintenance activities such as herbicide treatment. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Tapertip Desertparsley	Insufficient knowledge of how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Teton Wirelettuce	Vulnerable to the spread of nonnative plant species and associated herbicide treatment. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Thickleaf Bladderpod	Vulnerable to increasing invasion of nonnative plant species and vulnerable to associated herbicide treatment. Mechanical ground disturbance and crushing. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Thickleaf Pepperweed	Mechanical ground disturbance and associated crushing, invasion of nonnative plant species, and road maintenance activities such as herbicide treatment. Factors that affect the water table can eliminate portions of this species' alkaline habitat. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Trelease's Milkvetch	Mechanical ground disturbance and associated crushing, invasion of nonnative plant species, and road maintenance activities such as herbicide treatment. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Ute Ladies' Tresses	Suppression of natural disturbances, competition with nonnative plant species, and herbicide and pesticide drift. Factors that affect the species' necessary hydrological regime. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).

Common Name	Challenges
Whitebark Pine	Impacted by blister rust and mountain pine beetle outbreaks. Young trees may succumb to fire but medium thickness bark offers some fire resistance. Vulnerable to succession from changes in fire regime. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Winward's Goldenweed	Insufficient knowledge of how challenges affect this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Woodrush Sedge	Excessive herbivory. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Woolly (Common) Twinpod	Mechanical ground disturbance, invasion by nonnative plant species, and associated herbicide treatment. Human trampling, introduction of nonnative plant species, and associated herbicide treatment. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Wyoming Tansymustard	Drought leads to population declines. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).
Yellowstone Sand Verbena	Human trampling, mechanical ground disturbance, road construction, and erosion. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).

Actions

Because the same actions are applicable across nearly all species, actions are identified for all plants after the species-specific challenges. Please refer to Chapter 3 for descriptions of how actions were identified and categorized. Notably, the identified actions are not inclusive of all potential circumstances these species may face; instead this list summarizes the priority actions at this time, although they may change over the next 10 years.

Research and monitoring

- Conduct surveys and research that fill key information gaps. Studies should 1) investigate life history, pollination biology, and suitable propagation protocols; 2) investigate how species respond to management treatments and challenges (especially climate change and invasive species); 3) revise taxonomic uncertainties; 4) develop species distribution models and habitat suitability models; 5) identify species and habitats that are most vulnerable to climate change; and 6) identify climate refugia.

- Develop a standardized, long-term, and repeatable monitoring program to detect population trends and respond to Endangered Species Act listing petitions or status changes.

Land/water management

- Conduct an assessment to determine which populations fall outside of protected areas or areas with active conservation management plans and seek opportunities to improve conservation status. Evaluate whether SGCN occurrences meet criteria for designation as U. S. Forest Service Special Botanical Areas or Bureau of Land Management Special Status Plant Areas of Critical Environmental Concern (ACEC).

- For all SGCN plants, minimize disturbance from human activities that deviates from the natural disturbance regime by establishing exclusion zones and buffers around populations. Selected zones and buffers should be adequate to prevent deleterious impacts to populations and safeguard sufficient habitat to ensure long-term persistence and preserve functional pollinator networks.

- For habitat-restricted or endemic SGCN plants, avoid or minimize disturbances outside of natural disturbance regime, because these species generally cannot be found or propagated elsewhere and impacts could cause local or global extinction.

- Reduce disturbance from recreation through signage, thoughtful trail placement, and protective barriers.

- When controlling or managing invasive plant species and pests (especially when using herbicides, insecticides, or biocontrols), account for the occurrence of SGCN plants and pollinators and develop appropriate monitoring plans to detect declines.

- For species that are poor competitors or require disturbance, encourage the restoration of natural disturbance regimes where possible and use habitat management practices such as carefully timed grazing, mowing, removal of encroaching woody vegetation, prescribed fire, and treatment of invasive species to maintain suitable habitat conditions as needed.

- Develop site-specific strategies for microhabitat-dependent species that are vulnerable to climate change but cannot range shift.

Species management

- Conserve and restore populations using techniques such as seed collection, seed banking, propagation, and population augmentation. Implement the Wyoming Seed Strategy.

Conservation designation and planning

- Conduct NatureServe Global and State conservation status ranking for all SGCN plants.

- Develop common guidelines and best practices for cross-boundary surface disturbances near SGCN populations, such as those related to transportation and utility corridors.

- Develop a Wyoming Plant Conservation Strategy to guide strategic, collaborative conservation efforts.

- Produce cross-boundary conservation management plans for the most at-risk SGCN plants.

Awareness raising

- Build community science programs to survey rare plants and increase public support for rare plant conservation.

- Build public support through education, citizen science, and community involvement. Coordinate with land managers, herbaria, and conservation groups through existing initiatives like the Wyoming Seed Partnership and the Wyoming Seed Strategy and consider the value of starting new cross-boundary interagency groups such as a state-level plant conservation alliance.

- Encourage data collection on undersurveyed private lands through outreach and collaboration and assist interested landowners with enrolling lands into conservation easement or land acquisition programs.

Institutional development

- Develop additional funding options and collaborative efforts to support conservation.

Chapter 11: Reptiles

Twenty-five of Wyoming's reptiles are considered Species of Greatest Conservation Need (SGCN; *Table 1*). SGCN reptiles include turtles, lizards, and snakes that live in habitat types ranging from riparian areas to desert shrublands to montane forests. Although reptiles are typically cryptic and their roles in ecosystems can be hard to detect, they provide multiple ecosystem and cultural services. For example, reptiles are important components of food webs: depending on the species, reptiles are both predators and prey and can help maintain and shape broader ecological communities (Chase 1998, Diller and Johnson 1988). Lizards can help disperse seeds, some species can serve as indicators of environmental quality, and many species have been used as model organisms for scientific study (Valido and Olesen 2019). Some species, such as the Great Basin Gophersnake, are important for pest control, as they consume ground squirrels, pocket gophers, and mice. Taken together, the conservation of Wyoming's SGCN reptiles will support not only individual species, but the surrounding ecosystem as well.

Reptile biodiversity is relatively depauperate in Wyoming, in large part because reptiles are ectotherms (so-called "cold-blooded"), and Wyoming has low annual temperatures (Whiting and Fox 2020). Most SGCN reptiles have small distributions within Wyoming, although some are relatively widespread (e.g., Prairie Rattlesnake; *Appendix D*). Reptiles are typically active during periods with warmer temperatures and less snow, which is often April through October, depending on the species and location. They overwinter below frost line in burrows, ant mounds, rock crevices, rotting logs, and other structures. Many species hibernate communally; for example, Midget Faded Rattlesnakes hibernate in aggregations of up to 100 individuals (Parker and Anderson 2007). Some species lay eggs, while others bear live young. For example, Plains Black-headed Snakes lay 1-3 eggs/year, while Plains Short-horned Lizards birth up to 48 live offspring/year (Baxter and Stone 1985). Diets of reptiles vary across species and body sizes, but typically include insects, spiders, earthworms, amphibians, lizards, eggs, birds, and small mammals. Some species are primarily diurnal (e.g., Northern Tree Lizard), while others are primarily nocturnal (e.g., Western Milksnake). Most species are terrestrial, although some are found in riparian areas (e.g., Valley Gartersnake) or are primarily aquatic (e.g., Northern Spiny Softshell; Barko and Briggler 2006). They exhibit a wide range of behaviors, including courtship behaviors (e.g., pushups by Prairie Lizards; Martins 1993), seasonal migration (e.g., Red-sided Gartersnake; Aleksiuk 1976), and anti-predator behaviors (e.g., Plains Hog-nosed Snakes play dead if threatened; Durso and Mullin 2014). Reptiles are typically cryptic or move so quickly that they can be hard to observe and appreciate, but they exhibit diverse ecologies, life history strategies, behaviors, and roles in broader ecosystems. For additional details about the ecology of individual species, please refer to the online Field Guide available through the Wyoming Natural Diversity Database (*https://fieldguide.wyndd.org/*).

Aspects of reptile ecology can make this taxonomic group vulnerable to various challenges, although one of the most pervasive challenges is an overall lack of knowledge of life history, species trends, and how species respond to challenges (Speight et al. 2025). Less funding is allocated for conservation and research for reptiles relative to other taxonomic groups, which can hinder both detection of concerns and response to concerns (Gibbons et al. 2000, Olson and Pilliod 2022). Human attitudes and behaviors remain critical components of the conservation of many species (Olson and Pilliod 2022). For example, snakes are often feared or otherwise disliked, which can lead to direct killing of individuals or to destruction of their hibernacula, at times resulting in local declines or extirpations. Habitat loss and modification are significant challenges for reptiles (Gibbons et al. 2000). For example, human activities can degrade or reduce rocky outcrops, which is challenging to restore despite providing opportunities for thermoregulation, overwintering sites, and more. Climate change may augment these challenges by altering habitat characteristics and contributing to shifts in the locations of suitable habitat (Biber et al. 2023, Bohm et al. 2016a, Pilliod et al. 2024). Life history traits such as clutch size and other intrinsic factors (e.g., range size) can make some species more vulnerable to possible challenges (Bohm et al. 2016b). For example, species that have small, disjunct populations (e.g., Prairie Lizard, Prairie Racerunner) and limited genetic diversity may have limited ability to adapt to changing environmental conditions. Snake fungal disease may be concerning for snakes in Wyoming and beyond (Lorch et al. 2016). Key strategies to support the conservation of SGCN reptiles can include incorporating reptile ecology into siting for development, continued research, and outreach and communication.

Challenges and actions

Wyoming's SWAP identifies the significant challenges facing SGCN in the state, as well as priority conservation actions to support their conservation. Species-specific challenges and actions are identified in *Table 12*. Please refer to *Chapter 3* for descriptions of how challenges and actions were identified and categorized. Notably, the identified challenges and actions are not inclusive of all potential challenges these species may face; instead this list summarizes the priority challenges and actions at this time, although they may change over the next 10 years.

Table 12. Challenges and actions for Species of Greatest Conservation Need reptiles.

Priority challenges and actions relevant to Species of Greatest Conservation Need reptiles.

Common Name	Challenges	Voluntary actions
Desert Striped Whipsnake	Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. May be susceptible to snake fungal disease. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to snake fungal disease, and response to potential stressors. Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Great Basin Gophersnake	Human disturbances (deliberate killing and hibernacula destruction). Collection (e.g., for pet trade, export/sale). Loss, fragmentation, or degradation of habitat by factors that affect vegetation structure and composition and availability of prey (e.g., small mammals, lizards). Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. May be susceptible to snake fungal disease. Road mortality. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring). Lack of information regarding distribution, abundance, population trends, habitat associations, and response to stressors directly impact the ability to manage for this species.	Survey/research distribution, abundance, habitat associations, population trends, susceptibility to snake fungal disease, and response to challenges such as habitat fragmentation and road mortality. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Work with land managers to minimize disturbance to important habitat features for this species (e.g., rock outcrops) when planning energy or other development projects. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Great Basin Skink	Loss, fragmentation, or degradation of habitat due to factors that negatively impact the integrity of riparian areas and surrounding uplands, soil moisture, vegetation structure and composition, and availability of cover (e.g., rocky debris, logs, leaf litter). Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. Pesticides and herbicides can reduce food resources (namely insects) and negatively affect the species itself. Lack of information regarding distribution, abundance, population trends, habitat associations (due in part to difficulty detecting the species), and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, important food resources, and response to changes in habitat (e.g., increases in invasive plant species). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Great Plains Earless Lizard	Loss, fragmentation, or degradation of sandy, sparsely vegetated, eastern plains habitat. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. Pesticides and herbicides can reduce food resources (namely insects) and negatively affect the species itself. Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, and response to loss or modification of habitat. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.
Hernandez's Short-horned Lizard	Loss, fragmentation, and degradation of sandy, sparsely vegetated areas. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, and response to challenges like development, invasive vegetation, and conversion of habitat. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Midget Faded Rattlesnake	Human disturbances (deliberate killing and hibernacula destruction). Collection (e.g., for pet trade, export/sale). Factors that affect rock outcrops and vegetation in surrounding uplands can lead to habitat loss, fragmentation, or degradation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. May be susceptible to snake fungal disease. Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Continue efforts to educate the public about the biology and ecological role of reptiles. Improve outreach on how to live, work, and hike safely in rattlesnake country. Survey/research distribution, abundance, habitat associations, population trends, susceptibility to snake fungal disease, and response to challenges such as habitat fragmentation and deliberate killing and collection by humans. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Work with land managers to minimize disturbance to important habitat features for this species (e.g., rock outcrops) when planning energy or other development projects. Explore and/or develop alternative funding options to maintain conservation efforts.
Northern Many-lined Skink	Factors that affect the integrity of eastern grasslands and availability of cover can lead to habitat loss, fragmentation, and degradation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. Pesticides and herbicides can reduce food resources (namely insects) and negatively affect the species itself. Lack of information regarding distribution, abundance, population trends, habitat associations (due in part to difficulty detecting the species), and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, and response to challenges like development and conversion of habitat. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Increase efforts to control invasive plant species. Develop techniques to improve species detection. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Northern Rubber Boa	Collection (e.g., for pet trade, export/sale). Factors that affect the integrity of foothill and montane canyon habitat can lead to habitat loss, fragmentation, or degradation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species can change vegetation structure, impacting the availability of important resources including food and basking habitat. Road mortality. May be susceptible to snake fungal disease. Pesticides and herbicides can reduce food resources (namely insects) and negatively affect the species itself. Lack of information regarding distribution, abundance, population trends, habitat associations (due in part to difficulty detecting the species), and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to snake fungal disease, diet, and response to challenges like wildfires, vehicle mortalities, and collection for pet trade. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Work with land managers to conserve the integrity of canyons where the species occurs from development, recreation, and land conversion and minimize pesticide use. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.
Northern Spiny Softshell	Changes in the amount and timing of water, availability of sand and gravel bars, and structure and composition of riparian vegetation can lead to habitat loss, fragmentation, and degradation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, and response to challenges like human altered flow regimes, invasive vegetation, nest predation, and climate change. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify and protect important nesting areas. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Northern Tree Lizard	Factors that affect rock outcrops can lead to habitat loss, fragmentation, or degradation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, and response to challenges like development. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.
Ornate Box Turtle	Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. Collection (e.g., for pet trade, export/sale). Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, habitat associations, and factors limiting the population in Wyoming. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Plains Black-headed Snake	Factors that affect soil composition and structure, vegetation composition and structure, and availability of cover (e.g., rocky debris, logs) can lead to habitat loss, fragmentation, or degradation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. May be susceptible to snake fungal disease. Pesticides and herbicides can reduce food resources (namely insects) and negatively affect the species itself. Lack of information regarding distribution, abundance, population trends, habitat associations (due in part to difficulty detecting the species), and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to snake fungal disease, and response to challenges like habitat conversion, climate change, and vehicle mortalities. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.
Plains Gartersnake	Factors that affect the structure and composition of riparian vegetation or availability of prey can lead to habitat loss, fragmentation, or degradation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. May be susceptible to snake fungal disease. Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to snake fungal disease, diet, and response to challenges like development and climate change. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Plains Hog-nosed Snake	Factors that affect soil compaction, availability of small mammal burrows, and prey availability can lead to habitat loss, fragmentation, or degradation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. Similarity in appearance to rattlesnake leads to persecution and deliberate killing. Road mortality. Collection (e.g., for pet trade, export/sale). May be susceptible to snake fungal disease. Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to snake fungal disease, diet, and response to challenges like development and land use practices. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts. Conduct a public outreach campaign to reduce persecution due to misidentification as rattlesnakes.
Plains Short-horned Lizard	Loss, fragmentation, and degradation of sandy, sparsely vegetated areas. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations and response to challenges like development, invasive vegetation, and land use practices. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Plateau Fence Lizard	Factors that affect rock outcrops can lead to habitat loss, fragmentation, or degradation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, and response to challenges like development. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.
Prairie Lizard	Loss of and fragmentation between places with complex structure within grasslands and shrublands in the eastern plains, as well as rock outcrops. This fragmentation has led to small, disjunct populations that suffer from low genetic diversity, limiting the species' ability to adapt to stressors. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. Pesticides and herbicides can reduce food resources (namely insects) and negatively affect the species itself. Lack of information regarding distribution, abundance, population trends, habitat associations, genetic differentiation between Laramie Mountain populations and plains populations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, genetic diversity and connectivity, and response to factors that affect habitat loss and fragmentation. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Support research that uses genetic methods to clarify the taxonomy between prairie lizard populations that occur in the Laramie Mountains and those that occur on the eastern plains. Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Increase efforts to control invasive plant species. Because of genetic differentiation and different habitat requirements, manage the populations in the Laramie Mountains separately from populations that occur on the eastern plains. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Prairie Racerunner	Loss of and fragmentation of intact grasslands and shrublands in the eastern plains. This fragmentation has led to small, disjunct populations that suffer from low genetic diversity, limiting the species' ability to adapt to stressors. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. Pesticides and herbicides can reduce food resources (namely insects) and negatively affect the species itself. Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, genetic diversity and connectivity, and response to challenges like invasive species, development, and land use practices. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.
Prairie Rattlesnake	Human-caused mortality and destruction of hibernacula. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. May be susceptible to snake fungal disease. Lack of information regarding distribution, abundance, population trends, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, habitat associations, population trends, susceptibility to snake fungal disease, and response to challenges such as deliberate killing of snakes and destruction of hibernacula. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Continue efforts to educate the public about the biology and ecological role of reptiles. Improve outreach on how to live, work, and hike safely in rattlesnake country. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Red-bellied Snake	Loss and fragmentation of riparian areas, wet meadows, and adjacent forested uplands. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. Road mortality (Blais et al. 2023). May be susceptible to snake fungal disease. Pesticides and herbicides can reduce food resources (namely insects) and negatively affect the species itself. Lack of information regarding distribution, abundance, population trends, habitat associations (due in part to difficulty detecting the species), and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to snake fungal disease, diet, and response to challenges like land use practices, road mortality, and changes in vegetation and soil moisture resulting from climate change. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Work with land managers to conserve the integrity of foothills riparian areas. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.
Red-sided Gartersnake	Factors that affect the structure and composition of riparian vegetation or availability of prey can lead to habitat loss, fragmentation, or degradation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. May be susceptible to snake fungal disease. Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to snake fungal disease, diet, and response to challenges like development and climate change. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Smooth Greensnake	Loss and fragmentation of riparian areas, wet meadows, and adjacent uplands. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. May be susceptible to snake fungal disease. Pesticides and herbicides can reduce food resources (namely insects) and negatively affect the species itself. Road mortality (Blais et al. 2023). Lack of information regarding distribution, abundance, population trends, habitat associations (due in part to difficulty detecting the species), and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to snake fungal disease, diet, and response to challenges like land use practices and changes in vegetation and soil moisture resulting from climate change. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Work with land managers to conserve the integrity of foothills riparian areas where the species occurs. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.
Valley Gartersnake	Factors that affect the structure and composition of riparian vegetation or availability of prey can lead to habitat loss, fragmentation, or degradation Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. May be susceptible to snake fungal disease. Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to snake fungal disease, and response to challenges like land use practices, development, and climate change. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Western Milksnake	Collection (e.g., for pet trade, export/sale). Factors that affect soil composition and structure, vegetation composition and structure, and availability of cover (e.g., rocky debris, logs) can lead to habitat loss, fragmentation, or degradation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. May be susceptible to snake fungal disease. Lack of information regarding distribution, abundance, population trends, habitat associations (due in part to difficulty detecting the species), and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, susceptibility to snake fungal disease, diet, and response to challenges like habitat loss/fragmentation and collection for pet trade. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify vital habitats (e.g., winter hibernacula) and work with landowners and land managers to minimize disturbance to important resources. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.

Common Name	Challenges	Voluntary actions
Western Painted Turtle	Factors that affect the availability of water and hydroperiod, as well as soil compaction, vegetation composition, and vegetation structure surrounding water bodies can lead to habitat loss, fragmentation, and degradation. Climate change may alter temperature and precipitation patterns, shift breeding phenology, alter sex ratios, desiccate vital habitats, contribute to range shifts, and decrease the availability of important food resources. Invasive plant species (e.g., cheatgrass, Canada thistle, Russian olive) can change the vegetation structure and composition of habitat, impacting the availability of important resources including food, nesting habitat, cover, and basking habitat. Road mortality. Lack of information regarding distribution, abundance, population trends, habitat associations, and response to and severity of stressors directly impact the ability to manage for this species. Insufficient funding and resources available for conservation of this species (e.g., habitat improvement, research, monitoring).	Survey/research distribution, abundance, population trends, habitat associations, and response to challenges like degradation of nesting habitat and altered water availability and hydroperiods. Support research to help understand how species respond to climate change, especially changes to habitat quality and the timing of phenological events (e.g., breeding, summer foraging, overwintering). Identify and protect important nesting areas. Increase efforts to control invasive plant species. Continue efforts to educate the public about the biology and ecological role of reptiles. Explore and/or develop alternative funding options to maintain conservation efforts.

Chapter 12: Terrestrial habitat type and aquatic basin overview

From headwaters surrounded by montane forests to slow-moving streams meandering through the prairie, Wyoming's terrestrial and aquatic habitats support the health and diversity of wildlife across the state. Habitat provides the necessary food, water, shelter, space, and other resources for species to carry out their life cycles, and it is represented by terrestrial habitat types and aquatic basins in Wyoming's 2027 State Wildlife Action Plan (SWAP). Given that wildlife use a diversity of habitat throughout Wyoming, all habitats were considered key for the conservation of Species of Greatest Conservation Need (SGCN).

The terrestrial habitat types and aquatic basins that were identified in the 2010 SWAP and used in the 2017 revision were retained during this revision. These habitat types and aquatic basins were identified to create habitat delineations that:

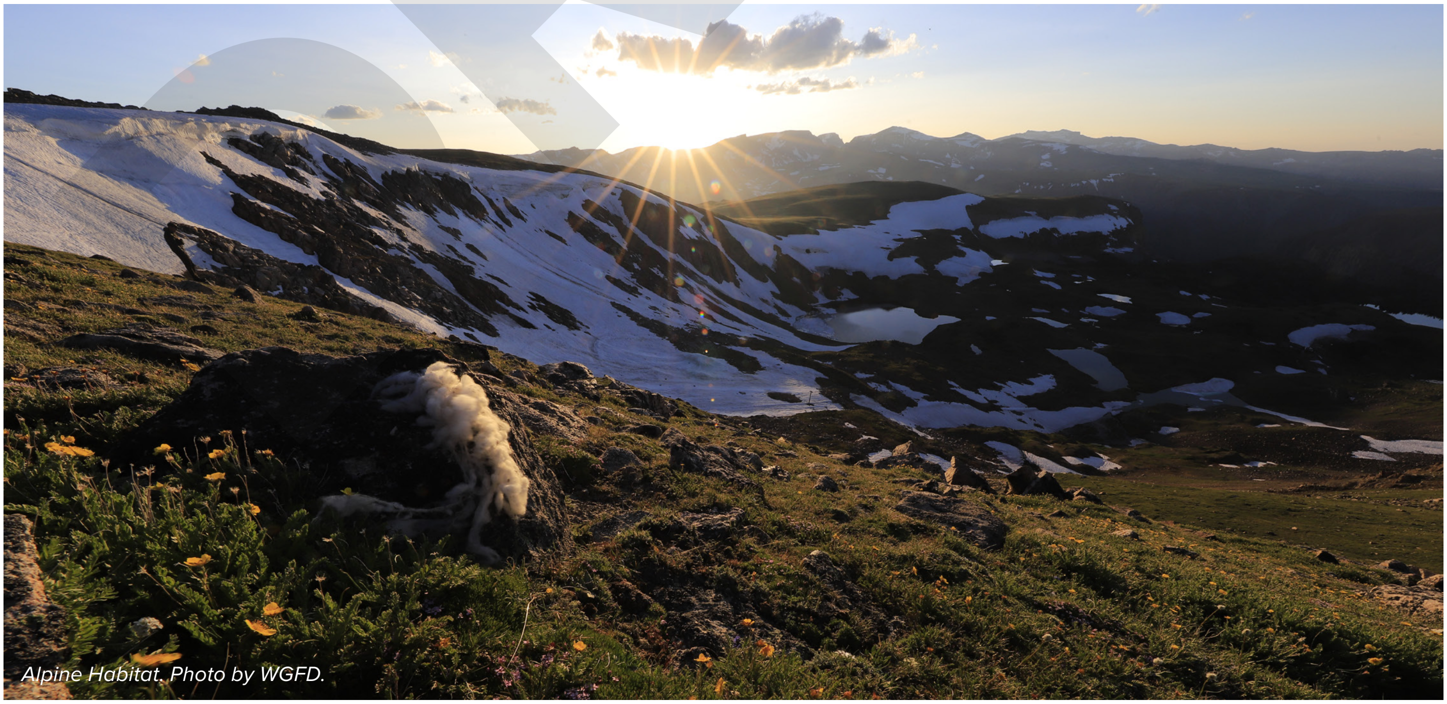
1. Contain similar flora, fauna, and conservation concerns;

2. Reflect scales that are consistent with those frequently used in wildlife management;

3. Describe habitats that are easily recognized by the public and policy makers; and

4. Result in a manageable number of habitats for planning purposes.

Chapters for each of the terrestrial habitat types and aquatic basins are standalone. Each chapter contains the following components: 1) description, location, and relative condition of the terrestrial habitat type or aquatic basin, 2) a map, 3) a list of SGCN that are characteristic of the terrestrial habitat type or aquatic basin, and 4) a list of priority challenges and actions that are relevant to the conservation of SGCN and their habitats.



Alpine Habitat. Photo by WGFD.

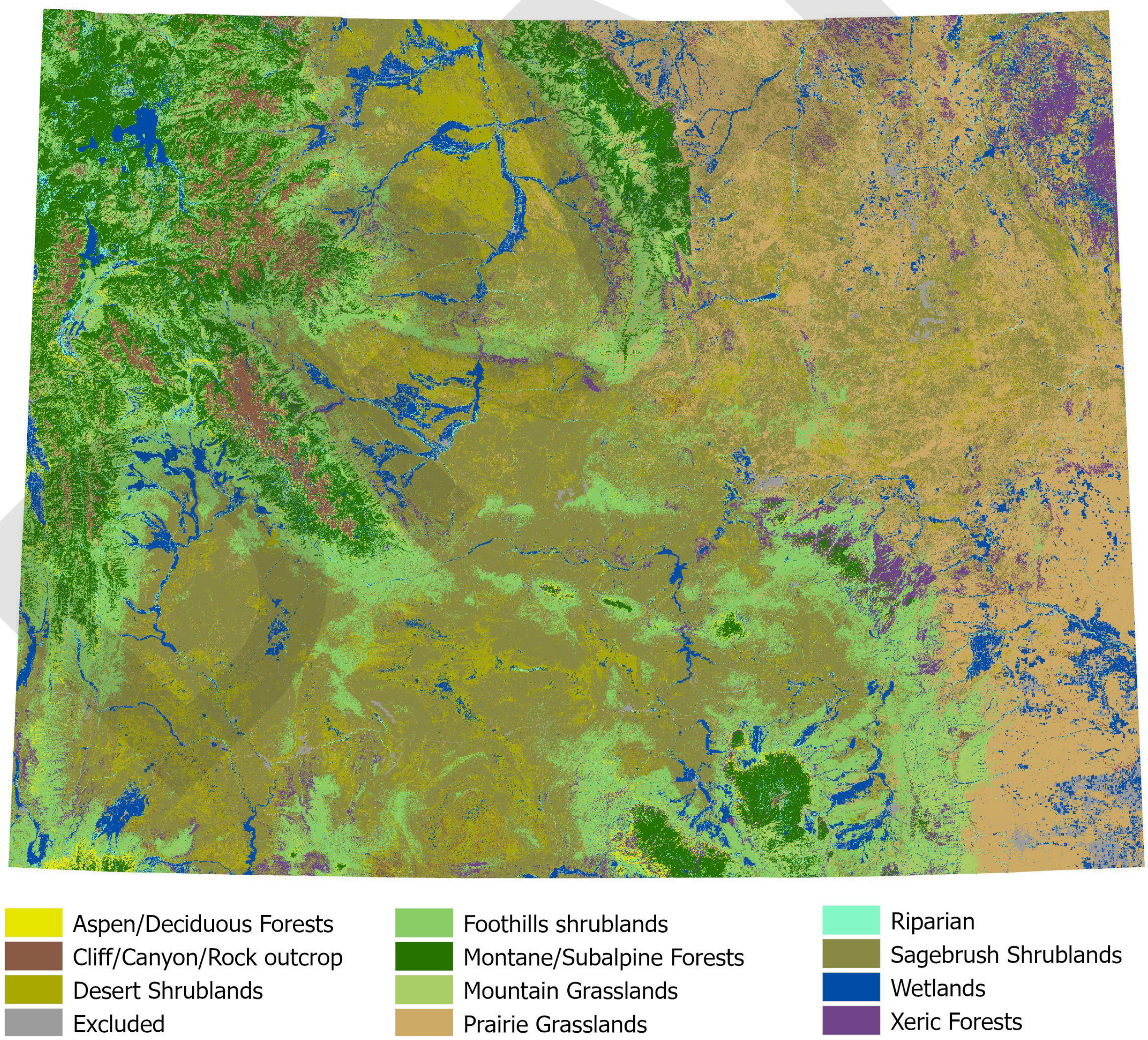
Habitat classification systems

Terrestrial habitat types

The 11 terrestrial habitat types that were identified in previous versions of Wyoming's SWAP were retained (*Figure 1*). These terrestrial habitat types closely resemble major types described in Knight et al. (2014). These 11 terrestrial habitat types encompass finer-scale ecological systems that have been lumped together based on shared ecological characteristics. Previous versions of Wyoming's SWAP used NatureServe Terrestrial Ecological Systems (TES) and USGS 2010 GAP to classify and map terrestrial habitat types, respectively. For the 2027 revision, the TES approach was used again to classify terrestrial habitat types, and LANDFIRE (v. 2023) was used to map them. In 2017, terrestrial habitat experts assigned each TES within Wyoming to one of the 11 terrestrial habitat types. For the 2027 revision, a crosswalk was conducted between the TES from the 2017 SWAP and the closest match with the TES in the updated LANDFIRE data. Additional TES were assigned to each of the 11 terrestrial habitat types by terrestrial habitat experts. The 11 terrestrial habitat types and the TES assigned to each are available in *Appendix E*.

Figure 1. Map of terrestrial habitat types.

This map depicts the 11 terrestrial habitat types used in Wyoming's 2027 State Wildlife Action Plan.

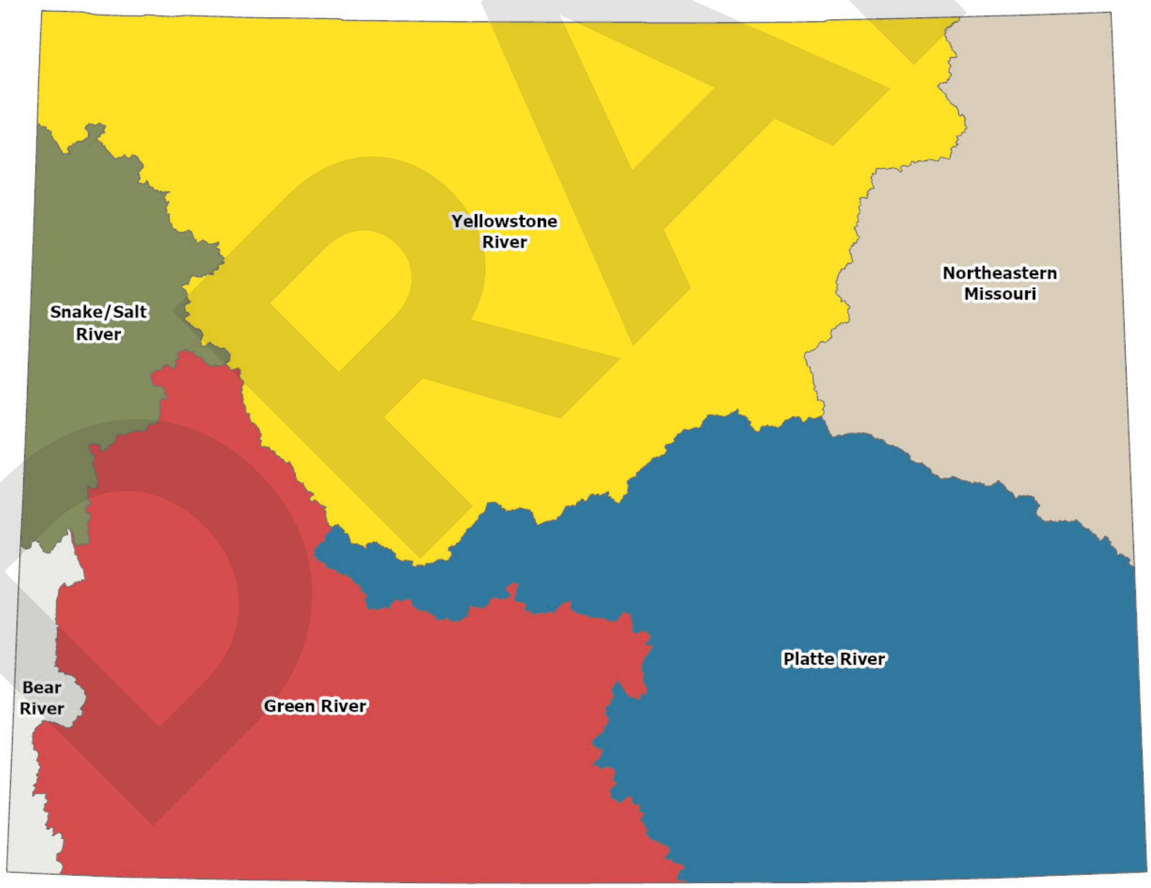


Aquatic basins

Three of the nation's major river systems have their headwaters in Wyoming: the Missouri, Colorado, and Columbia rivers. Additionally, the Bear River, originating in Wyoming, is a major tributary to the inland Great Basin. Based on hydrographic boundaries, fish assemblages, and management considerations, these watersheds provide a natural basis for delineating the 6 aquatic basins in Wyoming's SWAP (*Figure 2*). These aquatic basins have been used since Wyoming's 2005 SWAP. Aquatic basins each include one to four "subregions" (4-digit hydrologic unit code [HUC] watersheds) that are delineated using the Watershed Boundary Dataset v. 2.3.1 (U. S. Geological Survey 2023). This approach allows the nesting of multiple spatial and temporal scales for planning and prioritizing conservation actions. The areas are consistent with the aquatic ecosystems identified for freshwater biodiversity conservation worldwide by Abell et al. (2008). The watershed areas are also synonymous with "aquatic zoogeographical units" and "ecological drainage units" identified under The Nature Conservancy's hierarchical classification framework (Higgins et al. 2005).

Figure 2: Map of aquatic basins.

This map depicts the 6 aquatic basins used in Wyoming's 2027 State Wildlife Action Plan.



Habitat descriptions

Terrestrial habitat types

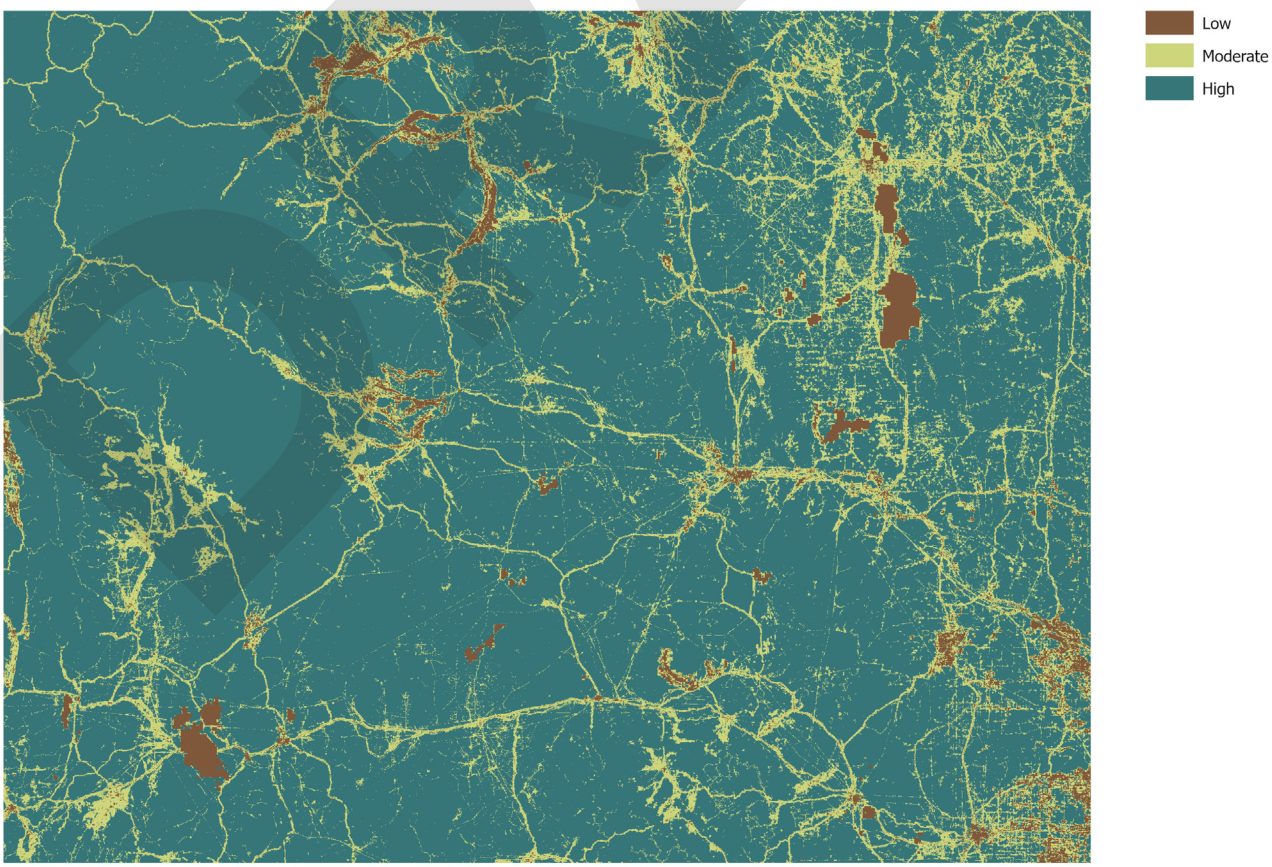
For each terrestrial habitat type, the habitat type is described based on the dominant vegetation and its location in the state, and a map visualizes where the habitat type occurs throughout the state. Descriptions also include reports of minimum and maximum elevation (U. S. Geological Survey 3D Elevation Program [3DEP]; 30 m resolution for minimum and 10 m resolution for maximum elevation; U. S. Geological Survey 2024), the percent of the state that is covered by the habitat type, and the relative condition of the habitat type using a measure of habitat intactness described below. Finally, each chapter contains a list of SGCN that are characteristic of the habitat type and the role of the habitat type for SGCN.

Following the 2017 SWAP, habitat intactness was used to characterize relative habitat condition (*Figure 3*). The habitat intactness layer was originally created using the methodology outlined in Copeland et al. 2007, and for this revision the layer was updated with recent datasets. This layer reflects current anthropogenic surface intactness based on eight criteria: high/medium urban development, low urban development, tilled agriculture, untilled agriculture, primary/secondary roads, local/primitive roads, active oil and gas wells, inactive oil and gas wells, pipelines, power lines, wind turbines, active mines, inactive mines, and meteorological and cell towers. Each input was given a disturbance weight, cutoff distance of impact, and distance decay function based on euclidean distance at a 30-meter resolution (*Appendix F*). Inputs were then combined to give a score from zero to one and assigned the following categories: low intactness/high human disturbance (<0.34), moderate intactness/moderate human disturbance (0.34 – 0.67), and high intactness/low human disturbance (>0.67) .

Due to differences in data inputs, direct comparisons between values in the 2017 SWAP and this version should not be made.

Figure 3. Map of terrestrial habitat condition.

This map depicts habitat intactness, a measure of terrestrial habitat condition, across Wyoming. This map reflects current anthropogenic surface intactness based on criteria described in text.



Aquatic basins

Each aquatic basin includes a description of the primary hydrological features, climate, and elevation range. Primary hydrological features include basins (6-digit HUCs) and major drainages. Climate is characterized by 30-year normals (1991 – 2020) for mean annual temperature, mean January temperature, mean July temperature, and mean annual precipitation (PRISM Group 2025). Elevation range is the minimum and maximum elevation within each basin (3DEP; 30 m resolution for minimum and 10 m resolution for maximum elevation; U. S. Geological Survey 2024). Chapters contain a description of the location and a map of the basin. Each chapter also includes a list of fish, turtles, mollusks, and crustaceans found within the basin.

The relative condition of each basin is presented as 1) the percentage of each type of landownership (federal, private, state, and other) type within the basin (Bureau of Land Management 2022), 2) the miles of streams (U. S. Geological Survey 3D National Hydrography Program 2025), 3) miles of impaired streams and rivers (4a, 5, and 5R) and number of impaired lakes or reservoirs (4a and 5; Wyoming Department of Environmental Quality 2025), and 4) the number of dams and road crossings with at least moderate barrier severity (National Aquatic Barrier Inventory and Prioritization Tool, Southeast Aquatic Resources Partnership 2024).

Fish Bypass Channel On Clear Creek. Photo by Stephen Siddons/WGFD.

PPM Reintroduction Monitoring On North Platte River Above Glendo Reservoir. Photo by Stephen Siddons/WGFD.

Lodgepole Creek Seining. Photo by WGFD.

Challenges and actions

Working groups of technical experts identified priority challenges and actions for each terrestrial habitat and aquatic basin. There were >60 working group members across the 17 working groups; group size ranged from 2 – 7 members, and they were made up of experts from the Wyoming Game and Fish Department and other organizations across the state with relevant technical expertise.

Priority challenges for each habitat type or aquatic basin were identified using a modified version of the ecosystem status assessment framework detailed in Master et al. (2012), which is a robust and widely-used framework. Through this status assessment, a broad range of technical expertise identified the challenges that could negatively affect the habitats that SGCN rely on within the next 10 years.

Each working group member independently determined the scope, severity, and timing of a suite of challenges that could apply to the habitat type or basin. Following best practices recommended by the Association of Fish and Wildlife Agencies (AFWA), challenges were drawn from the International Union for Conservation of Nature–Conservation Measures Partnership Classification of Direct Threats to Ecosystems and Species version 4.0 (AFWA 2012, Salafsky et al. 2024). Definitions for scope, severity, and timing were drawn from Master et al. (2012; *Table 13*). After every working group member independently completed their assessment, they could review the assessments of other working group members and modify their assessment if desired.

Table 13. Scope, severity, and impact framework used to identify priority challenges.

Impact is the intersection of severity and scope; only challenges with "Very high" or "High" impact (in bold) were identified in Wyoming's 2027 SWAP. Please refer to Master et al. (2012) for additional details on this framework.

		Severity Level of damage within the portion of the habitat type that is affected by the challenge that can reasonably be expected with continuation of current circumstances and trends.				
		Extreme Likely to destroy or eliminate the habitat type.	**Serious** Likely to seriously degrade or reduce habitat type.	**Moderate** Likely to moderately degrade or reduce the habitat type.	**Slight** Likely to only slightly degrade or reduce the habitat type.	**NA** Does not degrade or reduce habitat at all.
Scope Percentage of habitat that can be expected to be affected by the challenge within 10-20 years with continuation of current circumstances and trends.	**Pervasive** 71 – 100%	**Very high**	**High**	Medium	Low	NA
	Large 31 – 70%	**High**	**High**	Medium	Low	NA
	Restricted 11 – 30%	Medium	Medium	Low	Low	NA
	Small 1 – 10%	Low	Low	Low	Low	NA
	NA 0%	NA	NA	NA	NA	NA

To prioritize the most significant conservation challenges, only challenges with a “very high” or “high” impact are reported. Impact is the intersection between scope and severity, and ranges from low to very high. A challenge was determined to be relevant to a habitat type or aquatic basin if >51% of the working group members considered the scope of a possible challenge to be large or pervasive and the severity of a possible challenge to be extreme or serious (*Table 13*). In working groups with an even number of members, technical experts at the Wyoming Game and Fish Department provided tie-breakers.

After challenges were identified, working group members identified priority voluntary actions that could support habitat conservation. Working group members were advised to consider a wide range of possible actions based on the Conservation Measures Partnership Action Classification v. 2.0 and to suggest actions that were collaborative, voluntary, forward-looking, and applicable to more than one species. Additionally, actions were crafted to be 1) specific enough to provide guidance without being constraining, 2) measurable, and 3) achievable within the next 10 years under realistic social and economic scenarios.

Each terrestrial habitat and aquatic basin chapter includes priority challenges and corresponding priority voluntary conservation actions.

Priority areas

Priority conservation areas for terrestrial habitat types and aquatic basins may support coordinated and strategic conservation efforts.

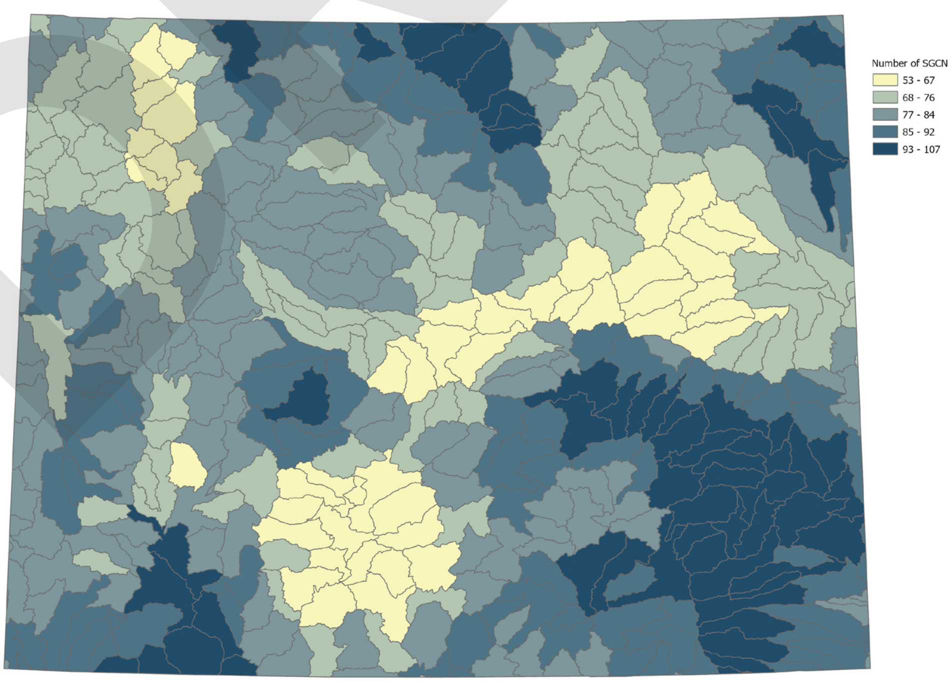
Terrestrial habitat types

In the 2017 SWAP revision, it was decided that terrestrial SGCN considerations are best integrated into conservation planning through the use of improved mapping systems and availability of geographic data. In addition to the habitat intactness layer and maps of terrestrial habitat types, a layer depicting the total number of amphibian, bird, mammal, and reptile SGCN in each 10-digit HUC watershed was generated using the currently accepted range for each species (*Figure 4*). These layers can be used individually or in combination with other resources to generate geographic data relevant to user needs.

Terrestrial priority areas are also identified in Wyoming Game and Fish Department’s Statewide Habitat Plan (SHP). The SHP is not connected to the SWAP, although many of the goals align. Please refer to the SHP for additional information on these priority areas.

Figure 4. Map of terrestrial priority areas.

This map displays the number of amphibian, bird, mammal, and reptile Species of Greatest Conservation Need in each 10-digit hydrologic unit code (HUC) watershed.



Aquatic basins

Priority aquatic conservation areas represent areas in each aquatic basin where density and/or sensitivity of aquatic SGCN merit increased focus and prioritization. These areas generally represent only a fraction of the streams in each basin, but the management of fishes and habitats in these streams is critical to WGFD efforts to conserve Wyoming's rarest native fishes.

Fish conservation primarily guided the identification of conservation areas, although mollusk and turtle conservation were considered when information was available. Technical experts within the Wyoming Game and Fish Department identified priority watersheds (10-digit HUCs), guided by previous inventories and assessments (Patton 1997, Stewart et al. 2015). Each basin chapter includes a brief narrative describing and a map visualizing priority aquatic conservation areas. Please refer to the SHP for additional information regarding priority areas.

Availability of geospatial data

Geospatial data is available through Wyoming Natural Diversity Database's Data Explorer (https://wyndd.org) or through the Wyoming Game and Fish Department.

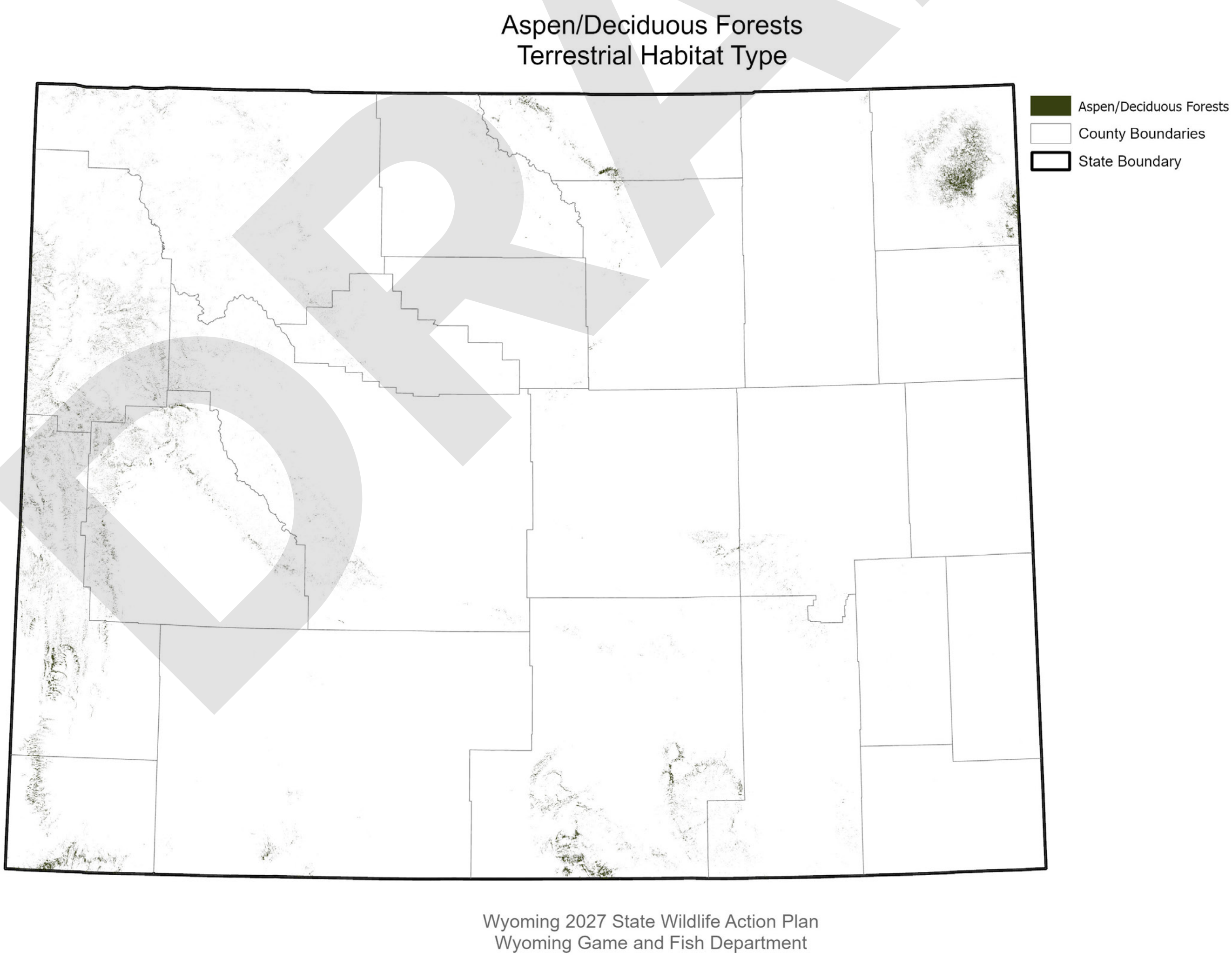
Menance Falls. Photo by Troy Fieseler/WGFD.

Chapter 13: Aspen/Deciduous Forest

The Aspen/Deciduous Forest habitat type consists of the NatureServe Terrestrial Ecological Systems dominated by quaking aspen (*Populus tremuloides*), bigtooth maple (*Acer grandidentatum*), bur oak (*Quercus macrocarpa*), or gambel oak (*Quercus gambelii*; Appendix E). The herbaceous understory can be lush, and herbaceous plants include bluegrass (*Poa* spp.), heart-leaf arnica (*Arnica cordifolia*), lupine (*Lupinus* spp.), meadow-rue (*Thalictrum* spp.), and sedges (*Carex* spp.). Additional dominant species in these systems include box elder (*Acer negundo*), chokecherry (*Prunus virginiana*), narrowleaf cottonwood (*Populus angustifolia*), plains cottonwood (*Populus deltoides*), Rocky Mountain maple (*Acer glabrum*), and snowberry (*Symphoricarpos* spp; Knight et al. 2014).

Aspen/Deciduous Forests cover about 1% of Wyoming and occur in patches from 3,196 to 11,512 feet in elevation (*Figure 5*). The largest concentrations of aspen forests are found on the Sierra Madre, Wyoming, Wind River, Gros Ventre, Medicine Bow, and Laramie mountain ranges. Small and isolated aspen stands occur in Wyoming's intermountain basins as well. Oak-dominated woodlands are found only in small areas of the northern and eastern slopes of the Black Hills (bur oak) and on the west side of the Sierra Madre (gambel oak). Portions of northeastern Wyoming support moist ravines and draws dominated by bigtooth maple and associated deciduous shrubs. The Aspen/Deciduous Forests habitat type is characterized by 0.3% low intactness, 6.5% moderate intactness, and 93.2% high intactness. Please refer to *Chapter 12* for details about data, data sources, and methodology.

Figure 5. Map of Aspen/Deciduous Forest in Wyoming.



Aspen communities are among the most important habitat types for wildlife in Wyoming, as well as globally, and they support biodiversity across taxa (Kuhn et al. 2011, Rogers et al. 2020, Swift et al. 2017). Aspen habitats often include species-rich plant understories and high insect biomass (Kuhn et al. 2011), providing food for herbivores such as Mule Deer and insectivores including shrews, bats, MacGillivray's Warbler, and Valley Gartersnake (*Table 14*). Aspen stands also provide important nesting, hiding, and roosting habitat for many species. For example, Smooth Greensnake hide and nest under downed logs, Williamson's Sapsucker excavate holes for nesting, and multiple bat species roost in cavities.

Mixed communities in which oak forms a prominent mid-story between a herbaceous layer and conifer canopy are rather rare in Wyoming and may play an important role in providing a unique habitat for some wildlife (Kaufmann et al. 2016). Old stands of gambel oak contain large amounts of dead crown wood and hollow boles and limbs that provide nesting sites for small mammals and birds. In addition to cover, the acorns of bur oak and gambel oak provide energy-rich food for wildlife.

Table 14. Aspen/Deciduous Forest characteristic Species of Greatest Conservation Need.

Species of Greatest Conservation Need that are characteristic of the Aspen/Deciduous Forest habitat type in Wyoming. Refer to *Appendix D* for a full list of species that are associated with this habitat type.

Taxonomic group	Characteristic Species of Greatest Conservation Need
Amphibians	Columbia Spotted Frog, Western (Boreal) Toad, Wood Frog
Birds	American Goshawk, American Kestrel, Boreal Owl, Calliope Hummingbird, Columbian Sharp-tailed Grouse, Flammulated Owl, Great Gray Owl, Lewis's Woodpecker, MacGillivray's Warbler, Purple Martin, Red-headed Woodpecker, Williamson's Sapsucker
Mammals	Eastern Red Bat, Fringed Myotis, Little Brown Myotis, Long-legged Myotis, Mule Deer, Northern Long-eared Myotis, Pallid Bat, Spotted Bat, Townsend's Big-eared Bat, Western Pygmy Shrew, Western Small-footed Myotis
Plants	There are no plant SGCN species centered in Aspen/Deciduous Forests.
Reptiles	Red-bellied Snake, Smooth Greensnake, Valley Gartersnake

Challenges and Actions

The following challenges have been identified for Aspen/Deciduous Forests and the species of Greatest Conservation Need (SGCN) that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this habitat type at a local scale, the challenges identified here are significant concerns across much of the habitat type in Wyoming. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Recruitment and survival of aspen and other vegetation can be reduced by overutilization (Granger et al. 2017, Reikowski et al. 2022, Rhodes et al. 2018). Voluntary actions to address this challenge include:

- Work with land managers to adjust land use management when necessary to promote aspen recruitment and survival.
- Manage elk and other wild ungulate populations within the herd objective.
- Coordinate with federal partners and private landowners to implement large, landscape-scale, cross boundary treatments to spread herbivory out over larger areas.

Aspen ecology is intertwined with fire, and aspen requires periodic disturbance to become established and regenerate (Shinneman et al. 2013). Fire suppression and lack of disturbance can lead to conifer encroachment and severe wildfires, which can affect community composition and degrade habitat quality for wildlife (McCullough et al. 2012, Stam et al. 2008). Voluntary actions to address this challenge include:

- Promote the use of prescribed fire to enhance aspen communities, reduce fuel loading, and prevent catastrophic fires (Bartos and Mueggler 1981, Livingston et al. 2016).
- Develop fire plans where naturally caused wildfires are allowed to burn specific areas.
- Encourage sustainable forest management to reduce fuels on federal lands.

Elk populations that are over objective and increasing conifer encroachment can affect regeneration and community composition (Kaye et al. 2005, Reikowski et al. 2022). Voluntary actions to address this challenge include:

- Manage elk and other wild ungulate populations within the herd objective.
- Increase the number and size of aspen treatments. Promote treatments that target conifer removal.

Climate change can affect aspen and deciduous trees both directly through changing temperature and moisture availability, as well as indirectly through increased disease and insect susceptibility and changing fire dynamics (Refsland and Cushman 2021). Sudden aspen decline (SAD), landscape-level loss of aspen stands, has been linked to reduced moisture availability and drought (Singer et al. 2019). In general, deciduous tree communities are likely to be threatened by hotter, drier conditions due to increased mortality and reduced growth (Ayers et al. 2024). Voluntary actions to address this challenge include:

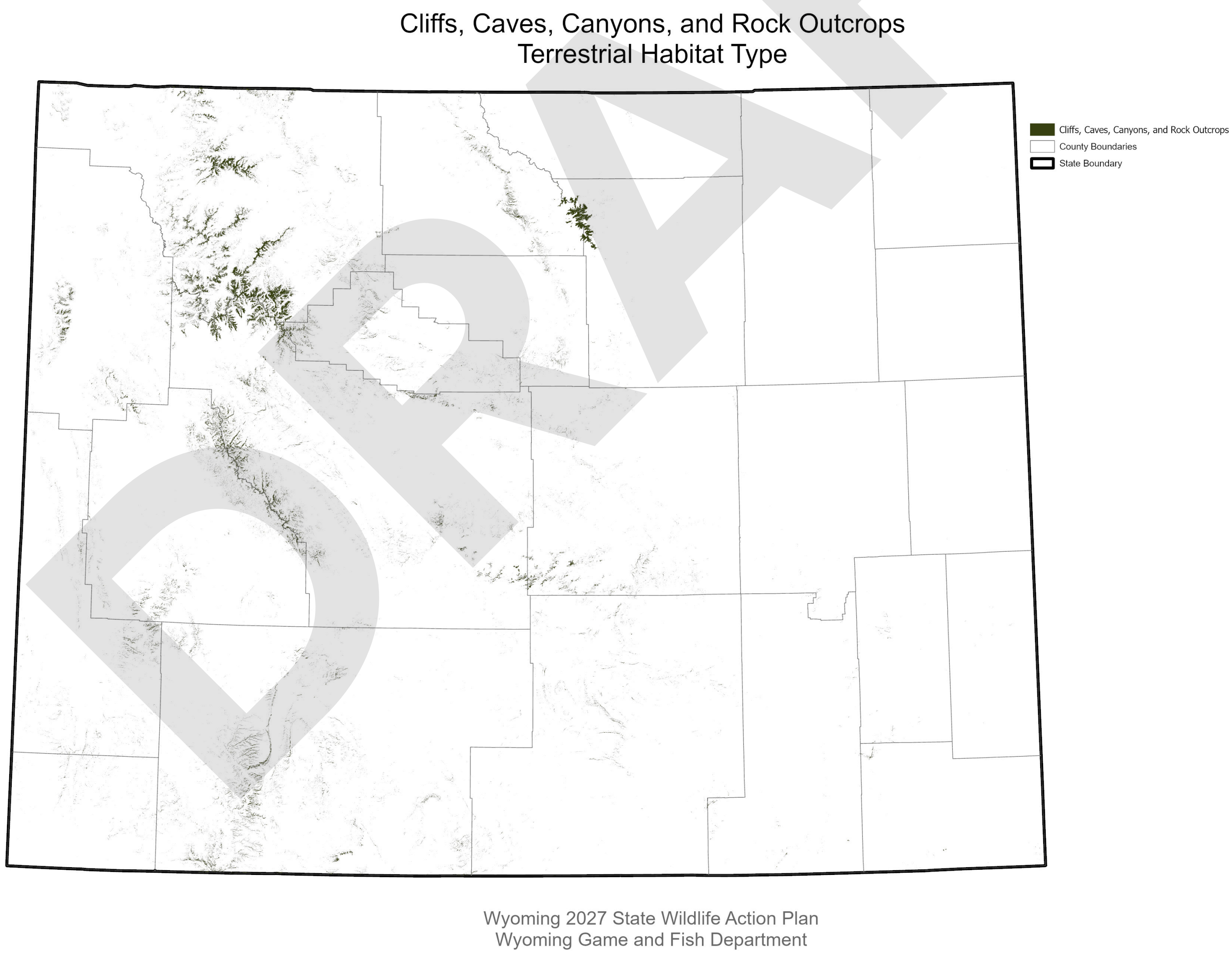
- Conduct research to better understand how aspen will respond to changes in the timing and amount of precipitation.
- Through remote sensing (or other avenues), develop a statewide inventory of aspen that can be used to demonstrate long term changes in aspen stands.
- Design aspen enhancement treatments to ensure multiple age classes exist within a watershed to decrease susceptibility to disease.

Chapter 14: Cliffs, Canyons, Caves, and Rock Outcrops

The Cliffs, Canyons, Caves, and Rock Outcrops habitat type contains the NatureServe Terrestrial Ecological Systems that are dominated by these habitat features (*Appendix E*). Cliffs, canyons, caves, and rock outcrops are common features of the mountainous West, and their unique habitats provide topographic diversity in sometimes homogeneous landscapes. Landscape features are strongly influenced by parent material and geologic processes. These features are typically barren with little soil. Sparse vegetation can sometimes be found along cracks and shelves, and species include limber pine (*Pinus flexilis*), currant (*Ribes* spp.), red raspberry (*Rubus idaeus*), and many lichen species.

This habitat type is found across a wide elevational range (3,274 – 13,789 feet), from high, wet, cold alpine landscapes all the way down to dry desert and warm plains environments (*Figure 6*). It is patchily distributed in the mountain ranges and basins, covering approximately 2% of the state.

Figure 6. Map of Cliffs, Canyons, Caves, and Rock Outcrop habitat in Wyoming.



The Cliffs, Canyons, Caves, and Rock Outcrop habitat type occupies a small percentage of the land base (2%), but it is disproportionately important as wildlife habitat and supports many Species of Greatest Conservation Need (SGCN; *Table 15*). Cliffs, canyons, caves, and rock outcrops benefit wildlife directly by providing structure for shelter, winter hibernacula, protection from predators, and breeding sites, and indirectly by providing diverse vegetation. The wildlife that use these habitats are often highly specialized and may be dependent upon cliffs, rock outcrops, or canyons for aspects of their life cycle. The Cliffs, Canyons, Caves, and Rock Outcrops habitat type is characterized by 0.6% low intactness, 2.8% moderate intactness, and 96.7% high intactness. Please refer to *Chapter 12* for details about data, data sources, and methodology.

Well-known cliff- and rock outcrop-nesting raptors include the Peregrine Falcon, Ferruginous Hawk, and Golden Eagle (Crandall et al. 2016, Grebence and White 1989, Runde and Anderson 1986). The topography of these landscape features causes orographic uplift, which provides wind subsidies for soaring birds (Duerr et al. 2019). Bighorn Sheep feed on the vegetation found on cliffs, canyons, and rock outcrops and also use these habitats to escape predators such as mountain lions (Donovan et al. 2021). Cliff Chipmunk, Canyon Mouse, and Piñon Mouse are restricted to the juniper habitats and rock outcrops of southern Sweetwater County (Rompola and Anderson 2004). American Pika are confined to talus patches, where they cache food and are buffered from external temperatures in both summer and winter (Hall et al. 2016). Permanent snow and ice in proximity to exposed rock are important features of breeding habitat for Black Rosy-Finch and Brown-capped Rosy-Finch. Wolverine use the rocky features underneath snow drifts to structure dens and cache food (Brown 2021, Glass et al. 2022). Bats use caves as winter hibernacula, summer maternity roosts, day roosts, night roosts, and refugia (Weller et al. 2018). This habitat type also provides thermally favorable refuge, cover, hibernacula, and increased foraging opportunities for reptiles (Parker and Anderson 2007, Rurik et al. 2022). In addition, rock outcrop habitat is required by many SGCN plants, many of which have highly restricted distributions.

Table 15. Cliffs, Canyons, Caves, and Rock Outcrops characteristic Species of Greatest Conservation Need.

Species of Greatest Conservation Need that are characteristic of the Cliffs, Canyons, Caves, and Rock Outcrops habitat type in Wyoming. Refer to *Appendix D* for a full list of species that are associated with this habitat type.

Taxonomic group	Characteristic Species of Greatest Conservation Need
Birds	Black Rosy-Finch, Brown-capped Rosy-Finch, Canyon Wren, Ferruginous Hawk, Golden Eagle, Peregrine Falcon
Mammals	American Pika, Bighorn Sheep, Canyon Deermouse, Cliff Chipmunk, Dwarf Shrew, Fringed Myotis, Little Brown Myotis, Long-eared Myotis, Long-legged Myotis, Northern Long-eared Myotis, Pallid Bat, Piñon Mouse, Plains Spotted Skunk, Ringtail, Spotted Bat, Townsend’s Big-eared Bat, Uinta Chipmunk, Western Small-footed Myotis, Western Spotted Skunk, Wolverine, Yuma Myotis
Plants	Barneby's Clover, Colorado Tansyaster, Comb-hair Draba, Dorn's (Tunp Range) Twinpod, Dubois (Plains) Milkvetch, Green River Greenthread, Hairy Greenthread, Hyattville (Starveling) Milkvetch, Kirkpatrick's (Spiked) Ipomopsis, Laramie (Alpine) Clover, Laramie Columbine, Owl Creek Miner's Candle, Parasol Bladderpod, Payson's Draba, Prostrate (Low) Bladderpod, Sessileflower (Indian) Springparsley, Shoshonea, Small (Fremont County) Rockcress, Smallheaded Townsend Daisy, Smooth Summer Milkvetch, Snow Indian Paintbrush, Stemless Beardtongue, Woolly (Common) Twinpod, Wyoming Tansymustard
Reptiles	Great Basin Gophersnake, Midget Faded Rattlesnake, Northern Rubber Boa, Northern Tree Lizard, Plateau Fence Lizard, Prairie Lizard, Prairie Rattlesnake

Challenges and Actions

Cave. Photo courtesy of Bighorn National Forest.

The following challenges have been identified for Cliffs, Canyons, Caves, and Rock Outcrops and the SGCN that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this habitat type at a local scale, the challenges identified here are significant concerns across much of the habitat type in Wyoming. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Multiple diseases and pathogens that affect wildlife, including white-nose syndrome (Weller et al. 2018), affect wildlife that occur in this habitat type. Pathogens can interact with and be exacerbated by other factors, including climate change. Voluntary actions to address this challenge include:

- Collaborate with land managers and researchers to identify priority areas that are critical to the conservation and persistence of large portions of populations of susceptible species. Consider using this information to inform potential restrictions on use of habitat features, where necessary and appropriate.

- Educate recreationists and other land users about the dangers of introducing invasive species and pathogens into sensitive ecosystems, as well as about the importance of decontamination. Conduct education campaigns with a broad range of collaborators, including land managers across agencies, outdoor groups, and other user groups (e.g., local climbing or naturalist groups).

- Pursue policies that require the decontamination of equipment for human activities in these habitats. For example, work with state, federal, and local government environmental commenting or planning boards to require decontamination of gear and equipment when work is conducted in and around these habitats.

Human presence for recreational activities can displace animals at critical life stages (e.g., breeding and hibernating for bats, nesting for birds), interrupt travel to and from critical resources such as water, and reduce survival and recruitment of young (Kolek et al. 2025, Martínez-Abraín et al. 2010). Voluntary actions to address this challenge include:

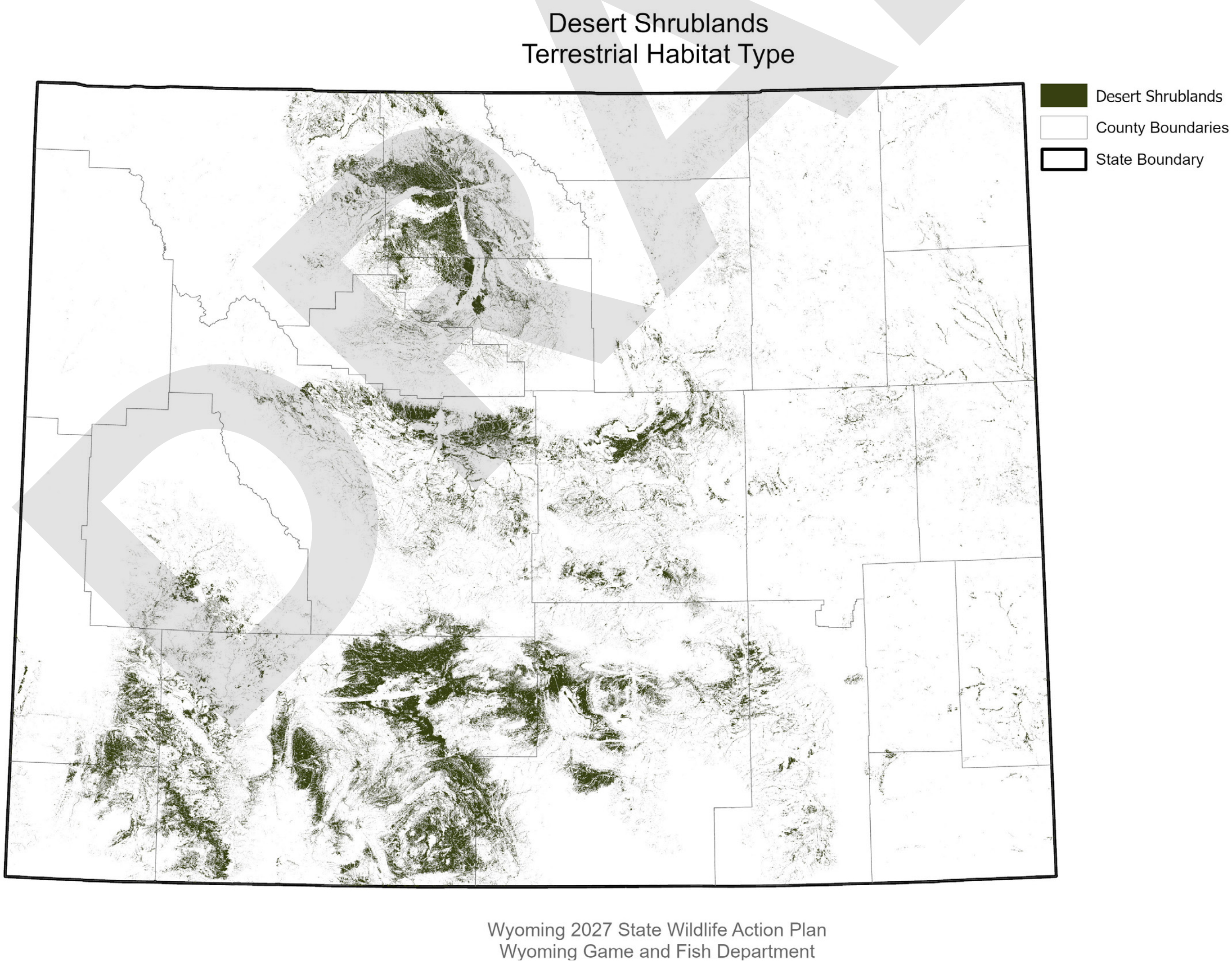
- Work with land management agencies, recreational user groups, and the public to implement voluntary or mandatory spatial-seasonal closures in areas where recreational activities may disturb critical activities of SGCN.

Chapter 15: Desert Shrublands

Desert Shrublands consist of the NatureServe Terrestrial Ecological Systems that are characterized by low primary productivity due to dry conditions, cold temperatures, high soil salinity, and a short growing season (*Appendix E*). Bare ground is common. Common Wyoming desert shrubs include four-wing saltbush (*Atriplex canescens*), gardner's saltbush (*Atriplex gardneri*), greasewood (*Sarcobatus vermiculatus*), shadscale (*Atriplex confertifolia*), spiny hopsage (*Grayia spinosa*), and winterfat (*Krascheninnikovia lanata*; Knight et al. 2014). Grasses associated with desert shrublands include blue grama (*Bouteloua gracilis*), Indian ricegrass (*Eriocoma hymenoides*), prairie junegrass (*Koeleria macrantha*), western wheatgrass (*Elymus smithii*), and wildryes (*Leymus* spp.). Perennial forb cover is generally sparse, although in some areas hood's phlox (*Phlox hoodii*), hooker's sandwort (*Eremogone congesta*), and smooth woodyaster (*Xylorhiza glabriuscula*) are common. The space between plants is frequently covered by a biotic soil crust.

Desert Shrublands cover approximately 7% of the state and typically occur in basins at elevations between 3,117 and 10,807 feet where fewer than 10 inches of precipitation falls annually (*Figure 7*; Knight et al. 2014). Patches are distributed throughout much of the state, with large portions in the Bighorn, Wind River, Great Divide, and Green River Basins. The Desert Shrublands habitat type is characterized by 1.8% low intactness, 12.9% moderate intactness, and 85.3% high intactness. Please refer to *Chapter 12* for details about data, data sources, and methodology.

Figure 7. Map of Desert Shrublands in Wyoming.



Desert Shrublands serve as year-round and seasonal habitat for a wide range of wildlife (*Table 16*). Animals, as well as plants, exhibit wide fluctuations in productivity from year to year, largely as a result of varying weather conditions.

Raptors such as Ferruginous Hawk and Golden Eagle nest on exposed cliffs (Squires et al. 2020). The Wyoming Pocket Gopher, Wyoming's only endemic mammal, is associated with dry, salty, low-productivity sites (Keinath et al. 2014, Britto et al. 2023). Mountain Plover have specific habitat needs, and they rely on Desert Shrublands for nesting (Plumb et al. 2005). Crucial winter range for Mule Deer has been designated in some Desert Shrubland habitat (Wyoming Game and Fish Department 2020). Although this habitat type is arid, amphibians such as Great Basin Spadefoot breed in ephemeral and permanent water sources (Hovingh et al. 1985). In addition to vegetation that provides forage for wildlife and livestock, insects are an important food source for vertebrate wildlife. Wildlife habitat is shared with multiple human uses, including agriculture, energy production and mining, and recreational activities.

Table 16. Desert Shrublands characteristic Species of Greatest Conservation Need.

Species of Greatest Conservation Need that are characteristic of the Desert Shrublands habitat type in Wyoming. Refer to *Appendix D* for a full list of species that are associated with this habitat type.

Taxonomic group	Characteristic Species of Greatest Conservation Need
Amphibians	Great Basin Spadefoot, Plains Spadefoot, Western Tiger Salamander
Birds	Brewer's Sparrow, Burrowing Owl, Ferruginous Hawk, Greater Sage-Grouse, Loggerhead Shrike, Mountain Plover, Sage Thrasher, Sagebrush Sparrow, Short-eared Owl
Mammals	Great Basin Pocket Mouse, Olive-backed Pocket Mouse, Wyoming Pocket Gopher, Yuma Myotis
Plants	Cedar Rim (Desert) Thistle, Desert Glandular Phacelia, Desert Yellowhead, Dropleaf Buckwheat, Dubois (Plains) Milkvetch, Gibbens' Beardtongue, Green River Greenthread, Hyattville (Starveling) Milkvetch, Large-fruited Bladderpod, Mystery (Biennial) Wormwood, Owl Creek Miner's Candle, Precocious Milkvetch, Trelease's Milkvetch, Winward's Goldenweed
Reptiles	Desert Striped Whipsnake, Great Basin Gophersnake, Midget Faded Rattlesnake, Plains Short-horned Lizard, Prairie Rattlesnake

Challenges and Actions

The following challenge was identified for Desert Shrublands and the Species of Greatest Conservation Need (SGCN) that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this habitat type at a local scale, the challenge identified here is significant concerns across much of the habitat type in Wyoming. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Invasive species such as invasive annual grasses (especially cheatgrass [*Bromus tectorum*]), Russian thistle (*Salosa* spp.), halogeton (*Halogeton glomeratus*), alyssum (*Alyssum* spp.), and feral horses (*Equus ferus*) can affect desert shrublands through competition with native species, changing fire frequency, and more (Balch et al. 2013, Chambers et al. 2014, Hak and Comer 2020, Wilcox et al. 2012). Invasive species can accompany and be exacerbated by other factors, including human disturbance (Boyte et al. 2016). Voluntary actions to address this challenge include:

- Develop diverse partnerships (weed and pest, conservation districts, land managers, permittees, landowners, energy developers, NGOs, funders, etc.) to fund and coordinate treatment of invasive plant species, prioritizing areas of early invasion where control is most effective and efficient.
- Work with local, state, and federal natural resource managers to create long term treatment plans designed around the "Defend the Core, Grow the Core" concept (Doherty et al. 2024).

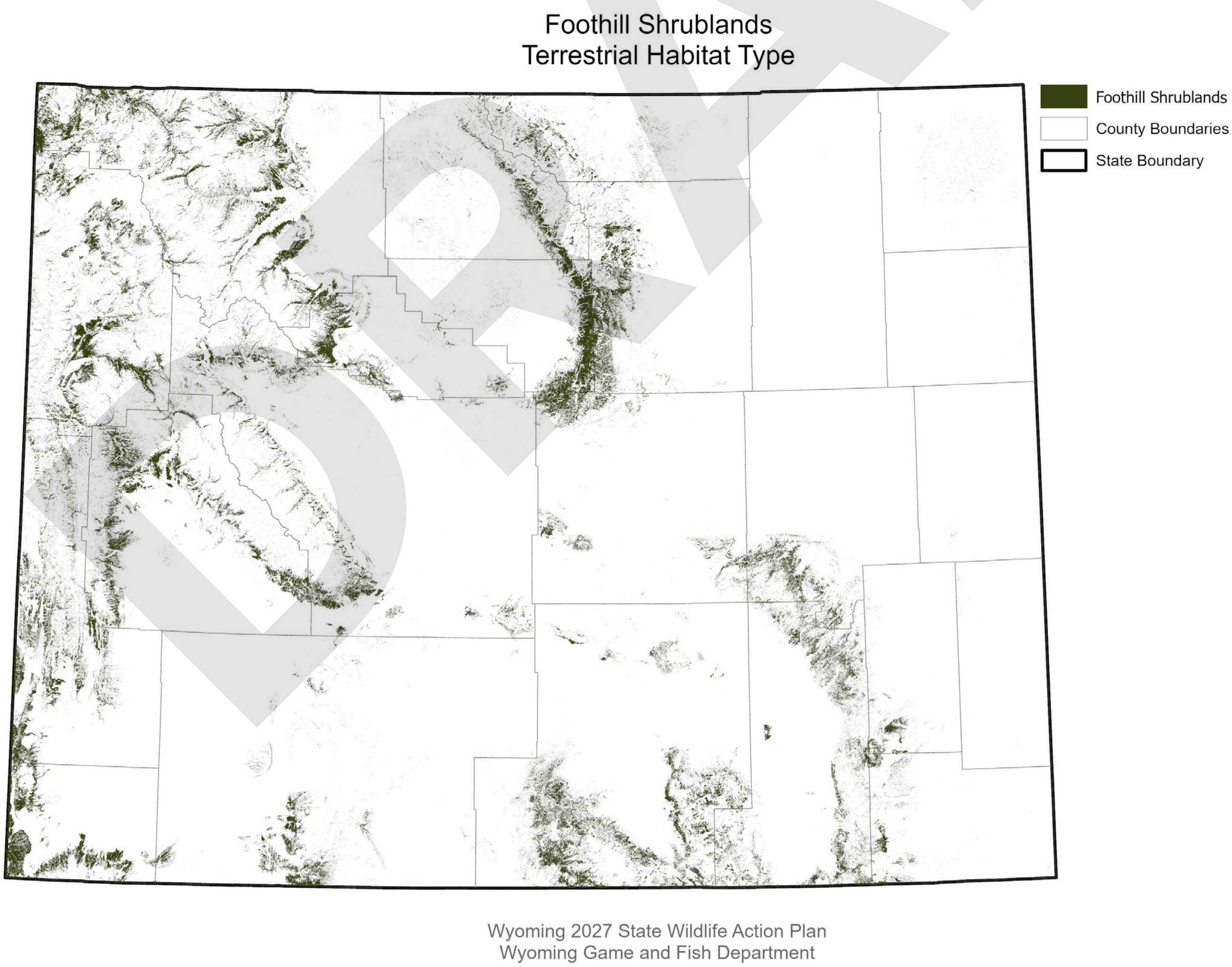
- Use both biological and chemical techniques for control of invasive plant species.
- When controlling or managing invasive plant species (especially when using herbicides), account for the occurrence of SGCN plants and incorporate monitoring for SGCN plants.
- Minimize introduction of invasive plant species by land use practices by implementing best practices and supporting local, state, and federal permitting. Best practices include cleaning of equipment and vehicles before transport, feeding livestock with weed-free feed prior to moving to new rangelands, minimizing off-trail offroad use, and hosting education events and cleaning stations for organized recreational events.
- Support planning tools, mapping and survey efforts, and other decision-support tools (i.e. modeling, future climate scenarios) to assist in the prioritization of treatment locations and identify management objectives (i.e., prevention, early detection and rapid response, suppression).
- Encourage adoption and implementation of the Wyoming Seed Strategy, including 1) using genetically and ecologically suitable, native, diverse native seed for reclamation work, and 2) working collaboratively to develop an adequate seed supply for habitat reclamation.
- Encourage developers to incorporate control of invasive vegetation as a routine practice through the entire life of their projects, including pre-treatment control, during operations, and post-reclamation.
- Work cooperatively to ensure adequate resources exist to enforce restrictions on offroad use and to educate recreationalists on the damage done by illegal offroad use.
- Collaborate with state and federal agencies regarding land use management to promote healthy native vegetation resistant to invasive species.
- Collect and provide vegetative data to support targeted feral horse reductions or removals in areas where rangeland health has or could be impacted.
- Support policy changes for feral horse management actions that allow for successful native plant restoration.

Chapter 16: Foothills Shrublands

The Foothill Shrublands habitat type, commonly known as mixed mountain shrubs, consists of the NatureServe Terrestrial Ecological Systems that are characterized by moderate elevations and dominated by shrubs (*Appendix E*). Shrub species include alder-leaf mountain-mahogany (*Cercocarpus montanus*), antelope bitterbrush (*Purshia tridentata*), big sagebrush (*Artemisia tridentata*), chokecherry (*Prunus virginiana*), curl-leaf mountain-mahogany (*Cercocarpus ledifolius*), currant (*Ribes* spp.), serviceberry (*Amelanchier* spp.), silver sagebrush (*Artemisia cana*), skunk brush (*Rhus aromatica*), and snowberry (*Symphoricarpos* spp.; Knight et al. 2014). Associated grasses and forbs include arrowleaf balsamroot (*Balsamorhiza sagittata*), bluebunch wheatgrass (*Pseudoroegneria spicata*), hairy goldenaster (*Heterotheca villosa*), lupine (*Lupinus* spp.), and prairie junegrass (*Koeleria macrantha*; Knight et al. 2014). The habitat type often includes patches and stringers of trees, including Douglas-fir (*Pseudotsuga menziesii*), limber pine (*Pinus flexilis*), ponderosa pine (*Pinus ponderosa*), and quaking aspen (*Populus tremuloides*), as well as rock outcrops.

Foothills Shrublands cover approximately 15% of the state and are typically found at elevations ranging from 3,104 to 11,893 feet with mesic environments that are not as cold and snowy as mountains, but not as hot and dry as basins (*Figure 8*). They are found in the transition zones between mountains and basins throughout the state. The Foothills Shrublands habitat type is characterized by 0.6% low intactness, 7.1% moderate intactness, and 92.3% high intactness. Please refer to *Chapter 12* for details about data, data sources, and methodology.

Figure 8. Map of Foothills Shrublands in Wyoming.



Foothills Shrublands are often more productive than surrounding habitat and provide food and forage for many species. The habitat type contains diverse berries, seeds, and arthropods that are consumed by species including small mammals, Greater Sage-Grouse, and Columbian Sharp-tailed Grouse (Carlisle et al. 2012). Antelope bitterbrush and curl-leaf mountain-mahogany provide important forage for Mule Deer and Bighorn Sheep throughout the winter.

In addition to food, Foothills Shrublands also provide important habitat for many wildlife species (*Table 17*). Foothill Shrublands provide breeding and year-round habitats for bird species including Black-throated Gray Warbler, Brewer's Sparrow, Columbian Sharp-tailed Grouse, and Virginia's Warbler (Berry and Bock 1998, Klott and Lindzey 1990). Abundant sagebrush (*Artemisia* spp.) promotes occupation by several sagebrush obligate wildlife species including Greater Sage-Grouse, Sage Thrasher, and Sagebrush Sparrow. Many Foothills Shrubland communities have been designated as crucial winter ranges for Mule Deer and Bighorn Sheep (Wyoming Game and Fish Department 2020).

Table 17. Foothills Shrubland characteristic Species of Greatest Conservation Need.

Species of Greatest Conservation Need that are characteristic of the Foothills Shrubland habitat type in Wyoming. Refer to *Appendix D* for a full list of species that are associated with this habitat type.

Taxonomic group	Characteristic Species of Greatest Conservation Need
Amphibians	Northern Leopard Frog
Birds	Bewick's Wren, Black-throated Gray Warbler, Blue-gray Gnatcatcher, Brewer's Sparrow, Calliope Hummingbird, Columbian Sharp-tailed Grouse, Greater Sage-grouse, Loggerhead Shrike, Sagebrush Sparrow, Sage Thrasher
Mammals	Bighorn Sheep, Dwarf Shrew, Plains Spotted Skunk, Hispid Pocket Mouse, Idaho Pocket Gopher, Mule Deer, Olive-backed Pocket Mouse, Silky Pocket Mouse, Yuma Myotis
Plants	Dorn's (Tunp Range) Twinpod
Reptiles	Northern Rubber Boa, Smooth Greensnake, Valley Gartersnake

Challenges and Actions

The following challenges have been identified for Foothills Shrublands and the species of Greatest Conservation Need (SGCN) that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this habitat type at a local scale, the challenges identified here are significant concerns across much of the habitat type in Wyoming. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Invasive species such as cheatgrass (*Bromus tectorum*) and other invasive annual grasses can affect habitat through competition with native species and changing fire frequency (Balch et al. 2013, Hak and Comer 2020). Invasive species can accompany and be exacerbated by other factors, including human disturbance (Boyte et al. 2016). Voluntary actions to address this challenge include:

- Support planning tools, mapping and survey efforts, and other decision-support tools (i.e. modeling, future climate scenarios) to assist in the prioritization of treatment locations and identify management objectives (i.e., prevention, early detection and rapid response, suppression).
- Work with local, state, and federal natural resource managers to create long term treatment plans designed around the "Defend the Core, Grow the Core" concept (Doherty et al. 2024).

- Promote the “Play, Clean, Go” message. Look for opportunities to add boot cleaning stations or washing stations at popular recreation locations.

- Encourage adoption and implementation of the Wyoming Seed Strategy, including 1) using genetically and ecologically suitable, native, diverse native seed for reclamation work, and 2) working collaboratively to develop an adequate seed supply for habitat reclamation.

- Use both biological and chemical techniques for control of invasive plant species.

- When controlling or managing invasive plant species (especially when using herbicides), account for the occurrence of SGCN plants and incorporate monitoring for SGCN plants.

- Continue to support research for the most effective tools and techniques for Invasive Annual Grasses control.

- Develop diverse partnerships (weed and pest, conservation districts, land managers, permittees, landowners, energy developers, NGOs, researchers, funders, etc.) to fund and coordinate treatment of invasive plant species, prioritizing areas of early invasion where control is most effective and efficient.

- Support the inclusion of cheatgrass on the statewide invasive species list.

- Provide information, technical support, and financial assistance to implement livestock grazing practices that minimize invasive species in Foothill Shrublands communities.

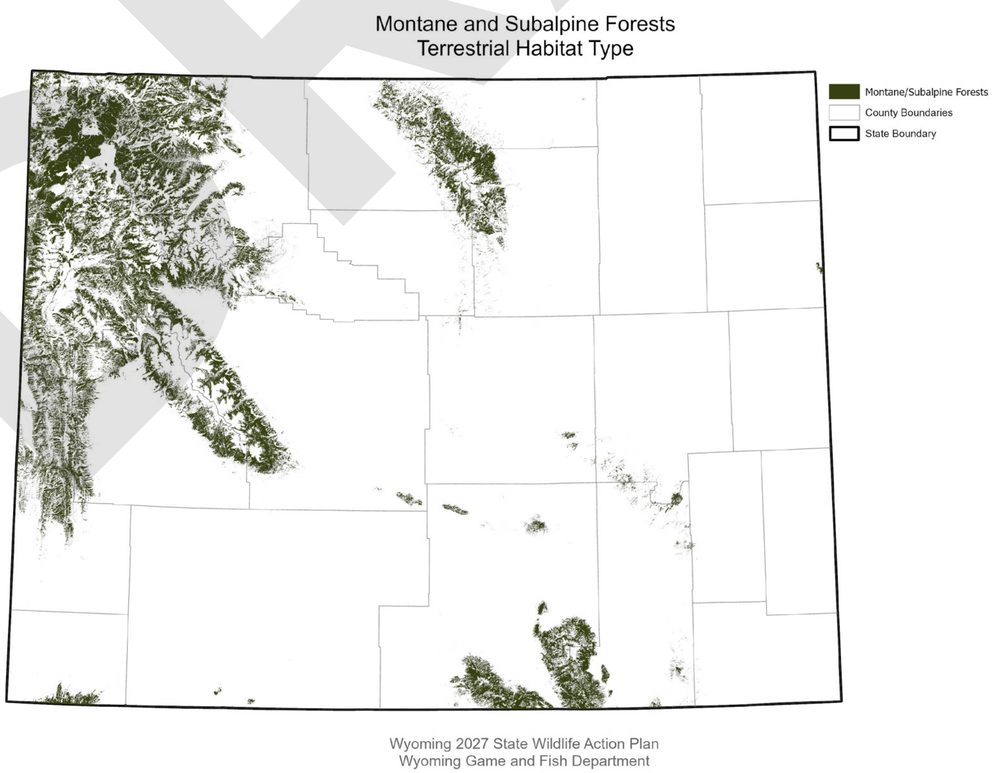
- Minimize introduction of invasive species by land use practices by implementing best practices and supporting local, state, and federal permitting. Best practices include cleaning of equipment and vehicles before transport, feeding livestock with weed-free feed prior to moving to new rangelands, minimizing off-trail offroad use, and hosting education events and cleaning stations for organized recreational events.

Chapter 17: Montane and Subalpine Forest

The Montane and Subalpine Forest habitat type consists of the NatureServe Terrestrial Ecological Systems that are dominated by conifers and occur in high elevation, mountainous environments characterized by short and cool growing seasons, complex topography, and snowfall that regularly persists until late spring (*Appendix E*). Across the state, Montane and Subalpine Forests are dominated by Engelmann spruce (*Picea engelmannii*), lodgepole pine (*Pinus contorta*), and subalpine fir (*Abies lasiocarpa*). Limber pine (*Pinus flexilis*) and quaking aspen (*Populus tremuloides*) form a minor to subdominant component in some montane and subalpine forests. Whitebark pine (*Pinus albicaulis*) occupies high elevation subalpine habitats in portions of the Greater Yellowstone Ecosystem (Knight et al 2014). These habitats form adjacent to mountain grasslands and meadows, aspen groves, wetlands, riparian areas, mountain shrublands, lakes, and streams. Associated shrubs include antelope bitterbrush (*Purshia tridentata*), chokecherry (*Prunus virginiana*), creeping barberry (*Mahonia repens*), grouse whortleberry (*Vaccinium scoparium*), kinnikinnick (*Arctostaphylos uva-ursi*), mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*), rose (*Rosa* spp.), russet buffaloberry (*Shepherdia canadensis*), and western serviceberry (*Amelanchier alnifolia*). Grasses include Idaho fescue (*Festuca idahoensis*), pinegrass (*Calamagrostis rubescens*) and spike fescue (*Festuca kingii*). Forbs include fireweed (*Chamaenerion angustifolium*), heartleaf arnica (*Arnica cordifolia*), timber milk-vetch (*Astragalus miser*), and Virginia strawberry (*Fragaria virginiana*; Knight et al 2014, Pappas et al. 2022). Forest stands within this habitat type form following infrequent, stand-replacing fire, and dominant species are adapted to fire intervals of 100 to more than 400 years. The natural structure of these forests is conducive to crown fires, and as such, wildfires have historically been limited; however, sufficiently warm and dry conditions can lower moisture content and create combustible conditions (Halofsky et al. 2018).

Montane and Subalpine Forests cover about 10% of Wyoming and occur at elevations from 4,068 to 12,546 feet in mountain ranges where temperature and moisture are sufficient to support tree seedling establishment (Knight 2014, *Figure 9*). These forests extend upward to treeline, which imposes a cold temperature limit on tree growth and seedling survival induced by physiological drought (Bailey et al. 2021). The Montane and Subalpine Forests habitat type is characterized by 0.1% low intactness, 3.3% moderate intactness, and 96.6% high intactness. Please refer to *Chapter 12* for details about data, data sources, and methodology.

Figure 9. Map of Montane and Subalpine Forest in Wyoming.



Montane and Subalpine Forests provide seasonal and year-round habitat for a diverse assemblage of species (*Table 18*). Many species possess adaptations for surviving the often harsh winters, including migratory behavior (e.g., Calliope Hummingbird; Sauer et al. 2013), food caching (e.g., American Pika; Dearing 1997), and the capacity to hibernate (e.g., Western Toad; Browne and Paszkowski 2010). The wildlife of Montane and Subalpine Forests in Wyoming are often ecologically similar to subarctic forests that extend across most of Canada and Alaska; many species that occur in this habitat type in Wyoming are either glacial relicts or occur near the southern edge of their ranges (e.g., Columbia Spotted Frog, Canada Lynx, Great Gray Owl).

Subnivean spaces are created in these forests by high structural diversity (e.g., downed logs, low-lying layered subalpine fir branches; Corn and Raphael 1992) and winter conditions; species such as wolverine and least weasel use these thermally-buffered spaces for denning and feeding (Jokinen et al. 2019, Scott et al. 2022, Sundell et al. 2000). Large mature trees and structurally diverse forests provide important roosting and nesting sites for birds including American Goshawk, Great Gray Owl, and Northern Pygmy-Owls (Giese and Forsman 2003, Greenwald et al. 2005, Gura et al. 2025). Snags provide important habitat for cavity-nesting and insect-feeding birds such as Black-backed Woodpecker and Williamson's Sapsucker (Dudley et al. 2012, St-Amand et al. 2018). Trees also contain cavities, crevices, and exfoliating bark that serve as maternity colonies and roost sites for bats including Northern Long-eared Bats and Long-legged Myotis (Alston et al. 2019, Ormsbee and McComb 1998). Amphibians such as Wood Frogs breed in the intermixed wet areas, and then move to nearby sites to spend the remainder of the year (Baldwin et al. 2006). Conifer seeds are central food resources for many small mammals and birds, and feedbacks influence forest structure: for example, Whitebark Pine seeds are important food resources for Clark's Nutcracker, and Clark's Nutcrackers disperse these and other conifer seeds (Hutchins and Lanner 1982, McLaren et al. 2023).

Table 18. Montane and Subalpine Forest characteristic Species of Greatest Conservation Need.

Species of Greatest Conservation Need that are characteristic of the Montane and Subalpine Forest habitat type in Wyoming. Refer to *Appendix D* for a full list of species that are associated with this habitat type.

Taxonomic group	Characteristic Species of Greatest Conservation Need
Amphibians	Columbia Spotted Frog, Western (Boreal) Toad, Wood Frog
Birds	American Goshawk, Black-backed Woodpecker, Boreal Owl, Calliope Hummingbird, Clark's Nutcracker, Common Loon, Evening Grosbeak, Flammulated Owl, Great Gray Owl, Harlequin Duck, Lewis's Woodpecker, MacGillivray's Warbler, Northern Pygmy-Owl, Red Crossbill, Rufous Hummingbird, White-winged Crossbill, Williamson's Sapsucker
Mammals	Canada Lynx, Dwarf Shrew, Eastern Red Bat, Fringed Myotis, Hayden's Shrew, Long-eared Myotis, Long-legged Myotis, Mule Deer, North American Water Vole, Northern Flying Squirrel, Northern Long-eared Myotis, Western Pygmy Shrew, Western Small-footed Myotis, Uinta Chipmunk, Wolverine, Yellow-pine Chipmunk
Plants	Farrar Moonwort, Kirkpatrick's Ipomopsis, Laramie Columbine, Payson's Milkvetch, Sessileflower Springparsley, Tapertip Desertparsley, Shoshonea, Whitebark Pine, Woolly Twinpod
Reptiles	Northern Rubber Boa, Smooth Greensnake, Valley Gartersnake

Challenges and Actions

The following challenges have been identified for Montane and Subalpine Forests and the species of Greatest Conservation Need (SGCN) that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this habitat type at a local scale, the challenges identified here are significant concerns across much of the habitat type in Wyoming. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Pathogens can shape survival and reproduction of wildlife in forested systems and shape the quality, structure, and composition of habitat (Hardy et al. 2023). Relevant pathogens that affect wildlife in this habitat include chronic wasting disease, white pine blister rust, and chytrid fungus (DeVivo et al. 2017, Tomback and Achuff 2010). Pathogens can have synergistic effects with other challenges, including climate change, anthropogenic disturbance, and insects (Burgess et al. 2022, Hansen et al. 2016). Voluntary actions to address this challenge include:

- Manage wildlife populations to be within carrying capacity to limit spread of diseases within those species.
- Increase wildlife resilience to disease by improving forage quantity and quality.
- Increase forest landscape resilience to insect and pathogen outbreaks. Specific strategies include:
    - Maintain and promote a mosaic of successional stages and size and age classes across the landscape using techniques such as fire (prescribed and wildfire), timber harvest, and mechanical thinning.
    - Open forest gaps to create establishment opportunities and facilitate future advance regeneration.
    - Increase tree vigor by planting resistant genotypes where possible (e.g., rust-resistant Whitebark Pine genotypes).
    - Promote and maintain stand scale species diversity, particularly when implementing silvicultural prescriptions.
    - Increase the use of pheromone treatments in limited, high-value areas including recreation areas, rare habitats, and after floods.
    - Support research and innovative trials that evaluate new techniques for managing forest pests and wildlife diseases.
- Continue monitoring population trends or changes in distribution of Montane and Subalpine Forest SGCN and other obligates to identify changes in habitat quality or responses to emerging challenges.

In Montane and Subalpine Forests, climate change may lead to warmer temperatures and shifts in the amount and timing of precipitation (Rangwala and Miller 2012, Rocca et al. 2014); these changes will likely have interactive effects on this habitat and amplify the impacts of other challenges. These changes can negatively affect species through spatial shifts in suitable habitat, reduced reproduction and survival, reduced foraging success, altered phenological responses, reduced genetic diversity, hybridization, and more (Barsugli et al. 2020, Garroway et al. 2010, Koen et al. 2014, McKelvey et al. 2011, Parmesan 2007, Piper et al. 2024, Saunders et al. 2021, Slatyer et al. 2022). Climate change may affect this habitat by altering tree survival, forage quality, community composition, and fire regimes, as well as facilitating the spread of invasive species and increasing susceptibility to pathogens (Abatzoglou and Williams 2016, Ackerly et al. 2020, Harvey et al. 2016, Harvey et al. 2021, Hogan et al. 2024, Reich et al. 2022, Seastedt and Oldfather 2021, Turner et al. 2022, Varner et al. 2023). Voluntary actions to address this challenge include:

- To minimize stressors to wildlife, encourage timber management practices that benefit wildlife including:
    - Manage for vertical and horizontal heterogeneity, multiple layers of native plants, forest floor complexity, and a variety of tree age classes.
    - Retain large-diameter snags and roost trees.
    - Support habitat resilience by maintaining a diversity of plant species and genetic diversity.
- Promote climate adaptation by increasing forest resilience, minimizing current stressors, and fostering post-disturbance recovery (Halofsky et al. 2017, Halofsky et al. 2018). Specific strategies include:
    - Manage for landscape-scale diversity in species, genetics, structure, successional stages, and age classes.
    - Promote fire resistant species such as Douglas-fir and fire resilient species such as lodgepole pine.

- Retain old and legacy trees as key seed sources for regeneration (Fedrowitz et al. 2014).

- Prioritize post-disturbance planting in areas vulnerable to recruitment failures; relaxing seed zone guidelines to include genotypes from warmer locations; and adjust planting production, densities, seedlings, and genotypes to account for increased mortality under warmer, drier conditions.

- Increase production of native plant materials for post-disturbance planting to account for regeneration failures.

- Increase invasive species control efforts using early detection, rapid response, and inventory regularly to detect new populations and species.

- Support broader efforts beyond Wyoming to better understand and identify management solutions to this widespread challenge.

- Improve understanding of landscape patterns in lodgepole pine serotiny to anticipate post-disturbance regeneration response and to identify priority populations.

- Continue monitoring population trends or changes in distribution of Montane and Subalpine Forest SGCN and other obligate species to infer changes in habitat quality or responses to emerging challenges.

Bat Cluster. Photo by WGFD.

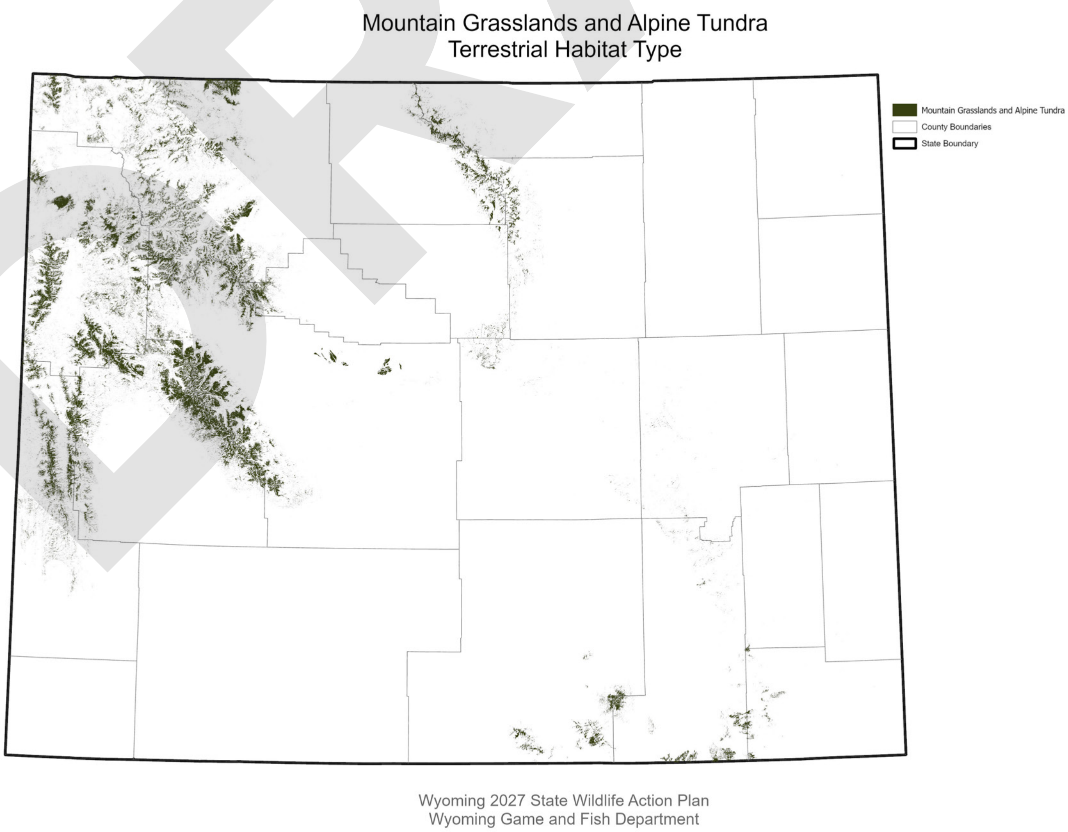
Chapter 18: Mountain Grasslands and Alpine Tundra

The Mountain Grasslands and Alpine Tundra habitat type consists of the NatureServe Terrestrial Ecological Systems that describe high-elevation grasslands and alpine habitats (*Appendix E*). These habitats are frequently referred to as parks or mountain meadows, and species composition varies with elevation, moisture, soil depth, and soil type (Knight et al. 2014). Species that are characteristic of mountain grasslands include bluebunch wheatgrass (*Pseudoroegneria spicata*), geranium (*Geranium* spp.), Idaho fescue (*Festuca idahoensis*), lupine (*Lupinus* spp.), needle and thread grass (*Hesperostipa comata*), sedges (*Carex* spp.), and willow (*Salix* spp.). Soil conditions, moisture levels, competition with herbaceous plants, cold temperatures, and disturbances often prevent the establishment of trees. Tall forb communities are interspersed within mountain grasslands and surrounding forests. These unique, typically mesic communities contain lush vegetation and are characterized by asters (*Eurybia* spp., *Symphyotrichum* spp.), cutleaf balsamroot (*Balsamorhiza macrophylla*), fernleaf licorice-root (*Ligusticum filicinum*), mountain brome (*Bromus marginatus*), mule-ears (*Wyethia amplexicaulis*), one-flower sunflower (*Helianthella uniflora*), slender cinquefoil (*Potentilla gracilis*), sticky purple geranium (*Geranium viscosissimum*), tall larkspur (*Delphinium occidentale*), and western coneflower (*Rudbeckia occidentalis*; Shiflet 1994).

Alpine tundra presents uniquely severe conditions for plants. The habitat type exists at the highest elevations where winds are severe, temperatures are low, and the growing season is short. Alpine plants have adaptations such as cushion plant growth form, mostly underground biomass, and the capacity to photosynthesize at lower temperatures (Knight et al. 2014). Characteristic vegetation includes alpine avens (*Geum rossii*), dwarf willow (*Salix herbacea*), lousewort (*Pedicularis* spp.), and purple reedgrass (*Calamagrostis purpurascens*).

Mountain Grasslands and Alpine Tundra cover about 3% of Wyoming and occur at elevations from 3,176 to 13,638 feet (*Figure 10*). Alpine areas occur above timberline. This habitat type is restricted to the mountains in the northwest and southeast corners of the state. The Mountain Grasslands and Alpine Tundra habitat type is characterized by 0.4% low intactness, 6.4% moderate intactness, and 93.2% high intactness. Please refer to *Chapter 12* for details about data, data sources, and methodology.

Figure 10. Map of Mountain Grasslands and Alpine Tundra Forest in Wyoming.



Diverse wildlife live in Mountain Grasslands and Alpine Tundra, making use of patches of high primary productivity, nearby forest matrix, microrefuge such as rock crevices, invertebrate biodiversity, and proximity to water (*Table 19*; Rosvold 2016). Many of the species that live in these habitats are specialized, possessing unique adaptations to survive the harsh and highly variable conditions of the habitat. Adaptations include migratory behavior (e.g., Mule Deer; Monteith et al. 2018), food caching (e.g., American Pika; Dearing 1997), and the capacity to hibernate (e.g., Western Toad; Browne and Paszkowski 2010).

Tall forb communities occupy small patches, but their ecological importance is disproportionately high because of the ecosystem services they provide. Tall forb communities provide habitat for a variety of species, including migratory species and pollinators (e.g., bees, butterflies). At a watershed level, this community is important for water retention, storage, and a slowly released runoff that positively influences native fisheries downstream in the form of channel stability and condition and riparian vegetation.

Insects and other invertebrates are key components of these habitat types; they provide food sources for insectivores including American Pipit and Dwarf Shrew and serve as pollinators of many plant species (Hoffmann and Owen 1980, Treteault et al. 2025, Verbeek 1970). American Pipit, Black Rosy-Finch, and Brown-capped Rosy-Finch are among the few vertebrate species able to breed in the alpine tundra (Brown 2021). Wolverine and American Pika use the subnivean space and talus patches for foraging, denning, and thermal buffering (Billman et al. 2021, Glass et al. 2022, Hall et al. 2016). Alpine habitats typically contain ample escape terrain, and Bighorn Sheep often rear vulnerable lambs in these comparatively safe habitats (Wagler et al. 2023). Amphibians such as Wood Frogs breed and spend summers in patches with water and dense vegetation, before moving to nearby forested areas for overwinter hibernation (Bishir 2017).

Table 19. Mountain Grasslands and Alpine Tundra characteristic Species of Greatest Conservation Need.

Species of Greatest Conservation Need that are characteristic of the Mountain Grasslands and Alpine Tundra habitat type in Wyoming. Refer to *Appendix D* for a full list of species that are associated with this habitat type.

Taxonomic group	Characteristic Species of Greatest Conservation Need
Amphibians	Columbia Spotted Frog, Western (Boreal) Toad, Wood Frog
Birds	American Pipit, Black Rosy-Finch, Brown-capped Rosy-Finch
Mammals	American Pika, Bighorn Sheep, Dwarf Shrew, Mule Deer, North American Water Vole, Wolverine, Uinta Chipmunk
Plants	Colorado Tansyaster, Fremont Bladderpod, Kirkpatrick's (Spiked) Ipomopsis, Laramie (Alpine) Clover, Payson’s Draba, Smallheaded Townsend Daisy, Snow Indian Paintbrush
Reptiles	Valley Gartersnake

Challenges and Actions

The following challenges have been identified for Mountain Grasslands and Alpine Tundra and the species of Greatest Conservation Need (SGCN) that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this habitat type at a local scale, the challenges identified here are significant concerns across much of the habitat type in Wyoming. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Increased recreation (hiking, climbing, skiing, ATV, on- and off road/trail use) in these habitats can affect wildlife and their habitats by altering community composition through soil compaction, trampling of plants, and modifying wildlife behavior (Cole and Monz 2002, Crisfield et al. 2012, Hochreutener et al. 2022, Kolek et al. 2025, Sato et al. 2013, Stafl and O’Connor 2015, van Vierssen Trip and Wiersma 2015). Recovery from disturbance can be challenging in these habitats, which are relatively fragile, slow to recover, and have short growing seasons (Willard et al. 2007). Voluntary actions to address this challenge include:

- Educate public land users about impacts of recreation on these habitats; build buy-in through custom campaigns that include advocacy and user groups. Communicate through informational signs at trailheads, tri-fold hand outs, and other resources that help provide guidance on how to minimize disturbance.

- Work collaboratively with local recreational organizations to develop best management practices that they can provide to their members.

- Perform active restoration of areas that have been degraded, including campsite reclamation in remote areas and excluding use from areas that have been heavily degraded.

- Work collaboratively to create recreation plans.

- Encourage adoption and implementation of the Wyoming Seed Strategy, including 1) using genetically and ecologically suitable, native, diverse native seed for reclamation work, and 2) working collaboratively to develop an adequate seed supply for habitat reclamation.

- Support research that can inform species and habitat conservation. Specific research needs include: 1) evaluate the effects of recreation on various habitats and the SGCN they support, 2) leverage GIS-based recreation pressure data (e.g., Strava Heatmap) to assess impacts in high-use routes and areas, 3) investigate dynamics of plant communities following disturbance (e.g., at what level of disturbance does wildlife use decrease), and 4) collect long-term data using citizen science programs (e.g., Wyoming Wilderness Association solitude monitoring protocol).

- Collaborate with land management agencies to explore and implement strategies to balance recreation with the needs of SGCN and their habitats. Specific strategies may include limiting some recreation uses, limiting seasonality of use, reducing use on informal trails, decommissioning trails where reclamation will occur slowly.

High-elevation species are likely to be sensitive to changing temperature; however, the landscape-level response may be buffered by the topographically-driven climate variation (Oldfather et al. 2025). In particular, snow and its patchy presence across the landscape is a key feature of this habitat type, and climate change may affect both wildlife and their habitats by altering the amount, timing, and type of precipitation. Mountain Grasslands and Alpine Tundra in the Rocky Mountains are likely to experience longer growing seasons with less snow that melts earlier (Inouye 2020, Oldfather et al. 2025, Seastedt and Oldfather 2021). Increased temperatures may affect habitat by altering snowpack, water availability, plant phenology, pollinator-plant relationships, forage quality, and plant community dynamics (Inouye 2020, Oldfather et al. 2025, Seastedt and Oldfather 2021, Trunschke et al. 2024). With warmer temperatures, wildlife in these habitats may experience changing food resources, different requirements for home ranges, and shifts in the timing and magnitude of life events (e.g., survival, reproduction, migration; Arietta et al. 2020, Barsugli et al. 2020, Haver et al. 2022, Heim et al. 2017, Scridel et al. 2018, Varner et al. 2023). Changes in temperature regimes are connected to changes in precipitation and hydrological regimes, and changes to both can amplify the negative effects of other challenges. Voluntary actions to address this challenge include:

- Support research to better understand impacts of changing temperature regimes on Mountain Grassland and Alpine Tundra and the various SGCN species they support.

- Conduct educational campaigns to increase public awareness of the importance of this habitat type and how climate change may alter the habitat and the species that rely on it.

- Prioritize limiting disturbance on north-facing slopes, high-elevation wetland complexes.

- Work with federal agencies to implement innovative grazing strategies and other land management strategies that support wildlife habitat while being adaptable to changes in climatic conditions.

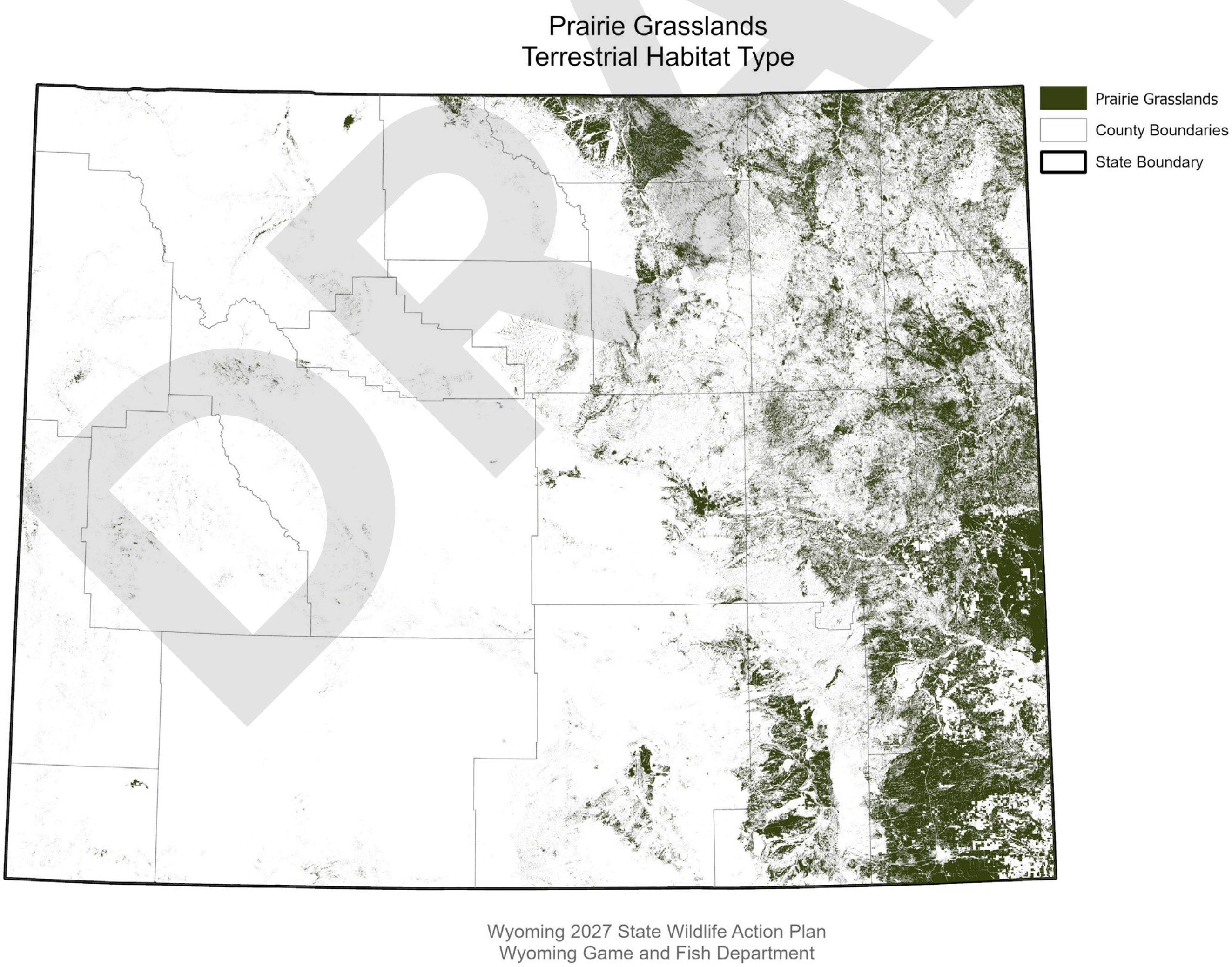
- Encourage adoption and implementation of the Wyoming Seed Strategy, including 1) using genetically and ecologically suitable, native, diverse native seed for reclamation work, and 2) working collaboratively to develop an adequate seed supply for habitat reclamation.

Chapter 19: Prairie Grasslands

The Prairie Grasslands habitat type consists of the NatureServe Terrestrial Ecological Systems that are characterized by mid- to low-elevation grasslands (*Appendix E*). Most of Wyoming's grasslands are classified as either shortgrass prairie or mixed-grass prairie (Augustine et al. 2021, Knight et al. 2014). Shortgrass prairie occurs mainly in the southeast corner of the state; blue grama (*Bouteloua gracilis*) and buffalo grass (*Bouteloua dactyloides*) are predominant grass species (Lauenroth et al. 2008). Mixed-grass prairie is common across much of eastern Wyoming. It typically receives more moisture and has greater plant species diversity than shortgrass prairie. Common plant species include blue grama (*Bouteloua gracilis*), Indian ricegrass (*Eriocoma hymenoides*), needle and thread grass (*Hesperostipa comata*), prairie junegrass (*Koeleria macrantha*), Sandberg's bluegrass (*Poa secunda*), western wheatgrass (*Elymus smithii*), and upland sedges (*Carex* spp.; Knight et al. 2014). Prairie grasslands have among the warmest and longest growing seasons of Wyoming's habitat types, as well as relatively deep and well developed soils. These factors result in grasslands having high primary productivity when compared to other Wyoming habitat types.

Prairie Grasslands cover about 18% of Wyoming and occur at elevations from 3,097 to 11,880 feet (*Figure 11*). They are predominantly located in the eastern portions of the state, although they are also common in basins of south central and southwestern portions of Wyoming. The Prairie Grasslands habitat type is characterized by 1.8% low intactness, 21.9% moderate intactness, and 76.2% high intactness. Please refer to *Chapter 12* for details about data, data sources, and methodology.

Figure 11. Map of Prairie Grasslands Forest in Wyoming.



Prairie grasslands can support diverse and abundant wildlife populations because of substantial vegetative biomass, abundant seeds, diversity of invertebrates, structural diversity, and climatic conditions (Hovich et al. 2023, Petermann and Buzhdygan 2011; *Table 20*). Most Wyoming prairie grasslands have a strong shrub component, which also contributes to the structural diversity by providing sites for perches, snow capture structures, wind breaks, nesting cover, and an additional forage base (Thompson and Gese 2013).

White-tailed Prairie Dogs and Black-tailed Prairie Dogs are important components of prairie grasslands because of their roles as keystone species and ecosystem engineers (Duchardt et al. 2021, Parker et al. 2019). Through foraging and creating burrows, prairie dogs affect nutrient cycling, shape food resources, and provide habitat for species including Black-footed Ferret, Burrowing Owls, Mountain Plover, and Swift Fox (Duchardt et al. 2019, Duchardt et al. 2020, Lantz et al. 2007, Nelson et al. 2024, Pearse et al. 2021). Prairie dogs also provide a prey base for species including Black-footed Ferret, Ferruginous Hawk, and Golden Eagle (Dierenfeld et al. 2021, Dreelin et al. 2025, Salas et al. 2024).

Grasslands serve as stopover or breeding ranges for many migratory birds, including Baird's Sparrow, Field Sparrow, Grasshopper Sparrow, and Thick-billed Longspur (Hill and Renfrew 2019, Niemuth et al. 2017, West and Swanson 2025). Relative to other habitat types in Wyoming, the Prairie Grassland habitat type supports a diversity of reptiles; many eat insects and occupy burrows that they dig themselves or are excavated by other animals (Ballinger et al. 1979, Snoberger and Walker 2014). Permanent and ephemeral water sources provide breeding habitat for amphibians, who typically move upland for the remainder of the year.

Wyoming once represented the western periphery of many species' continental ranges (e.g., Black-tailed Prairie Dog, Ferruginous Hawk, Mountain Plover, Swift Fox). Intensive conversion of grassland in the Great Plains resulted in the reductions of these habitats outside of Wyoming, but suitable habitat for some species remains in Wyoming (Davidson et al. 2023, Nelson et al. 2024).

Table 20. Prairie Grasslands characteristic Species of Greatest Conservation Need.

Species of Greatest Conservation Need that are characteristic of the Prairie Grasslands habitat type in Wyoming. Refer to *Appendix D* for a full list of species that are associated with this habitat type.

Taxonomic group	Characteristic Species of Greatest Conservation Need
Amphibians	Great Plains Toad, Northern Leopard Frog, Plains Spadefoot, Western Tiger Salamander
Birds	Baird's Sparrow, Bobolink, Burrowing Owl, Chestnut-collared Longspur, Common Nighthawk, Dickcissel, Ferruginous Hawk, Grasshopper Sparrow, Lark Bunting, Long-billed Curlew, Mountain Plover, Short-eared Owl, Swainson's Hawk, Thick-billed Longspur, Upland Sandpiper
Mammals	Black-footed Ferret, Black-tailed Prairie Dog, Hispid Pocket Mouse, Olive-backed Pocket Mouse, Pallid Bat, Plains Harvest Mouse, Plains Pocket Mouse, Sand Hills Pocket Gopher, Silky Pocket Mouse, Spotted Ground Squirrel, Swift Fox, White-tailed Prairie Dog
Plants	Blowout Beardtongue, Colorado Butterfly Plant, Foothill Milkvetch, Grassyslope Sedge, Prairie Dodder, Ute Ladies' Tresses
Reptiles	Great Plains Earless Lizard, Hernandez's Short-horned Lizard, Northern Many-lined Skink, Ornate Box Turtle, Plains Black-headed Snake, Plains Gartersnake, Plains Hog-nosed Snake, Plains Short-horned Lizard, Prairie Lizard, Prairie Racerunner, Prairie Rattlesnake, Red-sided Gartersnake

Challenges and Actions

The following challenges have been identified for Prairie Grasslands and the species of Greatest Conservation Need (SGCN) that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this habitat type at a local scale, the challenges identified here are significant concerns across much of the habitat type in Wyoming. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Energy development can be accompanied by habitat loss, degradation, and fragmentation, as well as the spread of invasive species, increased roads and infrastructure, erosion, changes to plant community, wildlife behavior change, changes to wildlife abundance and distribution, reduced reproductive success, and direct mortality (Bernath-Plaisted et al. 2023, Conkling et al. 2022, Copeland et al. 2009, Gomez-Catasus et al. 2024, Ludlow et al. 2015, Nasen et al. 2011, Ott et al. 2021, Pearse et al. 2021, Rutherford et al. 2024, Thompson et al. 2015). Voluntary actions to address this challenge include:

- Evaluate using spatial data to identify the most heavily impacted sites and sites with most conservation value (e.g., value to grassland obligate SGCN). Develop policies that mitigate the impact of development on these habitats.
- Partner with land management agencies to identify best management practices to restore/reclaim impacted areas.
- Coordinate and support restoration and reclamation efforts between industry and local, state, and federal agencies.
- Promote policies that support reclamation efforts that 1) ensure reclamation of utility lines, 2) minimize the spread of invasive annual grasses, 3) use native plant species seed, and 4) restore damaged hydrological function.
- Work closely with county planning offices to understand their natural resource land use plan to ensure cohesive planning and reclamation standards are being met.
- Seek funds to reclaim and restore drilling sites.
- Develop a habitat mitigation program that incentivizes placement of renewable energy projects on lands that are already disturbed, and disincentivizes placement of projects on large, contiguous blocks of grassland habitat.
- Consider the development of voluntary conservation agreements (Conservation Agreements and Strategies, or CAS) for certain species of conservation concern to implement proactive conservation efforts in areas likely to be developed.
- Work with county weed and pest districts to develop invasive plant management treatment options.
- Update conservation, mitigation, and restoration policies such as Executive Orders (e.g., Migration Corridor Executive Order) and Wyoming Game and Fish Department policies to incorporate emerging research, specify who is responsible for monitoring conditions throughout project phases, and emphasize accountability.

Construction and maintenance of utility and service lines can contribute to habitat loss, degradation and fragmentation, as well as direct mortality (Martin et al. 2022). Voluntary actions to address this challenge include:

- Consider using spatial data to identify the most heavily impacted sites and sites with most conservation value (e.g., value to grassland obligate SGCN). Develop policies that mitigate the impact of energy development on these habitats.
- Partner with land management agencies to identify best management practices to restore/reclaim impacted areas.
- Consider the development of voluntary conservation agreements (Conservation Agreements and Strategies, or CAS) for certain species of conservation concern to implement proactive conservation efforts in areas likely to be developed.
- Promote policies that support reclamation efforts that 1) ensure reclamation of utility lines, 2) control the spread of invasive annual grasses, 3) use native plant species seed, and 4) restore damaged hydrological function.
- Work closely with county planning offices to understand their natural resource land use plan to ensure cohesive planning and ensure reclamation standards are being met.

Fire can shape habitat quality, species abundance, and biodiversity (Arrogante-Funes et al. 2024, Larson 2014).

Changes in frequency and severity of fires, including through fire suppression, may affect habitat characteristics, such as community composition, invasive annual grasses, and degraded habitat quality. Voluntary actions to address this challenge include:

- Employ habitat management practices that reduce fine fuel loading that can increase the risk of unnatural fire regimes in prairie habitats.
- Promote prescribed burning in grassland habitats where fire was part of the natural ecological process. Encourage the development of prescribed fire cooperatives.
- Using spatial information, develop a "response dashboard" that tracks recent wildfires and serves as a predictive tool for invasive annual grass invasions.
- Mitigate juniper encroachment through forestry best management practices.
- Work with landowners and federal partners (e.g., Natural Resources Conservation Service) to prepare and implement drought management plans for their operations.
- Encourage state participation in drafting relevant Farm Bill Programs (i.e. participation in Natural Resources Conservation Service State Technical Advisory Committee and other avenues).

Invasive species such as cheatgrass (*Bromus tectorum*), ventenata (*Ventenata* spp.), and medusahead (*Taeniatherum caput-medusae*) can affect habitat through competition with native species, changing fire frequency or vulnerability, and more (Gaskin et al. 2021, Harrison et al. 2024). Wildlife species can be affected through changes in population dynamics, community composition, species interactions, food availability, reproduction, and more (Nelson et al. 2017, Nelson et al. 2018). Invasive species can accompany other challenges, such as climate change, residential development, and energy development. Voluntary actions to address this challenge include:

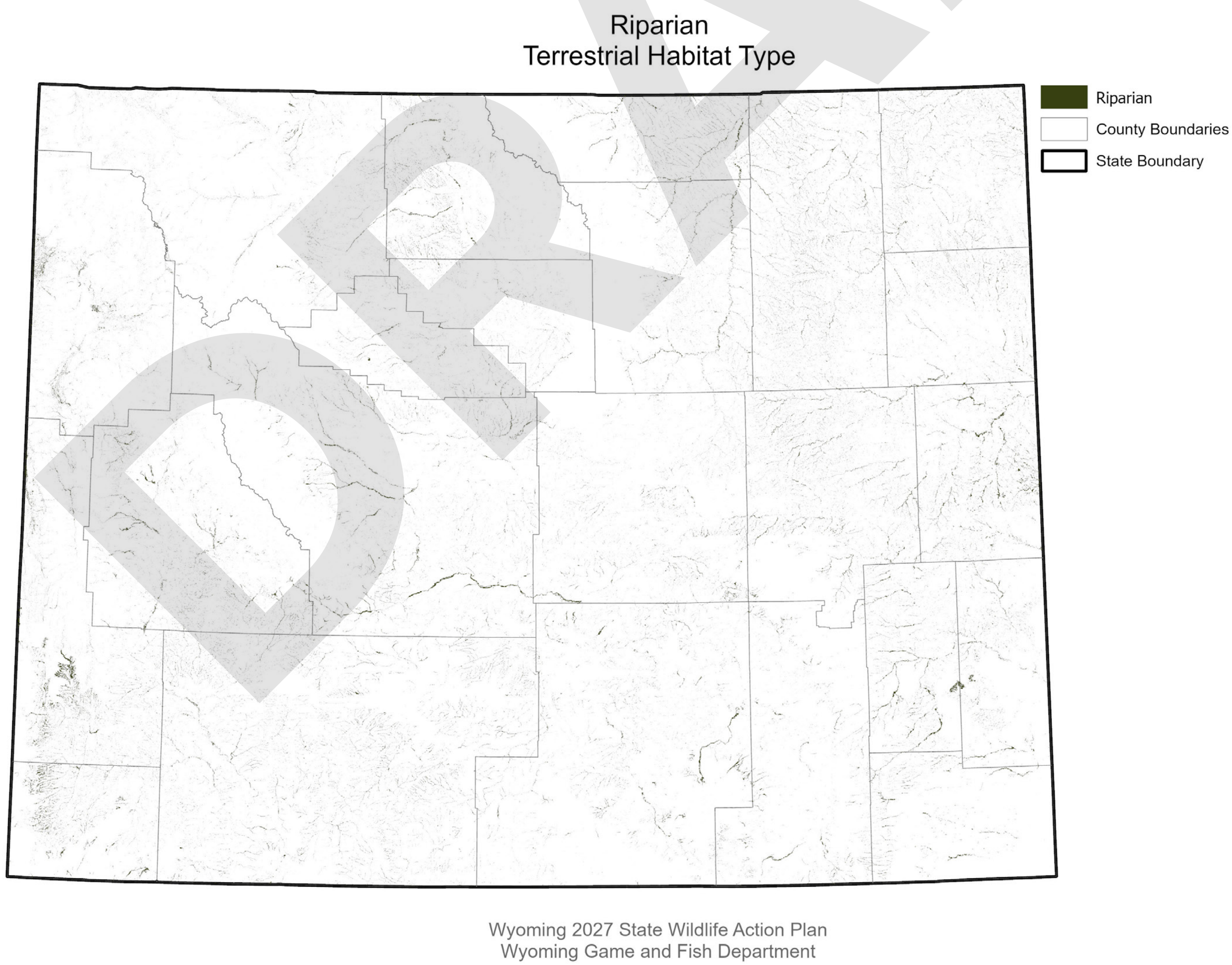
- Where possible, use herbicides to reduce invasive annual grass populations in native prairie habitats.
- Work with county weed and pest districts to develop invasive plant management treatment options.
- Work with local, state, and federal natural resource managers to create long term treatment plans designed around the "Defend the Core, Grow the Core" concept (Doherty et al. 2024).
- Using spatial information, develop a "response dashboard" that tracks recent wildfires and serves as a predictive tool for invasive annual grass invasions.
- Continue strong local and state coordination for reclamation and restoration efforts (technical and financial assistance) after wildfire events.

Chapter 20: Riparian Areas

The Riparian Areas habitat type consists of the NatureServe Terrestrial Ecological Systems that reflect the lands immediately adjacent to creeks, streams, and rivers (*Appendix E*). Wyoming's riparian areas can be broadly segregated into mountain and lowland riparian habitat (Knight et al. 2014). Mountain riparian habitats often have steeper stream gradients, cooler temperatures, and less soil deposition. Vegetation is often characterized by sedges (Carex spp.) and short willow shrublands (Salix spp.) at high elevations, while alder (Alnus spp.), Engelmann spruce (Picea engelmannii), lodgepole pine (Pinus contorta), narrowleaf cottonwood (Populus angustifolia), tall willows, and quaking aspen (Populus tremuloides) are common as elevation decreases. Lowland riparian habitats often have narrow bands of trees and shrubs surrounded by uplands of vegetation of lower stature (Knight et al. 2014). Native vegetation includes cottonwoods (Populus spp.), box elder (Acer negundo), chokecherry (Prunus virginiana), hawthorn (Crataegus spp.), peachleaf willow (Salix amygdaloides), rubber rabbitbrush (Ericameria nauseosa), silver buffaloberry (Shepherdia argentea), silver sagebrush (Artemisia cana), skunk brush (Rhus aromatica), rose (Rosa spp.), and various species of willow (Knight et al. 2014). Invasive species such as Russian olive (Elaeagnus angustifolia) and tamarisk (Tamarix ramosissima) are also common.

The Riparian Area habitat type covers just 2% of Wyoming, but the habitat type is widely distributed across the state (*Figure 12*). The habitat type occurs at elevations from 3,110 to 12,041 feet. The Riparian Areas habitat type is characterized by 2.2% low intactness, 29.4% moderate intactness, and 68.4% high intactness. Please refer to *Chapter 12* for details about data, data sources, and methodology.

Figure 12. Map of Riparian Areas in Wyoming.



The importance of riparian habitat to wildlife far exceeds its small footprint on the landscape, with most species in Wyoming using riparian areas for at least some part of their annual cycle and many completely dependent on them. Riparian areas are the interface between aquatic ecosystems and terrestrial ecosystems, and the habitat heterogeneity provides food, habitat, and thermal refuge to many species (Bateman and Merritt 2022, Naiman and Decamps 1997; *Table 21*).

Riparian areas typically have lush vegetation and increased insect biomass, providing a diversity of food sources for herbivores, insectivores, and omnivores (Hamilton et al. 2015, Jackson et al. 2020). Riparian areas also serve as movement corridors that provide birds and mammals access to forage, cover, and water while moving or migrating across otherwise harsh prairies and desert landscapes (Lendrum et al. 2012, Machtans et al. 1996, Sanchez-Montoya et al. 2023). For example, bats such as Yuma Myotis use riparian habitats for commuting, migrating, roosting, and foraging habitat (Bernard and Minckley 2024, Rogers et al. 2006, Williams et al. 2006). Riparian areas support diverse herpetofauna: amphibians use riparian areas for breeding, prey, thermoregulation, and cover (Arkle and Pilliod 2015, Clipp and Anderson 2014), aquatic turtles use loose soils within riparian areas for nesting (Daigle et al. 2002), and riparian areas are of particular importance to gartersnakes. Riparian areas directly and indirectly influence fish by providing woody debris for cover and habitat, providing nutrient inputs, regulating stream temperature and sediment levels, and maintaining continuous flow of water (Albertson et al. 2018, Pusey and Arthington 2003, Saunders and Fausch 2012).

American beaver (*Castor canadensis*) play critical roles in shaping riparian ecosystems, and they enable suitable conditions for many species (Arkle and Pilliod 2015, Stoffyn-Egli and Willison 2011). Because riparian areas, especially areas where beavers are present, will retain water and provide a buffered thermal environment, these areas will likely serve as refuge for many species under warmer, drier climate scenarios (Jordan and Fairfax 2022, Szcodronski et al. 2024).

Table 21. Riparian Area characteristic Species of Greatest Conservation Need.

Species of Greatest Conservation Need that are characteristic of the Riparian Area habitat type in Wyoming. Refer to *Appendix D* for a full list of species that are associated with this habitat type.

Taxonomic group	Characteristic Species of Greatest Conservation Need
Amphibians	Columbia Spotted Frog, Great Basin Spadefoot, Great Plains Toad, Northern Leopard Frog, Plains Spadefoot, Western Tiger Salamander, Western (Boreal) Toad, Wood Frog, Wyoming Toad
Birds	Bald Eagle, Black-billed Cuckoo, Black-chinned Hummingbird, Common Yellowthroat, Great Blue Heron, Harlequin Duck, MacGillivray's Warbler, Trumpeter Swan, Willow Flycatcher, Yellow-billed Cuckoo
Mammals	Fringed Myotis, Hayden's Shrew, Little Brown Myotis, Long-eared Myotis, Long-legged Myotis, Meadow Jumping Mouse, Mule Deer, North American Water Vole, Northern Long-eared Myotis, Northern River Otter, Pallid Bat, Preble's Meadow Jumping Mouse, Spotted Bat, Townsend's Big-eared Bat, Western Pygmy Shrew, Western Spotted Skunk, Yuma Myotis
Plants	Colorado Butterfly Plant, Teton Wirelettuce, Ute Ladies' Tresses
Reptiles	Northern Rubber Boa, Northern Spiny Softshell, Plains Gartersnake, Red-bellied Snake, Red-sided Gartersnake, Smooth Greensnake, Valley Gartersnake, Western Painted Turtle

Challenges and Actions

The following challenges have been identified for Riparian Areas and the species of Greatest Conservation Need (SGCN) that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this habitat type at a local scale, the challenges identified here are significant concerns across much of the habitat type in Wyoming. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Bank erosion, trampling, and overutilization can alter plant community composition, reduce water quality, and alter stream hydrology (Herbst et al. 2012, Samuelson and Rood 2011). Voluntary actions to address this challenge include:

- Work with land managers and landowners to implement stewardship activities, such as off-stream watering, riparian exclusionary fencing with appropriate buffer widths, livestock water gaps (while considering the effects of nonpoint source pollution), and conservation easement acquisition.
- Ensure landowners and public lands lessees have access to guidance for best management practices, and support the implementation of these best management practices. Specific recommendations include:
    - Provide clear and practical guidance for livestock producers on riparian-friendly grazing management that highlights economic benefits, available funding incentives, and ecological benefits of healthy riparian areas.
    - Work with landowners, public lands lessees, and agencies to develop and implement management and monitoring plans that allow for adaptive management and are context-specific in regards to climate conditions, plant community, and stream type.
- Enhance coordination among natural resource agencies, private landowners, and nonprofit conservation organizations to identify and implement shared riparian habitat management objectives.
- Provide demonstrations and local learning events to improve diverse stakeholder understanding of the effects of different management approaches.

Roads often follow streams, and road use and construction can affect connectivity and hydrology, including increased runoff, erosion, pollution, channelization, and sedimentation (Blanton and Marcus 2009). Voluntary actions to address this challenge include:

- Work with Wyoming Department of Transportation and other agencies that maintain roads to implement best practices for riparian road crossings (e.g., erosion and runoff control) and road construction (e.g., use riparian buffers).
- Work with federal agencies to decommission and restore unneeded roads and to minimize impacts during new road construction.
- Support conservation and restoration efforts by increasing mapping of riparian areas. Update and make these data available through online sources, such as spatially explicit riparian priority sites found in the Wyoming Game and Fish Department's Statewide Habitat Plan.

Dam operations, altered flow regimes, increased water demand, interstate water compacts, withdrawals, and land use practices can affect riparian habitats through insufficient flows, drought-caused plant mortality, changes to soil salinity and chemistry, reduced establishment of seedlings, altered water tables, or flood suppression facilitating invasive species expansion (Caskey et al. 2014, Vanderhoof et al. 2019). Voluntary actions to address this challenge include:

- Review and comment on management actions proposed by state and federal agencies involving riparian habitats, and work closely with the Wyoming Governor's office, industry, private land owners, and agency staff during early stages of water development project planning. Evaluate avoidance and mitigation options for riparian habitat associated with new water development proposals.
- Work with dam operators and stakeholders to identify and implement flow regimes that benefit riparian habitats, such as high spring flows followed by sustained baseflows to promote cottonwood reproduction and survival. Implement other projects that promote natural processes that enhance and sustain riparian vegetation (seasonal flooding, and site-appropriate levels of erosion and deposition).
- Monitor snowpack, runoff, and streamflow to opportunistically pursue coordinating dam flow releases to benefit cottonwoods and other riparian elements.
- Acquire instream flow water rights to maintain stream channel processes that will contribute to

maintaining functioning riparian areas and stream habitat suitable to support fish populations. Focus acquisition in priority areas identified in the Water Management Unit Plan (Lobb and Dey 2025).

- Collaborate with stakeholders to identify, pilot, implement, and share information about creative and adaptive water use strategies. Specific examples include:
    - Work with policymakers to expand flexibility for private individuals to hold or lease water rights for in-stream flow or other conservation-driven water use that is not currently permitted under Wyoming's beneficial use language.
    - Work with specific local groups of water rights users to identify ways to voluntarily and creatively use and manage water rights.
    - Work with water users to improve efficiency of water delivery and management in ways that ensure adequate water supply for land, wildlife, and people and reduce risks of flooding.
- Develop educational materials and events to educate landowners, agencies, partners, and the general public about the importance of riparian areas, what a healthy, functioning riparian area is, and actions they can take to promote healthy riparian areas. Example projects may include educational videos that highlight effective projects and the ecological importance of riparian areas, as well as workshops, demonstrations, and educational materials regarding beavers and beaver-assisted restoration efforts.
- Identify functionally deficient riparian floodplains where channels are incised, potentially using LIDAR, to develop priorities for restoration and reconnection of the channels to the floodplains.
- Support conservation and restoration efforts by increasing GIS mapping of riparian areas. Update and make these data available through online sources, such as spatially explicit riparian priority sites found in Wyoming Game and Fish Department's Statewide Habitat Plan.
- Research trade-offs between increased irrigation efficiency and loss of wetland wildlife habitat that is sustained by irrigation.

Invasive species can affect the structure and function of riparian habitat. Invasive species include Russian olive, tamarisk, cheatgrass (*Bromus tectorum*), leafy spurge (*Euphorbia esula*), Canada thistle (*Cirsium arvense*), Aquatic Invasive Species (especially New Zealand mudsnail [*Potamopyrgus antipodarum*] and aquatic plants such as curly pondweed [*Potamogeton crispus*]), and feral horses (*Equus ferus;* Boyd et al. 2017, Lesica and Miles 2001, Ringold et al. 2008). Voluntary actions to address this challenge include:

- Facilitate annual meetings with relevant stakeholders such as weed and pest districts and landowners to increase coordination and better align goals and priorities. Support regional partnerships and cooperative weed management areas for treatments that span administrative boundaries.
- When invasive riparian trees are removed, collaborate with partners to ensure that the project also replaces the shade they previously provided with native tree plantings.
- Consider prioritizing invasive riparian plant treatments in places where significant natural riparian plant communities can be quickly and extensively enhanced.
- Conduct educational campaigns to enhance landowner, agency, and public awareness and knowledge about riparian invasive species and best practices for control techniques.
- Improve mapping of the location and spread of invasive species infestations to assist in prioritizing sites for treatment, and make this information available publicly.
- Facilitate the management of native willow and cottonwood communities by researching instream flow, overbank flow regimes, and water uptake and bank stability characteristics of riparian plant species (especially tamarisk and Russian olive).
- When controlling or managing invasive plant species (especially when using herbicides), account for the occurrence of SGCN plants and incorporate monitoring for SGCN plants.
- Integrate native riparian tree plantings into riparian restoration projects (Adams et al. 2025). For example, incorporate willow plug planting into low-tech process-based restoration projects.

The sources and types of pollution are variable, but pollutants can concentrate in riparian areas, bioaccumulate, and affect ecosystem function.

- Manage runoff by implementing best management practices such as off-stream watering or increased riparian vegetation buffers. Prioritize off-stream watering paired with riparian fencing instead of water gaps, because water gaps tend to concentrate livestock waste near the stream and contribute nonpoint source pollution to waters like pathogens and nutrients.

- Support policies that improve or enhance the requirement for adequate wastewater management plans and conduct or supplement water quality monitoring near industrial sites.

- Review management actions proposed by state and federal agencies involving riparian habitats, and work closely with the Wyoming Governor's office, industry, private land owners, and agency staff during early stages of water/energy/urban development project planning.

- Identify opportunities on Wyoming Game and Fish Commission-owned lands to address areas contributing to water pollution.

- Collaborate across state and federal agencies to collect and share data, working to identify significant pollution sources.

- Support water purification processes by maintaining and restoring native wetland and riparian vegetation.

- Increase funding and institutional support for water quality monitoring.

Extreme precipitation events can lead to flooding, downcutting, erosion, loss of vegetation, and channel incision. These events are predicted to become more common as the climate changes. Voluntary actions to address this challenge include:

- Work in collaboration with private landowners and agencies to restore and enhance floodplain connectivity and support solutions like wet meadow restoration, beaver reintroduction or beaver dam analogs (BDAs), willow plantings, better grazing practices, use of riparian buffers, or other habitat projects that can help buffer extreme weather events and increase riparian resilience.

- In cooperation with land management agencies and private landowners, support resilience to flooding by reintroducing beavers into stream systems where they have been extirpated or occur at low densities and have appropriate food, security, and dam-building vegetation.

- Collaborate with federal land management agencies to proactively identify watersheds expected to experience wildfire and take actions to enhance resiliency of riparian areas in those watersheds. For example, prioritize projects to enhance floodplain connectivity, woody riparian vegetation that can support beavers, and consider translocating beaver where adequate habitat exists to support them.

- Incorporate data such as flood frequency into project design and site selection for restoration and infrastructure projects.

- Facilitate annual meetings with relevant stakeholders to enhance coordination among natural resource agencies, private landowners, and nonprofit conservation organizations to identify and implement shared riparian habitat management objectives.

- Increase conservation easement acquisition with willing landowners on riparian habitats.

Climate change is predicted to lead to changes in the amount and timing of water, less predictable hydrology and more frequent high-flow events, which could affect wildlife and habitat (Rood et al. 2016, Wenger et al. 2011). Changes in temperature can affect the amount and timing of water, which can reduce wildlife habitat and affect invasive expansion, seedling establishment, demand for water by riparian plants and human uses, and erosion (Palmquist et al. 2025, Wenger et al. 2011). The location and extent of riparian refugia in Wyoming in the future will depend on the magnitude of increasing temperature and change in precipitation (Szcodronski et al. 2024). Changes in temperature regimes are connected to changes in precipitation and hydrological regimes. A higher proportion of precipitation falling as rain rather than snow, coupled with increased winter melt, will lead to faster and earlier spring run-off (Musselman et al 2018, Musselman et al. 2021). Voluntary actions to address this challenge include:

- Support the capacity for riparian habitat to offer thermal refuge amidst rising temperatures. Specific strategies include:

    - Support efforts to restore and maintain canopy cover (willows, cottonwoods, etc.) to buffer against rising water temperatures.

    - Identify streams and watersheds where riparian shading could be enhanced or is needed to shade stream water to reduce water temperature.

- As invasive riparian trees (Russian olive, tamarisk) are removed, ensure planting of native tree species to replace the lost shading.
- Strategically aim conservation efforts (e.g., conservation easements) in areas that contain thermal refuge.

- Update seed mixes used in restoration to incorporate species and genotypes expected to be adapted to future conditions.
- Use beaver-related management to support riparian restoration efforts. Specific strategies include:
    - Work with agencies and private landowners to increase beaver reintroduction and beaver mimicry/low-tech process-based restoration, which can help hold water on the landscape for longer into the dry season.
    - Prioritize translocation and establishment of beavers in watersheds or streams where extensive beaver dam complexes can be created and soil/geologic conditions exist to allow for groundwater recharge from beaver ponds.
    - Consider using existing tools (i.e., BRAT, riparian GIS data) or develop additional resources (e.g., Colorado Beaver Activity Mapper) to prioritize watersheds for beaver restoration, enhancement, and/or mitigation based on presence of SGCN, importance of beaver ponds to those SGCN, and potential for long-term sustenance of beaver colonies.
    - Consider creating a position or devoting significant time in an existing position to beaver mitigation and conservation/translocation efforts to more strategically use beaver in conservation efforts.
    - Provide education to land owners and managers and, when possible, technical support and funding for mitigating conflicts with beavers to enable beavers to enhance riparian habitat and retain the benefits they provide across the various elevations, ecoregions, and landscapes in Wyoming.
    - Maintain beaver presence where it already occurs by prioritizing non-lethal mitigation including coexistence strategies (e.g., tree protection, culvert protectors, pond-leveling devices, live trapping and relocation where necessary).
    - Coordinate an information sharing event and demonstration to share results and outcomes of beaver dam analog (BDA) projects across Wyoming to increase and improve implementation.
- Collect data and conduct research to support the conservation of SGCN and riparian habitats in light of changing temperature and water regimes. Specific needs include:
    - Model and map thermal refuges, such as climate resilient areas or cool groundwater-fed areas.
    - Collect information to better understand beaver populations and the extent of influence from active beaver colonies.
    - Monitor the landscape distribution and habitat intactness of riparian habitats through remote sensing.
    - Track changes in vegetative composition associated with altered temperature or flow regimes.
    - Identify areas and species that are most vulnerable to the effects of climate change and altered hydrological regimes.
    - Support research to identify aspects of riparian areas that could be enhanced, conserved, or restored to support cooler water temperatures and thermal regimes that will support aquatic communities in the future under ongoing climate change. This would inform priorities for future conservation efforts, such as voluntary conservation agreements.
- Participate in climate adaptation planning with state and federal agencies to better anticipate and manage shifts in hydrology.
- Work in collaboration with private landowners and agencies to buffer extreme hydrological regimes while restoring and enhancing floodplain connectivity using strategies like wet meadow restoration, beaver reintroduction or beaver dam analogs (BDAs), and willow plantings.

- Collaborate with stakeholders to identify, pilot, implement, and share information about creative and adaptive water use strategies, in anticipation of changing water availability. Specific examples include:
    - Work with policymakers to expand flexibility for private individuals to hold or lease water rights for in-stream flow or other conservation-driven water use that is not currently permitted under Wyoming's beneficial use language.
    - Work with specific local groups of water rights users to identify ways to voluntarily and creatively use and manage water rights.
- Work with water users to improve efficiency of water delivery and management in ways that ensure adequate water supply for land, wildlife, and people and reduce risks of flooding.
- Evaluate the efficacy of alternative irrigation practices that can conserve water, such as night watering.


Western Tiger Salamander. Photo by Stephen Siddons/WGFD.


Wyoming Toad. Photo by Christopher Martin/WGFD.

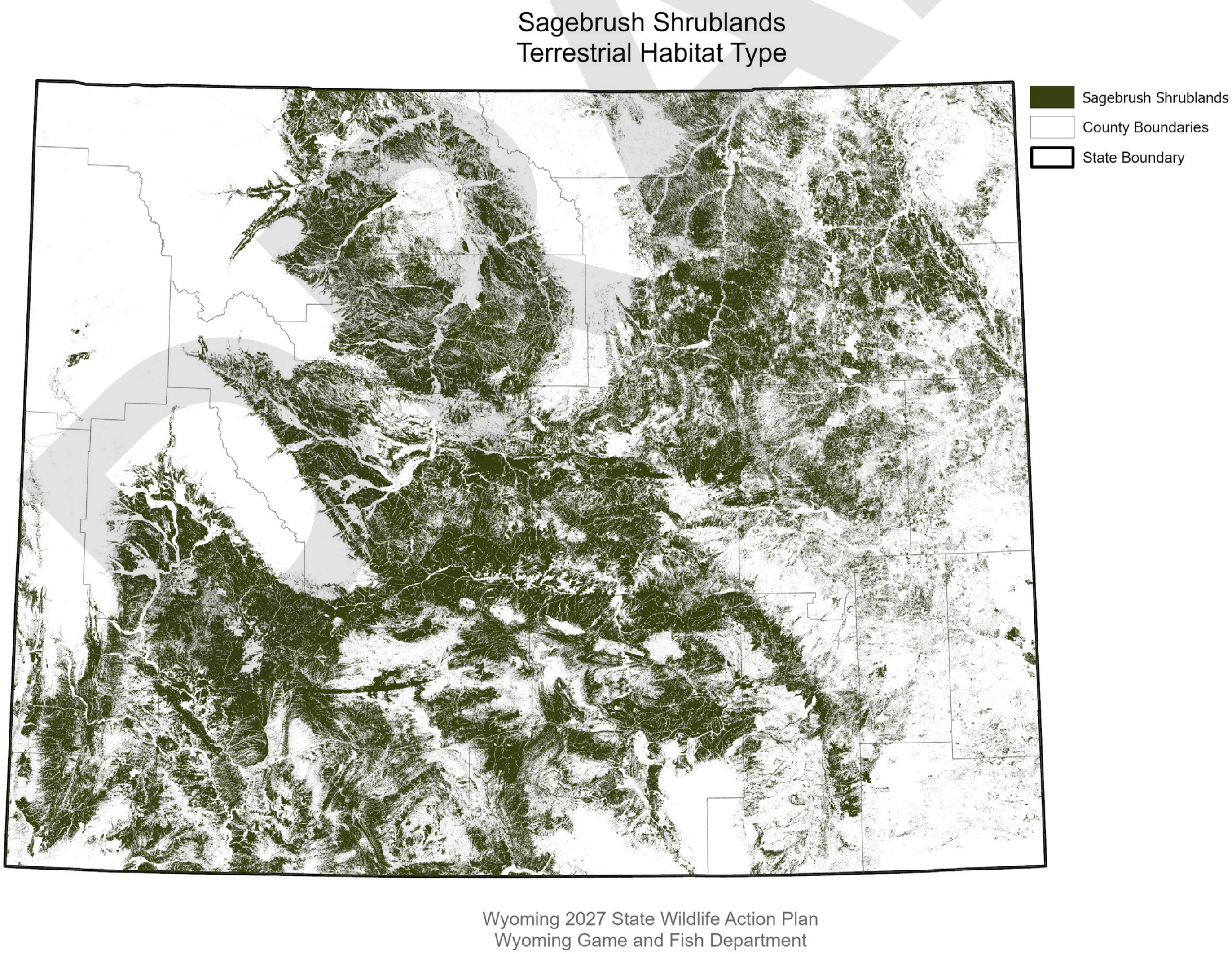

Trumpeter Swan. Photo by WGFD.

Chapter 21: Sagebrush Shrublands

The Sagebrush Shrubland habitat type consists of the NatureServe Terrestrial Ecological Systems that are dominated by sagebrush (*Artemisia* spp.; *Appendix E*). Sagebrush stands can vary from large patches dominated by a single species or subspecies of sagebrush to a mosaic of multiple species where sagebrush is intermixed with other shrubs (Paige and Ritter 1999). Major sagebrush species that dominate or co-dominate sagebrush systems in Wyoming include big sagebrush (*Artemisia tridentata*), including Wyoming, subalpine, mountain, and basin subspecies/varieties; birdfoot sagebrush (*Artemisia pedatifida*); black sagebrush (*Artemisia nova*); bud sagebrush (*Artemisia spinescens*); fringed sagebrush (*Artemisia frigida*); sand sagebrush (*Artemisia filifolia*); silver sagebrush (*Artemisia cana*); and threetip sagebrush (*Artemisia tripartita*; Knight et al. 2014). Additional characteristic species include antelope bitterbrush (*Purshia tridentata*), greasewood (*Sarcobatus vermiculatus*), Indian ricegrass (*Eriocoma hymenoides*), milkvetch (*Astragalus* spp.), rubber rabbitbrush (*Ericameria nauseosa*), sandberg bluegrass (*Poa secunda*), spiny phlox (*Phlox hoodii*), and yellow rabbitbrush (*Chrysothamnus viscidiflorus*).

The sagebrush biome is found in cold, semi-desert climates across the Intermountain West, and Sagebrush Shrublands are the most widespread habitat type in Wyoming, covering approximately 30% of the state (Doherty et al. 2024; *Figure 13*). The Sagebrush Shrublands habitat type occurs at elevations from 3,117 to 10,171 feet. The Sagebrush Shrublands habitat type is characterized by 1.9% low intactness, 12.6% moderate intactness, and 85.5% high intactness. Please refer to *Chapter 12* for details about data, data sources, and methodology.

Figure 13. Map of Sagebrush Shrublands in Wyoming.



Sagebrush and co-occurring plants provide important food, cover, and habitat for a diversity of Wyoming's wildlife (*Table 22*). Sagebrush Shrublands provide both seasonal and year-round habitat: for example Mule Deer tend to overwinter on low-elevation winter ranges dominated by sagebrush, whereas Great Basin Pocket Mice spend all year in home ranges less than one acre in size (O'Farrell et al. 1975, Sawyer et al. 2005). Wildlife occupying Sagebrush Shrublands make use of the physical structure of sagebrush by constructing burrows or using retreat sites that are visually obscured by sagebrush (Pygmy Rabbit, Prairie Rattlesnake; Gardiner et al. 2015, Rachlow et al. 2005) and by keeping nest temperatures stable by carefully selecting nest sites within the shrub (Brewer's Sparrow, Sagebrush Sparrow, and Sage Thrasher; Scherr and Chalfoun 2022). Grassland wildlife species such as Mountain Plover, Swift Fox, and Thick-billed Longspur use Sagebrush Shrublands with lower shrub stature and density. Although the sagebrush is a relatively arid habitat, ephemeral water sources can provide important breeding habitat for amphibians including spadefoots (Knight et al. 2014). Many Species of Greatest Conservation Need (SGCN) plants occupy habitat features including rock outcrops, dunes, wetland features, and riparian systems within Sagebrush Shrubland habitats. Multiple species depend on sagebrush; often called "sagebrush obligates," these species include Brewer's Sparrow, Greater Sage-Grouse, Sagebrush Sparrow, Sage Thrasher, Pygmy Rabbit, and Sagebrush Vole (Paige and Ritter 1999).

Table 22. Sagebrush Shrublands characteristic Species of Greatest Conservation Need.

Species of Greatest Conservation Need that are characteristic of the Sagebrush Shrubland habitat type in Wyoming. Refer to *Appendix D* for a full list of species that are associated with this habitat type.

Taxonomic group	Characteristic Species of Greatest Conservation Need
Amphibians	Great Basin Spadefoot, Great Plains Toad, Plains Spadefoot
Birds	Brewer's Sparrow, Columbian Sharp-tailed Grouse, Ferruginous Hawk, Greater Sage-Grouse, Loggerhead Shrike, Mountain Plover, Sagebrush Sparrow, Sage Thrasher
Mammals	Black-footed Ferret, Eastern Red Bat, Great Basin Pocket Mouse, Idaho Pocket Gopher, Mule Deer, Olive-backed Pocket Mouse, Pallid Bat, Pygmy Rabbit, Sagebrush Vole, Spotted Bat, Swift Fox, White-tailed Prairie Dog, Yuma Myotis
Plants	Alkali Wildrye, Barneby's Clover, Blowout Beardtongue, Desert Yellowhead, Fremont Bladderpod, Hairy Greenthread, Laramie (Alpine) Clover, Long-awned Alkali Wildrye, Parasol Bladderpod, Prostrate (Low) Bladderpod, Tapertip Desertparsley, Stemless Beardtongue, Thickleaf Bladderpod
Reptiles	Great Basin Gophersnake, Midget Faded Rattlesnake, Plains Hog-nosed Snake, Plains Short-horned Lizard, Prairie Rattlesnake, Western Milksnake

Challenges and Actions

The following challenges have been identified for Sagebrush Shrublands and the SGCN that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this habitat type at a local scale, the challenges identified here are significant concerns across much of the habitat type in Wyoming. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Sagebrush habitat overlaps considerably with places that have historic or potential future energy development (Copeland et al. 2009). Activities associated with energy development can be accompanied by habitat loss, spread of invasive plant species, increased roads and infrastructure, increased erosion, altered wildlife population dynamics, direct mortality, and wildlife behavior change (Arnett et al. 2008, Bergquist et al. 2007, Carlin and Chalfoun 2021, Chalfoun 2021, Dwinnell et al. 2019, Green et al. 2017, Kirol et al. 2015, Latif et al. 2023, LeBeau et al. 2017, Milligan et al. 2023, Walston et al. 2009). Voluntary actions to address this challenge include:

- Work collaboratively across industries, federal agencies, state agencies, and other partners to balance energy development with wildlife conservation goals. These efforts will be most effective if they 1) incorporate concerns not only on a project by project basis, but also identify cumulative effects and impact at a landscape level, and 2) occur well before project development. Specific strategies include:

  - Prioritize wildlife conservation in high-value areas, such as minimizing habitat loss within Sage-Grouse Core Areas,
  - Monitor effects of development on connectivity and distribution of sagebrush habitat,
  - Craft recommendations that broaden from focusing on a single species (e.g., Greater Sage-Grouse) to a habitat-wide perspective that supports conservation of sensitive sagebrush obligate species,
  - Identify development mitigation practices that align with documented thresholds of impact for priority species, such as those identified in Greater Sage-Grouse Core Area Protection Executive Order,
  - Implement reclamation strategies to restore sagebrush habitat and protect landscapes from the spread of invasive annual grasses, and
  - Work with partners at local, state, and federal levels to identify areas that are thought to have relatively minimal conservation value and provide these locations as an option to avoid development in critical habitat. For example, incentivize energy development on highly disturbed sites with minimal native habitat component or wildlife use.

- . Encourage the use of indaziflam and other emerging herbicides to control cheatgrass that can establish after disturbance.
- When controlling or managing invasive plant species (especially when using herbicides), account for the occurrence of SGCN plants and incorporate monitoring for SGCN plants.
- Encourage adoption and implementation of the Wyoming Seed Strategy, including 1) using genetically and ecologically suitable, native, diverse native seed for reclamation work, and 2) working collaboratively to develop an adequate seed supply for habitat reclamation.
- Continue to support data-informed siting and development by making data available publicly, in layers that can be incorporated into workflows at different organizations, and at a local scale.
- Develop collaborative relationships with county planning and zoning, county commissions, and utilities to provide recommendations related to wildlife habitat prior to project development.
- Leverage partnerships with research organizations to conduct research that will support balancing energy development and wildlife conservation goals. Research needs include:
  - Investigate the impacts of noise and the effectiveness of mitigation efforts.
  - Identify the indirect effects of energy development on sagebrush obligate species.
  - Identify the efficacy of mitigation actions to minimize disturbance.
  - Conduct a meta-analysis across multiple wildlife species to identify thresholds of surface disturbance where wildlife no longer will use areas of sagebrush habitat impacted by energy development.
  - Continue efforts to assess the effectiveness of the Greater Sage-Grouse Core Area Protection Executive Order stipulations at maintaining Greater Sage-Grouse populations in the state (e.g., Gamo and Beck 2017).
  - Develop effective sagebrush propagation and restoration techniques.
- Develop appropriate mitigation steps (i.e., avoid, minimize, offset) with state and federal agencies and energy industries as part of the permitting of developments. Specific strategies may include:
  - To avoid, prevent removal of sagebrush stands during development or site away from concentrated, sensitive wildlife resources (e.g., leks, nesting and brood-rearing habitat, migration corridors),
  - To minimize, restore sagebrush habitat function, implement timing stipulations, and co-locate with already degraded habitat.

    - To offset, incorporate mitigation banking or provide funding for habitat improvement projects.

Much of the native sagebrush plant community in Wyoming has a low to moderate annual probability of wildfire (Crist et al. 2024), but wildfire can change community composition, increase invasive annual grasses, and degrade habitat quality when it does occur (Anthony et al. 2020, Crist et al. 2023). Voluntary actions to address this challenge include:

- Prioritize land management actions, strategies, and incentives to reduce fire risk, minimize adverse effects of wildfire, and restore habitat after wildfire. Specific strategies may include:
    - Prioritize mapping and treatment of invasive annual grasses (especially cheatgrass) to reduce the likelihood of large scale fire.
    - Develop refined fuels and fire risk models to prioritize management interventions (Price et al. 2025).
    - Restore native plant community where appropriate.
    - Implement fuel reduction treatments in strategic locations. For example, work with land management agencies and private land owners to remove conifer that have encroached into sagebrush habitat.
    - Implement prevention, early detection, and rapid response to fires to reduce the cost of response and restoration.
    - Incorporate climate adaptation into fire response approaches.
    - Conserve the core Greater Sage-Grouse habitats and "grow the core" by maintaining areas with low surface disturbance and invasion of annual grasses.
    - Encourage adoption and implementation of the Wyoming Seed Strategy, including 1) using genetically and ecologically suitable, native, diverse native seed for reclamation work, and 2) working collaboratively to develop an adequate seed supply for habitat reclamation.
    - Work with federal and state partners to identify foundational species in sagebrush habitats including Big Sagebrush and perennial bunchgrasses. Identify herbaceous species best suited for post-fire rehabilitation.
- Create a means for land management personnel to borrow equipment to accomplish conifer removal.
- Encourage the development of funding mechanisms and resources that address both pre- and post-fire mitigation efforts, as well as early detection and rapid response to control fires while still small.
- To inform fire suppression tactics and post-fire reclamation, work with federal and state wildland fire management professionals to better understand fire potential in Wyoming.
- Support and increase implementation of wet meadow and stream restoration to improve landscape resilience to wildfire.

Invasive species such as invasive annual grasses (especially cheatgrass [*Bromus tectorum*]), spotted knapweed (*Centaurea stoebe*), leafy spurge (*Euphorbia esula*), and feral horses (*Equus caballus*) can affect habitat through competition with native species, changing fire frequency, and more (Beck et al. 2024, Boyd et al. 2024, Davis et al. 2014, Jones et al. 2018). Invasive species can accompany other challenges, such as climate change, residential development, and energy development. Voluntary actions to address this challenge include:

- Consider using the Sagebrush Conservation Design approach (Defend the Core, Grow the Core) of prioritizing actions and resources to address, prevent, and limit invasion by invasive annual grasses (IAG), especially cheatgrass. Prioritize areas for management actions to reduce threats of IAG by focusing resources first on preventative actions that retain ecosystem services in Core Sagebrush Areas because they are more cost-effective and more likely to be successful (Doherty et al. 2024). Namely, 1) defend largely intact, uninvaded areas from invasion of invasive annual grasses, 2) control/improve invaded habitats where infestations are small and not well established and where management success is most likely, and 3) contain invasions where necessary (Boyd et al. 2024).
- Create mapping and response products to detect and control non-native, invasive grasses, particularly cheatgrass, medusahead (*Taeniatherum caput-medusae*), and ventenata (*Ventenata* spp.).

- Work with county weed and pest districts and other natural resource managers to create long term treatment plans for invasive annual grass response.

- Support cross-boundary collaborations such as Weed Management Areas (WMAs) across jurisdictions (federal, state, local and private) to share knowledge and resources and to map, prioritize, and treat invasive species.

- Support research efforts to better understand the conditions (timing, application rates, and delivery systems) where contemporary selective and pre-emergent herbicides such as indaziflam are most effective in controlling invasive annual grasses within the Wyoming Basins and eastern Wyoming.

- Promote the “Play, Clean, Go” message. Look for opportunities to add boot cleaning stations or washing stations at popular recreation locations.

- Pursue land use practices that promote and maintain vigor of native vegetation.

- When controlling or managing invasive plant species (especially when using herbicides), account for the occurrence of SGCN plants and incorporate monitoring for SGCN plants.

- Support federal agencies in managing feral horses.

- Monitor for climate-driven changes in habitat composition; patterns of ecological resilience and resistance to disturbance and invasive annual grasses will shift as climate changes.

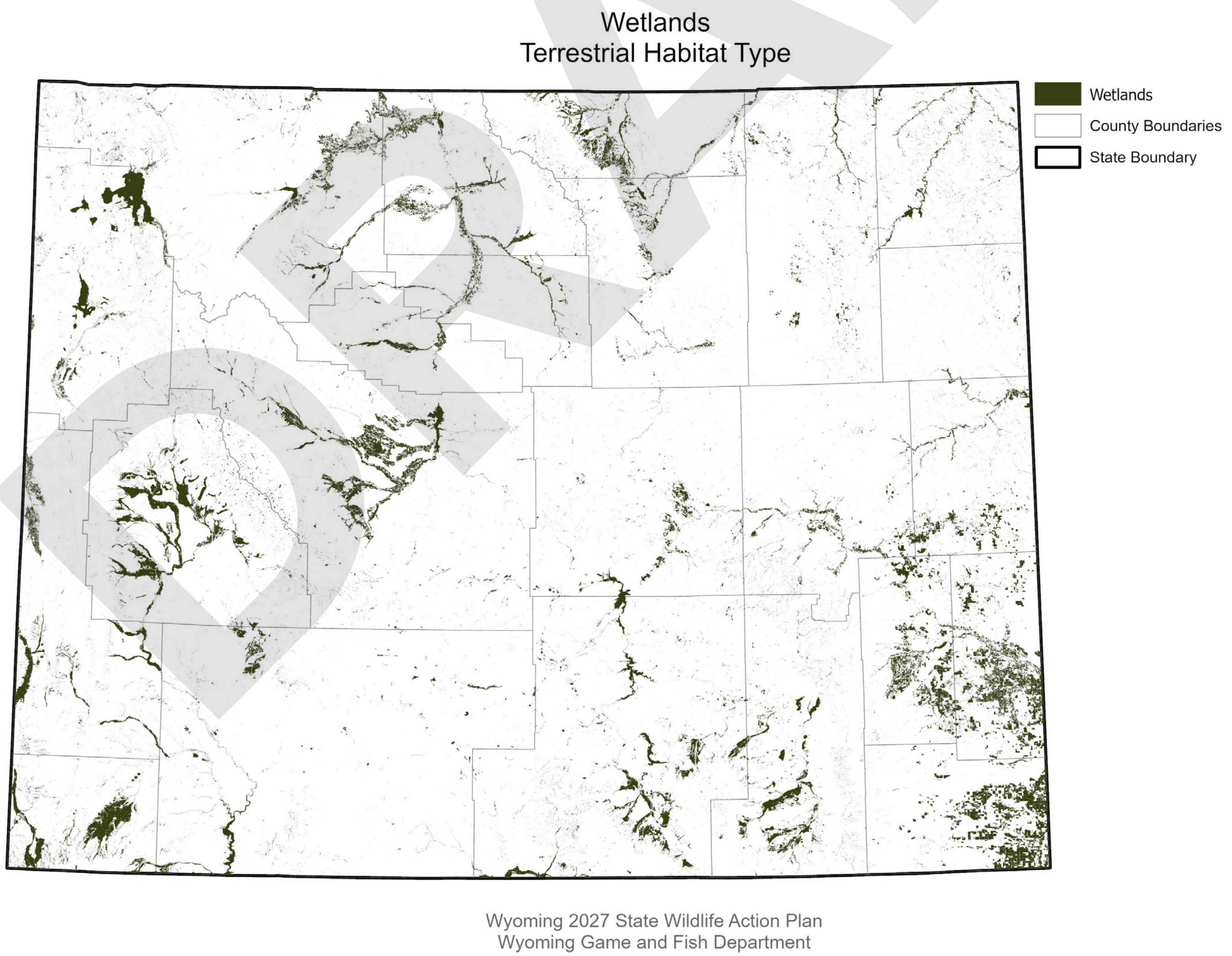
- Encourage adoption and implementation of the Wyoming Seed Strategy, including 1) using genetically and ecologically suitable, native, diverse native seed for reclamation work, and 2) working collaboratively to develop an adequate seed supply for habitat reclamation.

Chapter 22: Wetlands

The Wetlands habitat type consists of the NatureSer-veTerrestrial Ecological Systems that reflect habitats where the soil is annually saturated with water or covered by water at some time during the growing season of each year (*Appendix E*). Wetlands include wet meadows, potholes, playas, oxbows, beaver ponds, marshes, bogs, seeps, irrigation-induced wetlands, and the vegetated shorelines of streams, lakes, ponds, and other types of open water. Prevalent vegetation species in wetlands tend to be water tolerant. The plains and intermountain basins are typified by low densities of shallow, playa-type wetlands that formed either in blowouts or, in some cases, as a result of tectonic activity. Kettle, cirque, and moraine type wetlands and lakes are present in higher elevations once covered by montane glaciers. Springs, bogs, and seeps are scattered throughout the state, but are most common in montane areas. Characteristic vegetation includes desert saltgrass (*Distichlis spicata*), elephant's head (*Pedicularis groenlandica*), rushes (*Juncus* spp.), sedges (*Carex* spp.), slimstem reedgrass (*Calamagrostis stricta*), and tufted bulrush (*Trichophorum cespitosum*).

The Wetlands habitat type is widely distributed throughout the state, but it covers just 6% of Wyoming (*Figure 14*). This habitat type occurs at elevations from 3,104 to 13,232 feet. The Wetlands habitat type is characterized by 19.8% low intactness, 44.3% moderate intactness, and 35.9% high intactness. Please refer to *Chapter 12* for details about data, data sources, and methodology.

Figure 14. Map of Wetlands in Wyoming.



Wetlands are an extremely important wildlife habitat, disproportionately contributing to the diversity of Wyoming wildlife relative to the land base they occupy (Finch and Ruggiero 1993; *Table 23*). Isolated wetlands in arid environments are also extremely valuable for wildlife. Wetlands in these areas often provide a crucial water source and enhanced cover and forage production, making them a hub of activity for terrestrial wildlife that inhabit the surrounding area.

The presence of water, especially in an arid state like Wyoming, supports a diversity of plant and animal life (Wyoming Joint Ventures Steering Committee 2010). Wetlands provide food-rich environments for migratory shorebirds like Long-billed Curlew, White-faced Ibis, and Wilson's Phalarope to build up fuel reserves needed to complete their migrations (Andrei et al. 2007, Elmore et al. 2024, Safran et al. 2000). They also serve as breeding sites for species such as American Bittern and wintering sites for species such as migratory Trumpeter Swans (Fournier et al. 2021, Squires and Anderson 1995). Wetland habitats are important to bats, who drink water, feed on insects, and use vegetation as protection from predators (Mas et al. 2021). Shrews, North American Water Vole, and Greater Sage-Grouse forage on the forbs and invertebrates in alpine and sub-alpine wetlands and wet meadows (Donnelly et al. 2016). Wetlands provide important habitat for breeding, larval development, and adult periods for all of Wyoming's amphibian Species of Greatest Conservation Need (SGCN; Rimer and Goater 2016, Shive et al. 2010). Wetlands provide important food and habitat for gartersnakes, as these snakes are typically found in moist environments and feed on fish, invertebrates, and amphibians (Tuttle and Gregory 2009).

Temporary wetlands (flooded <2 months) have experienced moderate declines in area relative to historic levels, with the largest decline occurring in June (Intermountain West Joint Ventures, personal communication). Anthropogenic, seasonal wetlands (flooded between 2 and 9 months), which are largely tied to irrigation, have increased during late summer and early fall. However, gains in anthropogenic wetlands do not fully offset natural wetland losses.

Table 23. Wetland characteristic Species of Greatest Conservation Need.

Species of Greatest Conservation Need that are characteristic of the Wetland habitat type in Wyoming. Refer to *Appendix D* for a full list of species that are associated with this habitat type.

Taxonomic group	Characteristic Species of Greatest Conservation Need
Amphibians	Columbia Spotted Frog, Great Basin Spadefoot, Great Plains Toad, Northern Leopard Frog, Plains Spadefoot, Western Tiger Salamander, Western (Boreal) Toad, Wood Frog, Wyoming Toad
Birds	American Bittern, American White Pelican, Black Tern, Black-crowned Night-Heron, Caspian Tern, Clark's Grebe, Common Loon, Common Yellowthroat, Forster's Tern, Franklin's Gull, Great Blue Heron, Northern Pintail, Snowy Egret, Trumpeter Swan, Virginia Rail, Western Cattle-Egret, Western Grebe, White-faced Ibis, Wilson's Phalarope
Mammals	Fringed Myotis, Hayden's Shrew, Little Brown Myotis, Long-eared Myotis, Long-legged Myotis, North American Water Vole, Northern Long-eared Myotis, Pallid Bat, Spotted Bat, Townsend's Big-eared Bat, Western Pygmy Shrew
Plants	Alkali Wildrye, Meadow Milkvetch, Mystery Wormwood, Ross' Bentgrass, Slender Spiderflower, Thickleaf Pepperweed, Ute Ladies' Tresses, Woodrush Sedge, Yellowstone Sand Verbena
Reptiles	Plains Gartersnake, Red-sided Gartersnake, Valley Gartersnake, Western Painted Turtle

Challenges and Actions

The following challenges have been identified for Wetlands and the SGCN that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this habitat type at a local scale, the challenges identified here are significant concerns across much of the habitat type in Wyoming. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Invasive species including Russian olive (*Elaeagnus angustifolia*), tamarisk (*Tamarix ramosissima)*, common reed (*Phragmites australis*), and Common Carp (*Cyprinus carpio*) can affect native biodiversity and the ecosystem, reducing habitat value for wildlife. Invasive species are also a problem for wetlands throughout North America and in many places globally (Conventions on Wetlands 2025). Voluntary actions to address this challenge include:

- Encourage wildlife and land management agencies to use spatial and temporal data (including the Wetland Evaluation Tool) to track changes in hydroperiod or surface water extent to aid conservation efforts in areas where invasive species are a concern.
- Use fine-scale spatial data to evaluate effects of suppression treatments on invasive species over time.
- When controlling or managing invasive plant species (especially when using herbicides), account for the occurrence of SGCN plants and incorporate monitoring for SGCN plants.
- Identify wetland resilience to inform prioritization for new projects. For example, consider favoring more resilient wetlands for long-term investment and degraded wetlands for experimental treatments.

Fertilizers, herbicides, pesticides, and sedimentation can reduce water quality and contribute to algal blooms (Baker 1992, Main et al. 2014, Verhoeven et al. 2006). Voluntary actions to address this challenge include:

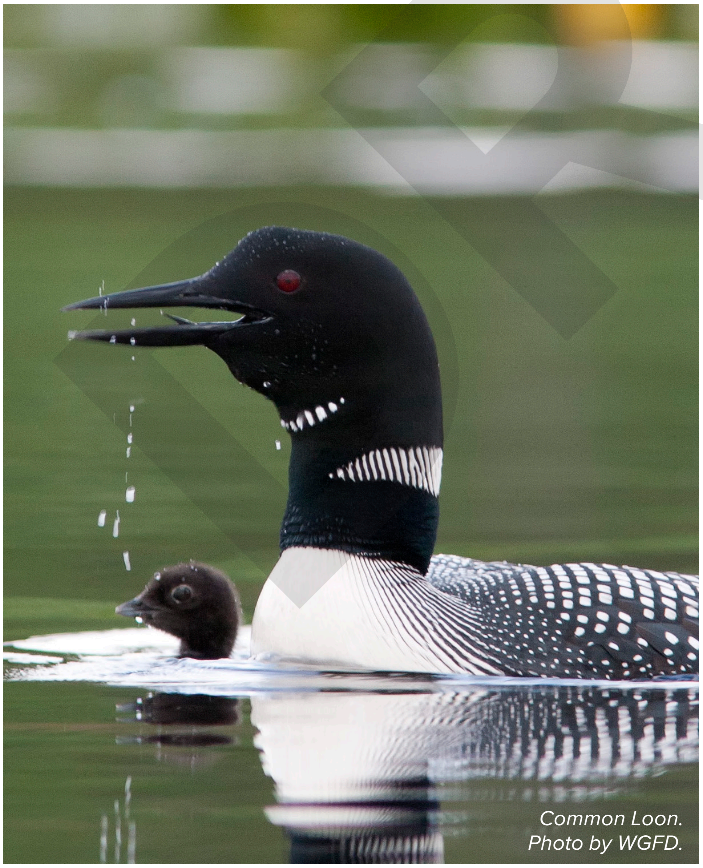
- Work with state, local, NGO, and federal partners to identify locations to create wetlands where pollutants can be trapped while providing habitat values. For example, create wetlands at sites of significant stormwater or irrigation-return flows.

Changes in temperature and precipitation can affect the amount and timing of water, increase evapotranspiration, change the hydrologic function of wetlands, and reduce value of habitat to wildlife (Donnelly et al. 2019, Donnelly et al. 2022, Fay et al. 2016, Mitsch and Hernandez 2013). For example, the length of inundation, and subsequent wetland function, may be decreasing with changing climate (Donnelly et al 2025). These changes may be associated with both severe droughts and rain/flooding events. Changes in temperature regimes are connected to changes in precipitation and hydrological regimes. Voluntary actions to address this challenge include:

- Use geomorphic, piezometer, surface water, and/or long-term trend data to prioritize projects for reconnection and restoration.
- Collaborate across agencies to track trends in wetland surface water area and seasonality to identify opportunities for conservation action.
- Create and maintain wetland habitat that is resilient to changing climatic conditions using water and habitat management techniques. Specific strategies may include:
    - Implement riparian restoration, vegetation planting, and beaver-related restoration projects where appropriate to encourage water cooling and groundwater storage.
    - Implement off-channel floodplain reconnection projects in targeted areas (e.g., historic oxbows and swales) to increase water storage and hyporheic exchange (interaction between surface water and groundwater).
    - Maintain flood-irrigated grass hay practices, improve infrastructure, and integrate flood-irrigated grass hay production into larger riparian management goals and objectives.
    - Update aging water management infrastructure to support effective and dynamic water deliveries in managed (National Wildlife Refuges) and private wetlands (agricultural producers).
    - Integrate wetland creation or restoration into riparian and stream restoration design and implementation.
- Explore alternative diversion structures for flood irrigation that support water management modernization while maintaining sufficient in-stream flows and aquatic habitat connectivity. State, local, NGO, and federal partners could identify sites where there is opportunity to increase the permanence of wetland

hydrology through water supply augmentation or structural repairs, while improving habitat value and planning for future years of low water supply and warm temperatures. Outcomes could include guidance on managing tradeoffs to support both wildlife habitat and irrigation needs, voluntary irrigation incentives, incidental aquifer recharge programs, cooperative water-sharing agreements, and streamflow enhancement projects to help ensure that water applied for flood irrigation benefits both wetlands and fisheries.

- Collaborate across agencies to include consideration of wetland and wildlife habitat values in current and future water quantity conservation programs (e.g., System Conservation Pilot Program).
- Monitor seasonal streamflows and shifts in the timing and duration of wetland availability to ensure they align with the ecological needs of migratory birds and other wildlife species. Use fine-scale spatial data where appropriate and available.
- Bring together multiple stakeholder groups (e.g., landowners, agricultural producers, water users, fisheries biologists, and wetland managers) to develop localized watershed planning efforts.


Common Loon.
Photo by WGFD.

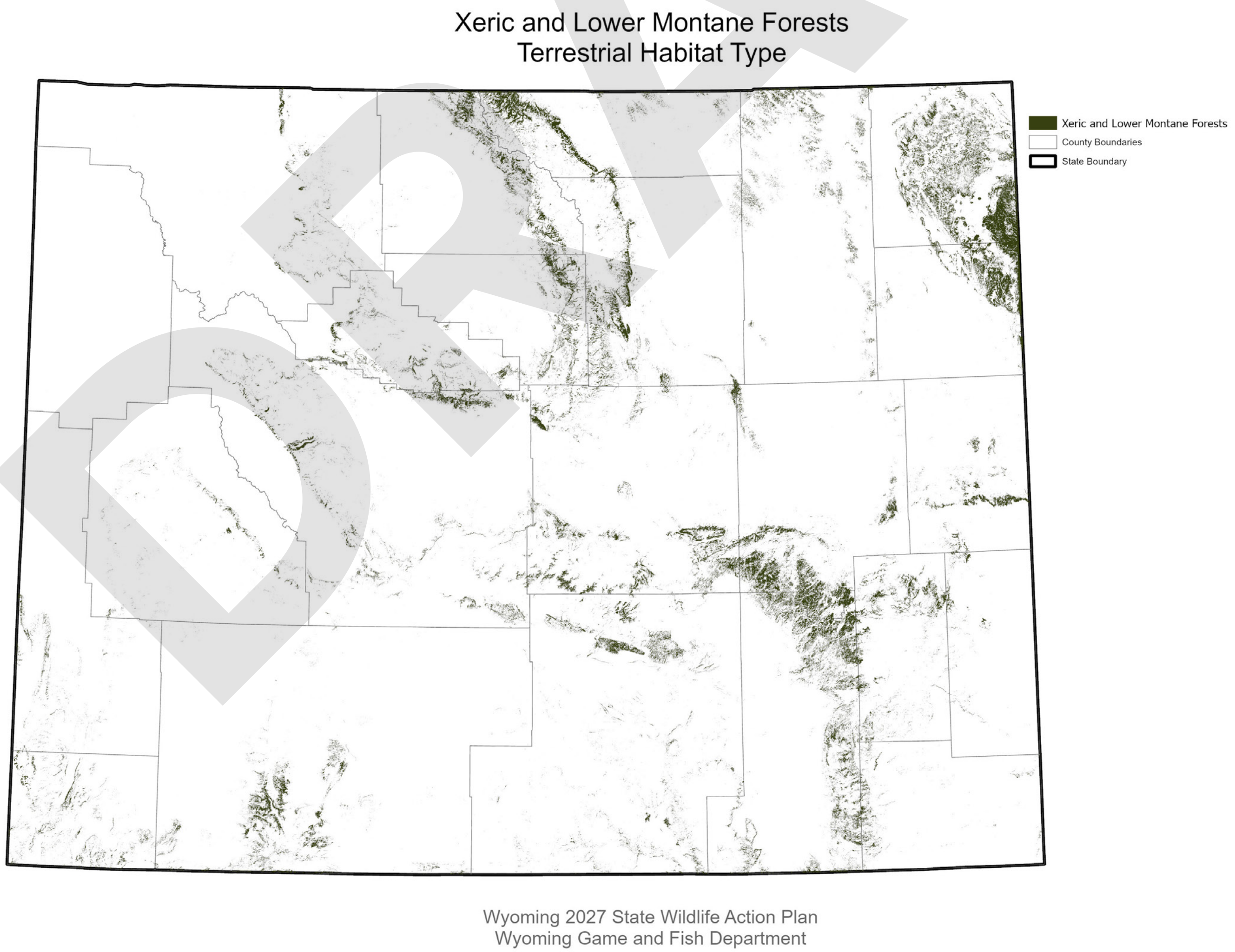

American Bittern. Photo by
Andrea Orabona/WGFD.

Chapter 23: Xeric and Lower Montane Forest

The Xeric and Lower Montane Forests includes the NatureServe Terrestrial Ecological Systems that are dominated by Douglas-fir (*Pseudotsuga menziesii*), limber pine (*Pinus flexilis*), ponderosa pine (*Pinus ponderosa*), Rocky Mountain juniper (*Juniperus scopulorum*), and Utah juniper (*Juniperus osteosperma*; *Appendix E*). Associated shrubs include antelope bitterbrush (*Purshia tridentata*), black sagebrush (*Artemisia nova*), curl-leaf mountain-mahogany (*Cercocarpus ledifolius*), true mountain-mahogany (*Cercocarpus montanus*), and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). Associated grasses include blue grama (*Bouteloua gracilis*) and bluebunch wheatgrass (*Pseudoroegneria spicata*). Forbs include creeping barberry (*Berberis repens*), prairie sagewort (*Artemisia frigida*), prickly pear cactus (*Opuntia* spp.), purple locoweed (*Oxytropis lambertii*), sulfur-flower wild buckwheat (*Eriognum umbellatum*), and yarrow (*Achillea millefolium*).

Xeric and Lower Montane Forests exist at lower elevations alongside mountain ranges and cover approximately 4% of the state (*Figure 15*). The habitat type occurs at elevations from 3,110 to 11,932 feet. Ponderosa pine occurs mostly in the eastern part of the state, which is warmer and has more summer precipitation. Juniper woodlands occur throughout the state, with Utah juniper occurring towards the west and Rocky Mountain juniper towards the east. Limber pine occurs across a range of elevations, but tends towards drier and colder sites. Douglas-fir dominates in western Wyoming (Knight et al. 2014). The Xeric and Lower Montane Forest habitat type is characterized by 0.5% low intactness, 8.5% moderate intactness, and 91.0% high intactness. Please refer to *Chapter 12* for details about data, data sources, and methodology.

Figure 15. Map of Xeric/Lower Montane Forest in Wyoming.



Juniper woodlands can support high abundance and diversity of species, including obligates or semi-obligates such as Bewick's Wren, Gray Vireo, Juniper Titmouse, and Woodhouse's Scrub-Jay (Fitton and Scott 1984, Harris et al. 2020, Pavlacky and Anderson 2001, Reidy and Thompson 2021; *Table 24*). The structural diversity in juniper stands provides numerous sites for perching, singing, nesting, roosting, hibernating, and seeking thermal refuge for a variety of birds, mammals, and reptiles. In southern Sweetwater County, rock outcrops in proximity to piñon-juniper habitats are particularly valuable to Cliff Chipmunk, Canyon Mouse, and Piñon Mouse (Rompola and Anderson 2004). Juniper berries, diverse insects, and vegetation from associated shrubs and forbs provide important sources of food. Also, the steep cliffs and canyons that are common in juniper woodlands provide many opportunities for rock and crevice-roosting bats such as Pallid Bat and Yuma Myotis (Chung-MacCoubrey 2005).

Forests dominated by ponderosa pine provide habitat for Abert's Squirrel, Mule Deer, American Kestrel, American Three-toed Woodpecker, and Black-backed Woodpecker, among others. Ponderosa pine is an important tree species for cavity-nesting birds, provides roosting habitat for a variety of species and snags also provide habitat for mammals, reptiles, and insects (Chambers and Mast 2005, Faris and Zack 2005).

Table 24: Xeric and Lower Montane Forest characteristic Species of Greatest Conservation Need.

Species of Greatest Conservation Need that are characteristic of the Xeric and Lower Montane Forest habitat type in Wyoming. Refer to *Appendix D* for a full list of species that are associated with this habitat type.

Taxonomic group	Characteristic Species of Greatest Conservation Need
Birds	American Goshawk, American Kestrel, Ash-throated Flycatcher, Bewick's Wren, Black-throated Gray Warbler, Blue-gray Gnatchatcher, Bushtit, Clark's Nutcracker, Common Nighthawk, Ferruginous Hawk, Gray Vireo, Juniper Titmouse, Lewis's Woodpecker, Loggerhead Shrike, Merlin, Pinyon Jay, Pygmy Nuthatch, Red Crossbill, Virginia's Warbler, Woodhouse's Scrub-Jay
Mammals	Abert's Squirrel, Canyon Mouse, Cliff Chipmunk, Fringed Myotis, Little Brown Myotis, Long-eared Myotis, Long-legged Myotis, Northern Long-eared Myotis, Pallid Bat, Piñon Mouse, Ringtail, Silky Pocket Mouse, Spotted Bat, Townsend's Big-eared Bat, Western Small-footed Myotis, Western Spotted Skunk, Yellow-pine Chipmunk, Yuma Myotis
Plants	Barneby's Clover, Comb-hair Draba, Prostrate (Low) Bladderpod, Sessileflower (Indian) Spring-parsley
Reptiles	Plateau Fence Lizard, Red-bellied Snake, Smooth Greensnake, Western Milksnake

Challenges and Actions

The following challenges have been identified for Xeric and Lower Montane Forests and the species of Greatest Conservation Need (SGCN) that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this habitat type at a local scale, the challenges identified here are significant concerns across much of the habitat type in Wyoming. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Historic fire suppression and lack of active timber harvest has contributed to fuel accumulation. This accumulation, mixed with climate change, is expected to change forest structure and composition, as well as promote larger and more intense wildfires (Board et al. 2018, Veblen et al. 2000). Voluntary actions to address this challenge include:

- Work with public land managers and private landowners to plan landscape-scale fuels reduction and habitat enhancement projects at key locations to reduce fuel continuity and promote the integrity of healthy woodlands.

- Use prescribed fire, wildfire, and thinning in historically fire-prone systems (e.g. ponderosa pine forests) to maintain desirable densities, natural fuel loads, and structural diversity.

- Design and implement juniper removal projects where juniper is encroaching into sagebrush-grassland and mixed mountain shrub habitats.

- Control and minimize nonnative grasses (e.g., cheatgrass [*Bromus tectorum*]) and shrubs that alter fire regimes.

- Promote post-treatment or post-fire recovery that supports resilient native vegetation, including replanting vegetation where appropriate.

- Prioritize funding for fuels reduction efforts in xeric forests, and seek collaborative partnerships for multiple cost shares to fund projects.

- Support community-based forest management, fuel breaks near homes, and public education about defensible space and fire-adapted landscapes.

Invasive species including cheatgrass, ventanata (*Ventenata* spp.), smooth brome (*Bromus inermis*), and medusahead (*Taeniatherum caput-medusae*) are common in this habitat type and will likely continue to increase. These species affect community composition, forage quality, and fire regimes (Flake and Weisberg 2021, Getz and Baker 2008, Jones et al. 2018). Voluntary actions to address this challenge include:

- Incorporate invasive annual grass control treatments into fuels reduction projects.

- Work with local, state, and federal natural resource managers to create long term treatment plans designed around the “Defend the Core, Grow the Core” concept (Doherty et al. 2024).

- Support land use management that reduces the potential for invasive species invasion by promoting and maintaining vigor of native vegetation.

- Use the latest technology to inventory and delineate invasions, and prioritize treatment locations where it makes sense to conserve and expand the core native understory vegetation.

- Minimize soil disturbance, especially during vulnerable periods (e.g., post-fire, drought).

- Where appropriate, use herbicides to reduce invasive annual grass populations.

- When controlling or managing invasive plant species (especially when using herbicides), account for the occurrence of SGCN plants and incorporate monitoring for SGCN plants.

- Depending on site conditions and occurrence of native vegetation, following disturbance or invasive removal, reseed with competitive native grasses and forbs.

- Coordinate invasive species management, funding, and support between agencies.

- Promote and fund research on effective techniques for treating invasive annual grasses under tree canopies.

Diseases such as white pine blister rust, root rot, and twig blight can change the structure and function of this habitat, and some may be amplified by climate change (Burns et al. 2023, Filip 2005). Wildlife diseases prevalent in this habitat type include chronic wasting disease, which can remain viable in the environment apparently indefinitely. Voluntary actions to address this challenge include:

- Consider using management efforts such as prescribed fire, wildfire, and thinning to increase diversity in forest age class and structure, improve tree health, reduce tree density, and accelerate development of late-successional conditions. Together, these actions may support resilience to disease and reduce the spread of disease.

- Prioritize post-disturbance treatment in areas with the greatest potential to recover post-disturbance, focusing on critical habitats and wildlife populations.

- Manage wildlife populations to be within carrying capacity to limit spread of diseases within those species.

- Plant and promote the regeneration of tree species and genotypes that are resistant to pathogens and better adapted to changing climate.

- Improve fitness of wildlife through appropriate habitat management actions.

Increased temperatures and changing precipitation patterns may affect seasonal moisture availability, wildfire risk, insect impacts, and disease susceptibility. In this woody-dominated habitat, these changes may affect seedling survival and subsequent community composition. Much of this habitat in Wyoming has been predicted to be highly vulnerable to climate change (Comer and Seddon 2023). For example, future climate change is projected to decrease the regeneration of ponderosa pine in this habitat (Petrie et al. 2017). Voluntary actions to address this challenge include:

- Improve soil moisture retention by preserving coarse woody debris, minimizing soil disturbance, and restoring riparian areas.
- Plant and promote tree species and genotypes that are heat- and drought-tolerant.
- Create larger gaps during thinning and retain a mix of species-including those that tolerate drought and establish quickly after disturbance-to support regeneration under changing moisture conditions.
- Use management practices such as prescribed fire, wildfire, and thinning to reduce competition under heat and drought stress, promote drought-resilient species, and support structural diversity by promoting a mix of age classes, patch sizes, and species composition.
- Manage forest density and canopy structure to reduce evapotranspiration and increase soil moisture.
- Support livestock grazing management that reduces the potential for invasive species invasion by promoting and maintaining vigor of native vegetation.
- Target conservation and restoration in areas that provide climate refugia.
- Monitor shifts in snowpack, runoff timing, and vegetation response and use this information to inform conservation and restoration.

Lack of research on this forest type and how potential challenges affect it limits the ability to conserve this habitat type. Voluntary actions to address this challenge include:

- Establish long-term monitoring plots across a range of site conditions to track changes in forests over time.
- Fund research on the efficacy and impacts of management activities (e.g. thinning, fire, planting/seeding), especially in prairie ponderosa pine forests.
- Investigate how SGCN juniper obligate species respond to fuel reduction projects.

Chapter 24: Bear River Basin

The Bear River Basin corresponds with the Bear River subregion (4-digit HUC 1601) and spans about 1,500 square miles in Lincoln and Uinta counties (*Figure 16*). Major river drainages in the basin include the Bear River (originates in Utah), Smiths Fork, and Thomas Fork.

Elevation varies from 6,059 to 10,638 feet above sea level. Mean annual temperature in the basin is 39.5°F, and monthly temperatures vary from an average of 19.7°F in January to 62.8°F in July. Mean annual precipitation is 18.4 inches. Peak precipitation occurs in May, while winters are cold and dry, with the exception of snow at bordering mountain high elevations. All 11 terrestrial habitat types defined in this document occur in the basin. Land use includes livestock grazing, timber production, irrigated hay fields, energy development and mining, recreation, and residential. Land ownership includes 54% federal, 37% private, 8% state, and 1% other. The basin contains approximately 4,204 miles of streams. There are approximately 2 miles of impaired rivers and streams and no impaired lakes or reservoirs. There are approximately 72 dams and 20 road-related barriers in the basin. Please refer to *Chapter 12* for details about data and data sources.

Species of Greatest Conservation Need (SGCN) in the Bear River Basin are listed in *Table 25*, *Table 26*, and *Appendix D*.

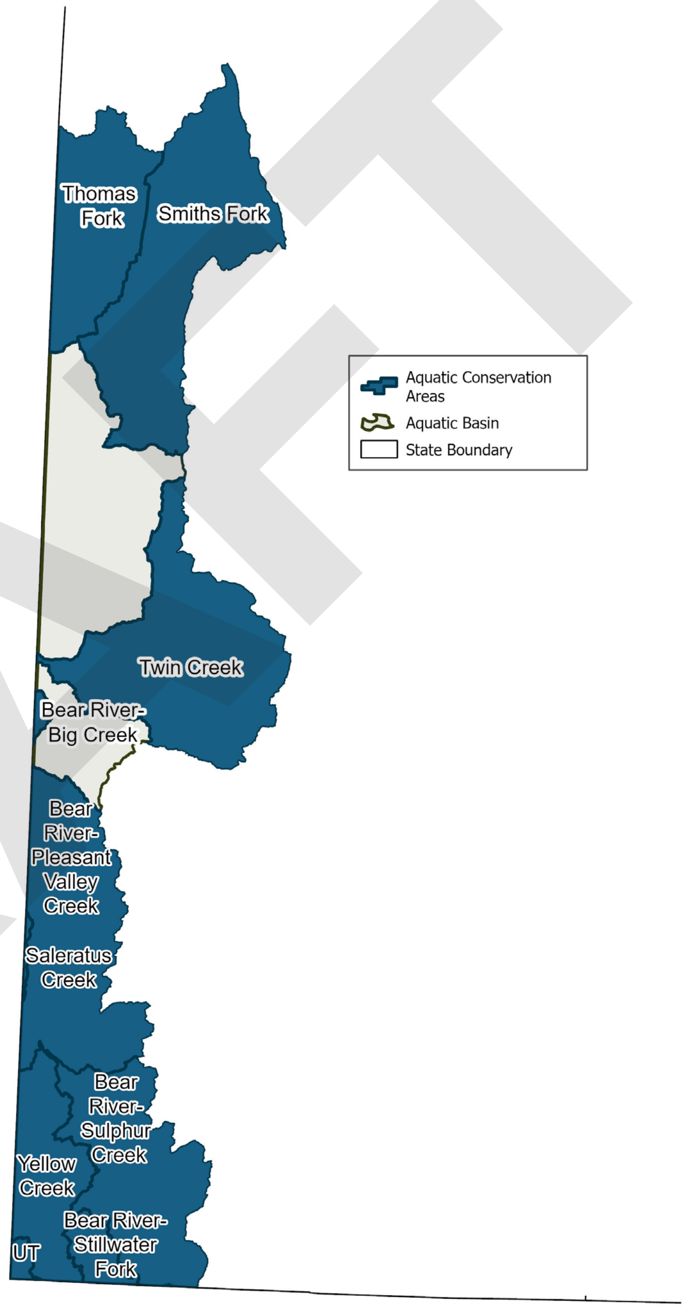


Figure 16. Map of Bear River Basin.

The Bear River Basin contains the Upper Bear (160101) and Weber (160201) basins (6-digit Hydrologic Unit Codes [HUCs]). The map includes priority aquatic conservation areas.

Table 25. Fishes present in the Bear River Basin.

Fishes present in the Bear River Basin. Species of Greatest Conservation Need (SGCN) are followed by an asterisk (*). "NS" indicates species that are nonnative in the basin, but are SGCN in other basins.

Native game	Native nongame	Nonnative game	Nonnative nongame
Bonneville Cutthroat Trout *	Green Sucker *	Brook Trout	Common Carp
Mountain Whitefish	Longnose Dace	Brown Trout	
	Mottled Sculpin	Kokanee Salmon	
	Mountain Sucker	Rainbow Trout	
	Northern Leatherside *	Smallmouth Bass	
	Paiute Sculpin	Snake River Cutthroat Trout (NS)	
	Redside Shiner	Tiger Trout	
	Speckled Dace	Walleye	
	Utah Chub	Yellow Perch	
	Utah Sucker		

Table 26. Turtles, mollusks, and crustaceans in Bear River Basin.

Other aquatic species present in the Bear River Basin. Species of Greatest Conservation Need (SGCN) are followed by an asterisk (*). "NI" indicates species that are nonnative and/or introduced.

Turtles	Mollusks	Crustaceans
No turtles	Bear Lake Springsnail *	Pilose Crayfish*
	California Floater *	Virile Crayfish (NI)
	Fragile Ancylid *	
	Marsh Pondsnail *	
	Mossy Valvata *	
	Rocky Mountain Duskysnail *	
	Sharp Sprite *	
	Swamp Lymnaea *	
	Western Pearlshell *	
	Woodland Pondsnail *	

Challenges and Actions

The following challenges have been identified for Bear River Basin and the SGCN that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this aquatic basin at a local scale, the challenges identified here are significant concerns across the basin. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Bank erosion, reduced spawning habitat, reduced streambank shade, and altered upland vegetation communities can negatively affect aquatic species and their habitats (Poff et al. 2011). Voluntary actions to address this challenge include:

- Maintain or restore stream conditions by encouraging sound land use practices (e.g., rotational grazing, fencing, virtual fencing, minimize concentrations of animals near surface waters, protect woody vegetation).
- Encourage development of off-channel water systems.
- Work with landowners to encourage enrollment in Conservation Reserve Program and Grassland Reserve Program programs through the United States Department of Agriculture.

Roads and railroads can affect aquatic species and their habitats through increased erosion and runoff, and can contribute to habitat loss (Al-Chokhachy et al. 2016, Bouska et al. 2010, Wheeler et al. 2005). Voluntary actions to address this challenge include:

- Maintain aquatic habitat by conserving riparian corridors and wetlands, as well as encouraging wide buffer zones when building roads and other development.
- Repair transportation structures that impede fish passage.
- Modify culverts that impact fish movement.
- Encourage land managers to update their travel management plans so that unauthorized trails created by off road vehicles can be addressed and minimized.
- Work with permitting agencies to ensure that all road construction and maintenance best management practices are followed to minimize additional sediment runoff.

Dams and other infrastructure to control the amount and timing of water can reduce movement and genetic connectivity, alter flow regimes, alter water temperatures, contribute to entrainment, reduce instream flows, increase erosion, affect community assemblage, and contribute to habitat fragmentation (Bergstedt and Bergersen 1997, Carlson and Rahel 2007, Compton et al. 2008, Hedden et al. 2021, Quist et al. 2005, Rosenthal et al. 2024). Voluntary actions to address this challenge include:

- Work with state (e.g., Wyoming Water Development Office) and local entities (e.g., irrigation districts) to 1) manage water for multiple purposes (e.g., manage draw downs to prevent habitat loss for fish during critical periods while maintaining water for irrigation purposes), 2) improve irrigation and conveyance efficiency, 3) implement best management practices for maximizing stream flow and connectivity, and 4) work to thoroughly understand and describe impacts of all new water development projects on native aquatic organisms.
- Continue to monitor timing, temperature, and flow from dams and how they impact habitat conditions downstream.
- Evaluate existing fish screens on irrigation diversions and make improvements, where necessary.
- Evaluate diversion dams to determine if installation of aquatic organism passage is necessary and feasible and implement as appropriate.
- Work to ensure water remains available to maintain all existing SGCN populations (e.g., Northern Leatherside populations).
- Identify stream segments where habitat and available flow regimes indicate a need to file instream flow water rights for SGCN, referring to Wyoming Game and Fish Department's Water Management Unit Plan (Lobb and Dey 2025) for priority segments. As opportunities are identified, conduct needed studies and file for state-held instream flow water rights.
- Work with irrigation groups to manage withdrawals in a manner that minimizes impacts to native fish and mussel populations.

Activities that contribute to sediment increases (e.g., road building) can impair watershed function and degrade habitat (Al-Chokhachy et al. 2016, Wheeler et al. 2005). Voluntary actions to address this challenge include:

- Request that construction activities that could increase sediment discharge into streams fall outside known native fish critical spawning windows.

- Work with permitting agencies to ensure that all stormwater and sediment management best management practices are followed to minimize additional sediment runoff at disturbed sites.

- Work with road maintenance and improvement entities to use practices that minimize sediment inputs to streams.

- Ensure sediment transport systems function properly and propose projects to improve the transport of sediments where there are issues.

Invasive and nonnative species, including Aquatic Invasive Species (AIS), can degrade habitat, compete for resources with native species, and change community composition (Bernery et al. 2022, Koel et al. 2019, Prestes et al. 2024, Rahel 2000). Invasive nonnative species are often linked to other challenges, including climate change, dams, and more (Bell et al. 2021). Voluntary actions to address this challenge include:

- Evaluate the impact of nonnative fish species on native fauna and work to eliminate or reduce those impacts where necessary.

- Determine the distribution and abundance of native and nonnative crayfish, potential competition between native and nonnative crayfish, and identify location of barriers and sites appropriate for artificial barrier construction that would limit the range expansion of invasive crayfish.

- Research and implement effective treatments to rehabilitate corridors and watersheds that have been altered by invasive and nonnative species.

- Strictly control nonnative sportfish stocking in watersheds where they might substantively impact native SGCN.

- Remove Common Carp to reduce predation on native mussel species and competition with native fish species.

- Continue to operate watercraft checkstations, enforce regulations, and educate the general public to prevent the spread of AIS.

Pathogens such as whirling disease and bacterial kidney disease can hinder native fish species recovery and limit options for reintroduction (Bartholomew and Reno 2002, Kowalski 2022). Recent declines in Pilose Crayfish populations could be associated with pathogens such as porcelain disease or other pathogens (Newkirk et al. 2023). Voluntary actions to address this challenge include:

- Conduct disease analysis of Bonneville Cutthroat Trout populations to assist with the understanding of the distribution and impacts of the whirling disease parasite and other pathogens.

- Monitor for new pathogens and disease in SGCN populations.

- Continue to investigate the impacts of porcelain disease and other potential pathogens on Pilose Crayfish populations.

- Engage water-based recreationalists in a communication campaign to limit spread and movement of pathogens.

Heavy rain events can cause turbidity issues, contribute to erosion, and affect reproduction by displacing redds and smothering eggs. Voluntary actions to address this challenge include:

- Encourage creation of riparian buffers to act as a sediment trap.

- Include bankfull benches in aquatic restoration projects to increase floodplain connectivity, attenuate flood energies, and retain sediment.

- Improve riparian habitat by reducing impacts from grazing, protecting woody vegetation, and other appropriate means.

Increased ambient air temperatures can increase in-stream temperatures, potentially affecting fish survival and community composition, contributing to range expansions or contractions, increasing stress load, and exacerbating disease susceptibility (Comte et al. 2013). Changes to the amount, form, and timing of precipitation can reduce habitat quality and quantity for aquatic species. Changes in temperature regimes are connected to changes in precipitation and hydrological regimes, and climate change can interact with and exacerbate other challenges (Barbarossa et al. 2021, Bell et al. 2021, Goode et al. 2012, Lennox et al. 2019, Rahel et al. 2008). Voluntary actions to address this challenge include:

- Implement management strategies that promote landscape resilience, water persistence, and habitat diversity. Conserve and manage riparian areas for native riparian vegetation by using riparian fencing, land use management, fire management, and invasive species control.

- Promote fish movement throughout the drainage by pursuing projects that maintain or improve connectivity.

- Pursue activities (e.g., purchase water rights, increase efficiency of irrigation practices) that enhance flows.

- Work in collaboration with private landowners and agencies to buffer extreme hydrological regimes and build up ground water while restoring and enhancing floodplain connectivity using strategies like wet meadow restoration, beaver reintroduction or beaver dam analogs, and willow plantings.

- Improve riparian habitat by reducing impacts from land use practices, protecting woody vegetation, and other appropriate means.

- Complete stream and watershed restoration projects in areas predicted to be climate resilient (e.g., Isaak et al. 2017, Szcodronski et al. 2024).

- Conserve functioning habitats and maintain wildlife populations to promote resilience to climate change (e.g., Isaak et al. 2017, Szcodronski et al. 2024).

- Identify stream corridor refugia and restore and/or maintain connectivity to refugia (e.g., Isaak et al. 2017, Szcodronski et al. 2024). Where necessary, address issues such as invasive species, land use, and fragmentation that affect refugia.

Priority aquatic conservation areas

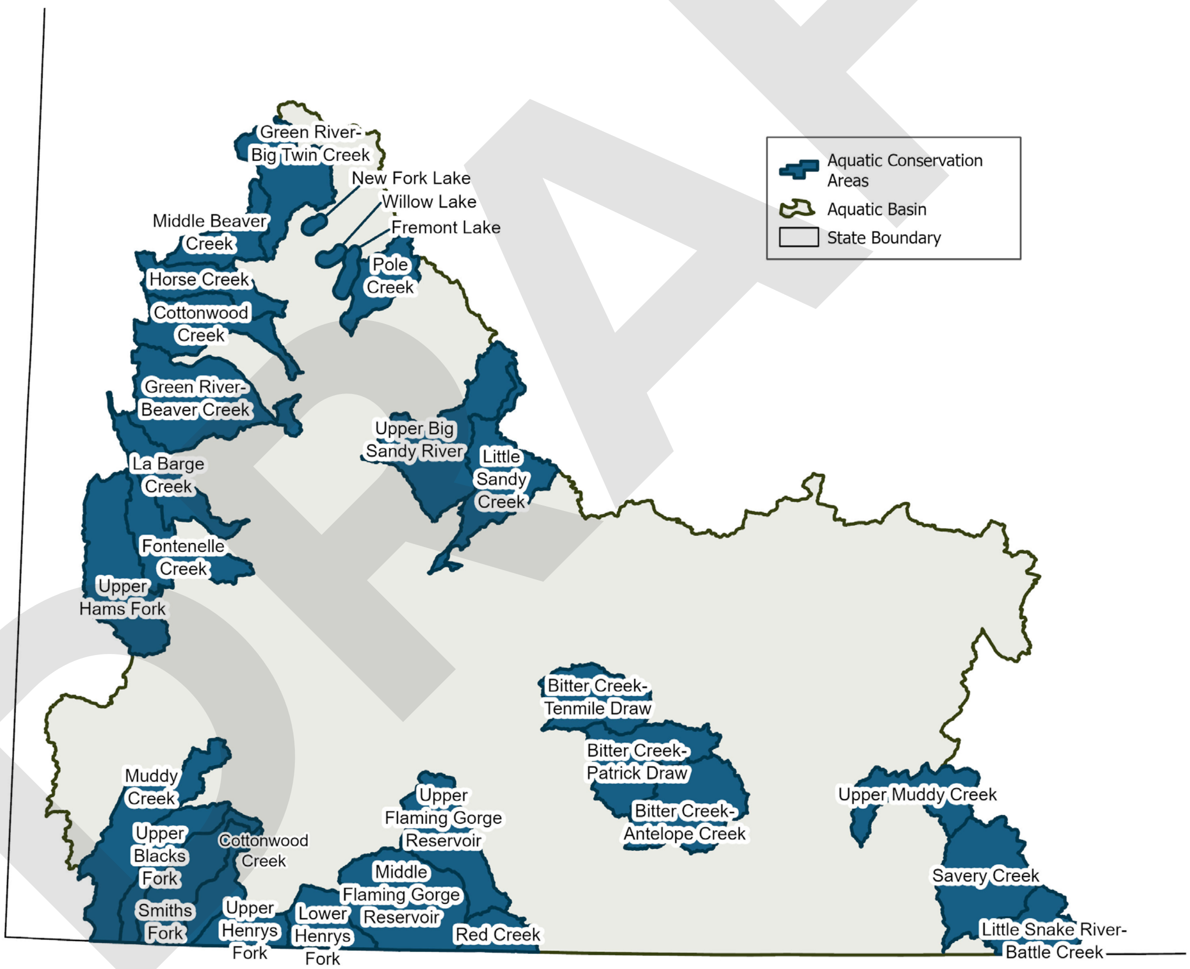
Priority conservation areas in the Bear River Basin are shown in *Figure 16*. Priority areas include major Bear River tributaries Twin Creek, Smiths Fork, and Thomas Fork that are critical to the conservation of Northern Leatherside, Bonneville Cutthroat Trout, or both. The headwater tributaries of Mill, LaChapelle, and Sulphur creeks draining the north slope of the Uinta Mountains are critical for Northern Leatherside. Additionally the Bear River and tributaries above Evanston harbor important Bonneville Cutthroat Trout populations. Please refer to the Wyoming Game and Fish Department’s Statewide Habitat Plan for narratives of each priority area.

Chapter 25: Green River Basin

The Green River Basin corresponds with the Upper Colorado region in Wyoming (2-digit HUC 14; *Figure 17*). The basin spans about 21,000 square miles in Carbon, Lincoln, Sublette, Sweetwater, and Uinta counties, as well as small portions in Fremont and Teton counties. Major river drainages include the Little Snake (tributary to the Yampa River in Colorado), Henrys Fork, Blacks Fork, Hams Fork, Big Sandy, East Fork, New Fork, and Green River.

Figure 17. Map of Green River Basin.

The Green River Basin, as defined for the 2027 State Wildlife Action Plan, contains the Upper Green (140401), Great Divide Closed Basin (140402), and White-Yampa (140500) basins (6-digit Hydrologic Unit Codes [HUCs]). The map includes priority aquatic conservation areas.



Elevation varies from 6,031 feet to 13,800 feet above sea level. Mean annual temperature in the basin is 40.3°F, and monthly temperatures vary from an average of 19.0°F in January to 64.6°F in July. The climate is relatively dry, with mean annual precipitation of only about 12.8 inches. All 11 terrestrial aquatic basins defined in this document occur in the Green River Basin. Land use includes all the customary western public lands players; the degree of oil and natural gas development is particularly noteworthy. Land ownership includes 68% federal, 27% private, 4% state, and 1% other. The basin contains approximately 58,138 miles of streams. There are approximately 16 miles of impaired rivers and streams and no impaired lakes or reservoirs. There are approximately 311 dams and 118 road-related barriers in the basin. Please refer to *Chapter 12* for details about data and data sources.

Species of Greatest Conservation Need (SGCN) in the Green River Basin are listed in *Table 27*, *Table 28*, and *Appendix D*.

Table 27. Fishes present in the Green River Basin.

Fishes present in the Green River Basin. Species of Greatest Conservation Need (SGCN) are followed by an asterisk (*). "X" denotes species that were extirpated from Wyoming. "E" denotes federally endangered species. "U" denotes species that may have been present in Wyoming, but historic presence cannot be confirmed. "NS" indicates species that are non-native in the basin, but are SGCN in other basins.

Native game	Native nongame	Nonnative game	Nonnative nongame
Colorado River Cutthroat Trout *	Bluehead Sucker *	Black Bullhead	Burbot (NS)
Mountain Whitefish	Bonytail (XE)	Bluegill	Common Carp
	Colorado Pikeminnow (XE)	Bonneville Cutthroat Trout (NS)	Creek Chub
	Flannelmouth Sucker *	Brook Trout	Fathead Minnow
	Humpback Chub (UE)	Brown Trout	Iowa Darter (NS)
	Kendall Warm Springs Dace *(E)	Channel Catfish	Lake Chub
	Mottled Sculpin	Golden Trout	Longnose Dace
	Mountain Sucker	Grayling	Longnose Sucker
	Razorback Sucker (XE)	Kokanee Salmon	Northern Leatherside (NS)
	Roundtail Chub *	Lake Trout	Redside Shiner
	Speckled Dace	Northern Pike	Sand Shiner
		Rainbow Trout	Utah Chub
		Tiger Trout	Utah Sucker
		Smallmouth Bass	White Sucker
		Snake River Cutthroat Trout (NS)	
		Yellowstone Cutthroat Trout (NS)	

Table 28. Turtles, mollusks, and crustaceans in Green River Basin.

Other aquatic species present in the Green River Basin. Species of Greatest Conservation Need (SGCN) are followed by an asterisk (*). "NI" indicates species that are nonnative and/or introduced. "NS" indicates species that are nonnative in the basin, but are SGCN in other basins.

Turtles	Mollusks	Crustaceans
North American Snapping Turtle (NI)	Creeping Ancylid *	Calico Crayfish*
Western Painted Turtles (NS)	Green River Pebblesnail *	Virile Crayfish (NI)
	Marsh Pondsnail *	
	Mossy Valvata *	
	Obtuse Physa *	
	Star Gyro *	
	Swamp Lymnaea *	
	Umbilicate Sprite *	
	Western Pearlshell (NS)	
	Woodland Pondsnail *	

Challenges and Actions

The following challenges have been identified for Green River Basin and the SGCN that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this aquatic basin at a local scale, the challenges identified here are significant concerns across the basin. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Water use and associated infrastructure for managing water can negatively affect fish and their habitats by altering water availability, stream bank vegetation, erosion, connectivity (i.e., lead to entrainment), community composition, spring hydrographs, and connectivity (Carlson and Rahel 2007, Davis et al. 2022, Richter et al. 2020). Voluntary actions to address this challenge include:

- Protect and manage riparian areas for native vegetation.
- Conduct instream habitat restoration activities to improve river function.
- Work with individual irrigators and irrigation districts to identify and implement actions that minimize alterations to river morphology, fish entrainment, and streambank disturbance. Specific strategies include implementing fish-friendly irrigation practices and enrolling in the Conservation Pilot Program.

Development can affect aquatic species and their habitats through increasing erosion and runoff, altering flows, introducing risk of spills, affecting connectivity, promoting headcuts, reducing wet meadows, and overall contributing to habitat loss. (Al-Chokhachy et al. 2016, Bouska et al. 2010, Brittingham et al. 2014, Dauwalter et al. 2011, Dauwalter 2013, Girard and Walters 2018, Wheeler et al. 2005). Voluntary actions to address this challenge include:

- Maintain aquatic habitat by conserving riparian corridors and wetlands, as well as encouraging wide buffer zones when building roads and other development.
- Encourage land managers to update their travel management plans so that unauthorized trails created by off road vehicles can be addressed and minimized.
- Work with private landowners and state and federal agencies to include best management practices in road construction and maintenance stipulations, including appropriate sized culverts for drainage areas, road maintenance that minimizes disturbance in barrow areas to reduce erosion and invasive species, and strategically placed water barring to decrease erosion from snowmelt and large rain events.

- Request that construction activities that could increase sediment discharge into streams fall outside known native fish critical spawning windows.

Larger and more severe fires may be possible due to fire suppression and climate change, which could affect habitat through sediment flushing and decreased water quality (Bixby et al. 2015, Isaza et al. 2022). Voluntary actions to address this challenge include:

- Conduct post-fire monitoring of aquatic organisms as well as instream and riparian habitat.

- Pursue land management plans that promote the reestablishment of native vegetation communities.

- Use prescribed fire and wildfire to enhance watershed function and decrease risk of catastrophic wildfire.

- Promote resilience to wildfire by implementing habitat improvement projects to restore river and floodplain function, since functioning floodplains can serve as fire breaks.

Dams and other infrastructure to control the amount and timing of water can reduce movement and genetic connectivity, alter flow regimes, alter water temperatures, contribute to entrainment, reduce instream flows, increase erosion, affect community assemblage, and contribute to habitat fragmentation (Bergstedt and Bergersen 1997, Carlson and Rahel 2007, Compton et al. 2008, Hedden et al. 2021, Quist et al. 2005, Rosenthal et al. 2024). Voluntary actions to address this challenge include:

- Work with state (e.g., Wyoming Water Development Office) and local entities (e.g., irrigation districts) to 1) manage water for multiple purposes (e.g., manage draw downs to prevent habitat loss for fish during critical periods while maintaining water for irrigation purposes), 2) improve irrigation and conveyance efficiency, 3) implement best management practices for maximizing stream flow and connectivity, and 4) work to thoroughly understand and describe impacts of all new water development projects on native aquatic organisms.

- Identify stream segments where habitat and available flow regimes indicate a need to file instream flow water rights for SGCN, referring to Wyoming Game and Fish Department's Water Management Unit Plan (Lobb and Dey 2025) for priority segments. As opportunities are identified, conduct needed studies and file for state-held instream flow water rights.

- Pursue opportunities to maintain or increase flows in streams critical to the life history of SGCN.

- Improve fish passage by maintaining flow, modifying diversions, and removing perched culverts.

- Work with partners to reduce entrainment.

Invasive and nonnative species, including Aquatic Invasive Species (AIS), can degrade habitat, compete for resources with native species, and change community composition (Bernery et al. 2022, Koel et al. 2019, Prestes et al. 2024, Rahel 2000). Invasive nonnative species are often linked to other challenges, including climate change, dams, and more (Bell et al. 2021). In this basin, nonnative fish species can affect native Colorado River Cutthroat Trout (CRCT Conservation Team 2022) as well as Bluehead Sucker, Flannelmouth Sucker, and Roundtail Chub (Gelwicks et al. 2009). Feral horses can negatively affect aquatic habitat. Voluntary actions to address this challenge include:

- Continue efforts to remove competing nonnative species to secure, enhance, and restore native fish populations.

- Identify sources of Colorado River Cutthroat Trout to be used for translocations, streamside spawns, and development of brood source.

- Ensure that private landowners located within Colorado River Cutthroat Trout conservation waters only stock Colorado River Cutthroat Trout as approved by the Department.

- Prevent stocking with nonnative species that are likely to negatively influence SGCN.

- Identify populations and habitats that currently support Colorado River Cutthroat Trout or that could support them if threats of nonnative species were removed either by creating a fish migration barrier and/or conducting a chemical rehabilitation project.

- Research and implement effective treatments to rehabilitate corridors and watersheds that have been altered by invasive and nonnative species.

- Relocate populations of Roundtail Chub, Bluehead Sucker, and Flannelmouth Sucker in locations that are void of competition from, hybridization with, and predation from nonnative species.

Hybridization with nonnative species can negatively affect native species (Rosenthal et al. 2022). In this basin, hybridization is a concern between native Colorado River Cutthroat Trout and Rainbow Trout, as well as Flannelmouth Sucker and Bluehead Sucker with White Sucker and Longnose Sucker (Mandeville et al. 2017). Voluntary actions to address this challenge include:

- Remove nonnative species through mechanical removal and chemical treatments.
- Continue with regular monitoring of Bluehead Sucker, Flannelmouth Sucker, and Roundtail Chub to track population trends, hybridization rates, and nonnative species threats.
- Prevent stocking with non-native species where they might hybridize with Colorado River Cutthroat Trout conservation populations.
- Conduct genetic analysis of all potential Colorado River Cutthroat Trout populations.
- Construct fish migration barriers to allow for removal of nonnative species and restoration of SGCN.

Pathogens such as whirling disease and bacterial kidney disease can hinder native fish species recovery and limit options for reintroduction (Bartholomew and Reno 2002, Kowalski et al. 2022). Voluntary actions to address this challenge include:

- Conduct disease analysis of Colorado River Cutthroat Trout populations to understand the distribution of the whirling disease parasite and other pathogens and to determine if these fish can be used for translocations, streamside spawn, and development of new brood source.

Shifts in temperature regimes can negatively affect timing of resource availability for aquatic species (Durant et al. 2007). Changes to the amount, form, and timing of precipitation can reduce aquatic habitat quality and quantity. Additionally, changes can lead to more frequent and intense storms or longer dry periods, both of which can destabilize riparian habitats. Changes in precipitation are often linked to changes in temperature, and climate change can interact with and exacerbate other challenges (Lennox et al. 2019). Voluntary actions to address this challenge include:

- Model Colorado River Cutthroat Trout distribution, abundance, and genetic status under current and future environmental scenarios.
- Acquire instream flow rights on streams supporting Colorado River Cutthroat Trout populations.
- Keep water in headwaters longer using natural approaches like beaver, BDAs, small rock dams, and other zeedyk structures.
- Complete stream and watershed restoration projects in areas predicted to be climate resilient (e.g., Isaak et al. 2017, Szcodronski et al. 2024).
- Conserve functioning habitats and maintain wildlife populations to promote resilience to climate change (e.g., Isaak et al. 2017, Szcodronski et al. 2024).
- Implement management strategies that promote landscape resilience, water persistence, and habitat diversity. Conserve and manage riparian areas for native riparian vegetation by using riparian fencing, land use management, fire management, and invasive species control.

Priority aquatic conservation areas

Priority conservation areas in the Green River Basin are shown in *Figure 17*. Priority areas for the conservation of Wyoming's three species (Bluehead Sucker, Flannelmouth Sucker, and Roundtail Chub) include Muddy Creek, Big Sandy River, Blacks Fork River, Hams Fork River, and Muddy Creek (Blacks Fork drainage), Little Sandy Creek, Upper Bitter Creek, the Henrys Fork, and select Finger Lakes near Pinedale.

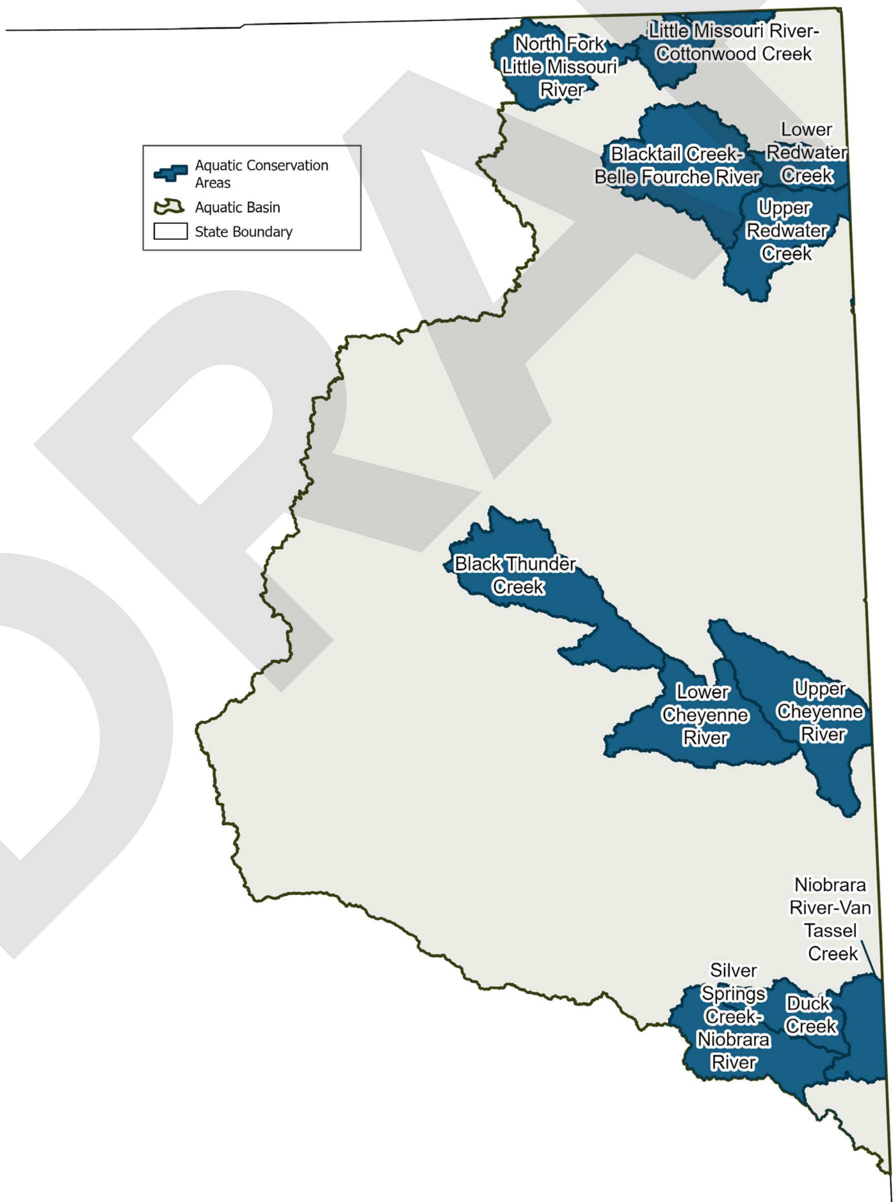
Priority areas for the Colorado River Cutthroat Trout are numerous and widespread. Priority areas in the Little Snake River drainage include North Fork, West Branch of the North Fork, and the upper Roaring Fork of the Little Snake River; Dirtyman Creek watershed and upper Deep, Mill, Hatch, and Hells Canyon creeks in the Savery Creek watershed; Haggarty Creek; and Littlefield Creek in the Muddy Creek watershed. Priority areas in the Blacks Fork River drainage include Muddy Creek, upper Sage and Gilbert creeks, and all tributaries to the upper Hams Fork River. Conservation areas in the upper Green River include Beaver, LaBarge, Lake, Horse, and Cottonwood creek watersheds, North Piney Lake and the Lake Creek watershed; and Trail Ridge, Fish, Beaver Tepee, Rock, Klondike, Jim, and Gypsum creeks. Please refer to the Wyoming Game and Fish Department's Statewide Habitat Plan for narratives of each priority area.

Chapter 26: Northeastern Missouri River Basin

The Northeastern Missouri River Basin includes the Missouri-Little Missouri and Cheyenne subregions (4-digit HUCs 1011 and 1012, respectively), both of which are direct tributaries to the Missouri River (*Figure 18*). The basin spans an area of about 12,000 square miles in Crook, Weston, Campbell, Converse, Niobrara, and Goshen counties. Major river drainages include the Little Missouri, Belle Fourche, Cheyenne, and the Niobrara Rivers.

Figure 18. Map of Northeastern Missouri River Basin.

The Northeastern Missouri River Basin contains the Little Missouri (101102), Belle Fourche (101202), Cheyenne (101201), and Niobrara (101500) basins (6-digit Hydrologic Unit Codes [HUCs]). The map includes priority aquatic conservation areas.



Elevation varies from 3,104 to 6,667 feet above sea level. Mean annual temperature in the basin is 45.5°F, and monthly temperatures vary from an average of 24.0° F in January to about 70.9°F in July. The Northeastern Missouri River basin is different from Wyoming's other basins in that it receives the bulk of its annual precipitation during the warmest portion of the year. Mean annual precipitation is 16.1 inches. All 11 terrestrial habitat types defined in this document occur in the Northeastern Missouri River Basin. Land use includes livestock grazing, energy development and mining (including oil, gas, coal bed methane), timber harvest, recreation, and residential. Land ownership is 14% federal, 78% private, and 7% state. The basin contains approximately 49,599 miles of streams. There are approximately 5 miles of impaired rivers or streams and one impaired lake. There are approximately 335 dams and 11 road-related barriers in the basin. Please refer to *Chapter 12* for details about data and data sources.

Species of Greatest Conservation Need (SGCN) in the Northeastern Missouri River Basin are listed in *Table 29*, *Table 30*, and *Appendix D*.

Table 29. Fishes present in the Northeastern Missouri River Basin.

Fishes present in the Northeastern Missouri River Basin. Species of Greatest Conservation Need (SGCN) are followed by an asterisk (*). "NS" indicates species that are nonnative in the basin, but are SGCN in other basins. "AIS" indicates species that are designated as Aquatic Invasive Species.

Native game	Native nongame	Nonnative game	Nonnative nongame
Black Bullhead	Brassy Minnow *	Black Crappie	Brook Stickleback (AIS)
Channel Catfish	Creek Chub	Bluegill	Common Carp
Stonecat	Central Stoneroller	Brook Trout	Emerald Shiner
Sauger*	Fathead Minnow	Brown Trout	Gizzard Shad
	Finescale Dace *	Freshwater Drum	Golden Shiner
	Flathead Chub *	Green Sunfish	Grass Carp
	Goldeye *	Largemouth Bass	Longnose Sucker
	Iowa Darter *	Northern Pike	Northern Plains Killifish (NS)
	Lake Chub	Rainbow Trout	Spottail Shiner
	Longnose Dace	Smallmouth Bass	
	Northern Pearl Dace *	Snake River Cutthroat Trout (NS)	
	Plains Minnow *	Walleye	
	Plains Sucker	White Crappie	
	Plains Topminnow *	Yellow Perch	
	Red Shiner		
	River Carpsucker		
	Sand Shiner		
	Shorthead Redhorse		
	Western Silvery Minnow *		
	White Sucker		

Table 30. Turtles, mollusks, and crustaceans in Northeastern Missouri River Basin.

Other aquatic species present in the Northeastern Missouri River Basin. Species of Greatest Conservation Need (SGCN) are followed by an asterisk (*).

Turtles	Mollusks	Crustaceans
Northern Spiny Softshell * Western Painted Turtle * North American Snapping Turtle	Ambersnail Cooper's Rocky Mountain Mountainsnail * Fatmucket * Giant Floater * White Heelsplitter Yavapai Mountainsnail *	Calico Crayfish *

Challenges and Actions

The following challenges have been identified for Northeastern Missouri River Basin and the SGCN that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this aquatic basin at a local scale, the challenges identified here are significant concerns across the basin. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Dams and other infrastructure to control the amount and timing of water can reduce movement and genetic connectivity, alter flow regimes, alter water temperatures, contribute to entrainment, reduce instream flows, increase erosion, affect community assemblage, and contribute to habitat fragmentation (Bergstedt and Bergersen 1997, Carlson and Rahel 2007, Compton et al. 2008, Hedden et al. 2021, Quist et al. 2005, Rosenthal et al. 2024). Voluntary actions to address this challenge include:

- Work with land managers and landowners to maximize the efficiency of irrigation water use and increase or maintain in-stream flows necessary to meet life history and passage needs for SGCN during all seasons.
- Collaborate with irrigation districts, landowners, and land management agencies to understand and improve fish movements throughout the watershed and passage at road crossings and diversion structures to improve connectivity among populations and ensure population persistence.
- Maintain ecological processes by allowing some level of flooding (i.e., riparian maintenance flows) and ensuring streams and riparian corridors are connected to a floodplain.

Invasive and nonnative species, including Aquatic Invasive Species (AIS), can degrade habitat, compete for resources with native species, and change community composition (Bernery et al. 2022, Koel et al. 2019, Prestes et al. 2024, Rahel 2000). Invasive nonnative species are often linked to other challenges, including climate change, dams, and more (Bell et al. 2021). Invasive and nonnative species of concern in this basin include annual grasses, Brook Stickleback, Northern Pike, Quagga Mussels, and Zebra Mussels. Voluntary actions to address this challenge include:

- Engage stakeholders, landowners, neighboring states, and public land managers through workshops, inspector training, and outreach events to emphasize the importance of minimizing risks of spreading AIS.
- Work to prevent the introduction of any new aquatic organisms to drainages with SGCN and monitor the distribution and impacts of established nonnative species.
- Continue to operate watercraft checkstations, enforce regulations, and educate the general public to prevent the spread of nonnative species and AIS.
- Research and implement effective treatments to rehabilitate corridors and watersheds that have been altered by invasive and nonnative species.
- Continue efforts to remove competing nonnative

species to secure, enhance, and restore native fish populations.

- Work with private landowners and the state of Nebraska to suppress or eradicate Northern Pike populations in the lower Niobrara River and Van Tassel Creek.

- Reintroduce populations of SGCN in locations that are void of competition from, hybridization with, and predation from nonnative species.

- Work with private landowners and the state of Nebraska to transplant Northern Pearl Dace into the Niobrara River and tributaries to establish secure populations outside of habitat occupied by Northern Pike.

- Work with land managers and private landowners to understand and expand populations of Finescale Dace and Plains Sucker to enhance population resilience and persistence in the presence of nonnative species.

- Work with land managers and private landowners to understand the influence of nonnative species on the distribution, life history and habitat needs of SGCN, such as Plains Minnow in the Cheyenne River and tributaries.

Shifts in temperature regimes can negatively affect timing of resource availability for aquatic species (Durant et al. 2007). Changes to the amount, form, and timing of precipitation can reduce aquatic habitat quality and quantity. Additionally, changes can lead to more frequent and intense storms or longer dry periods, both of which can destabilize riparian habitats. Changes in precipitation are often linked to changes in temperature, and climate change can interact with and exacerbate other challenges (Lennox et al. 2019). Voluntary actions to address this challenge include:

- Coordinate with land managers and private landowners to support and restore beaver populations where they will benefit overall watershed health and fish habitat.

- Work among land managers and landowners to maximize the efficiency of irrigation water use and maintain in-stream flows for fish habitat.

- Work to understand hydrology, intermittency, and how it impacts distribution, abundance, gene flow, and life history requirements of native SGCN. Where necessary, work to provide in-stream flow, refugia and connectivity.

- Collaborate among land managers and landowners to employ in-stream and riparian habitat restoration projects that improve floodplain connectivity, improve subsurface water storage, and support stream flow that improves fish habitat.

- Identify stream corridor refugia and restore and/or maintain connectivity to refugia (e.g., Isaak et al. 2017, Szcodronski et al. 2024). Where necessary, address issues such as invasive species, land use, and fragmentation that affect refugia.

- Implement management strategies that promote landscape resilience, water persistence, and habitat diversity. Conserve and manage riparian areas for native riparian vegetation by using riparian fencing, land use management, fire management, and invasive species control.

Priority aquatic conservation areas

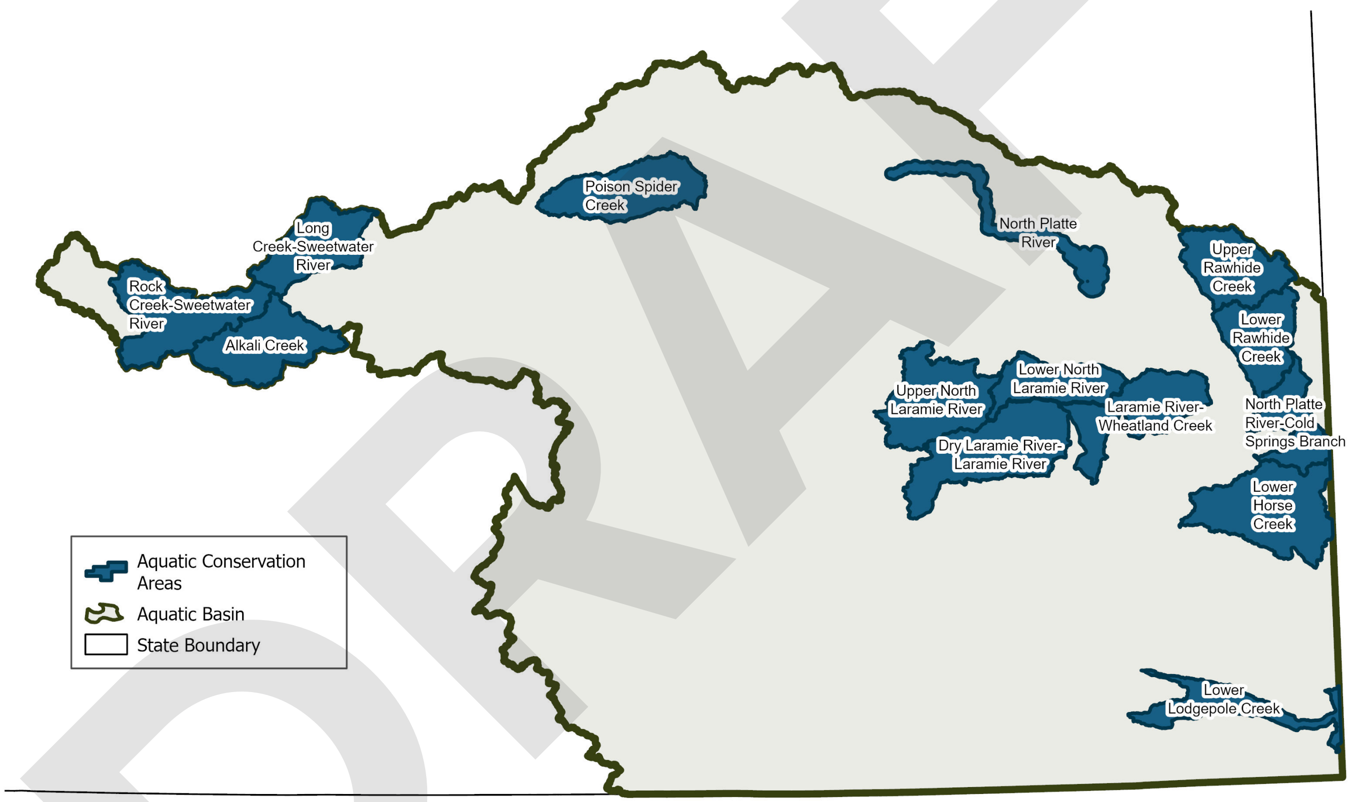
Priority conservation areas in the Bear River Basin are shown in *Figure 18*. Priority areas include drainages where native fish diversity is highest in the basin and includes streams where the density of rare species (e.g., Finescale Dace and Northern Pearl Dace) are high. Priority areas include the lower Little Missouri River drainage including the North Fork; the lower Cheyenne River including Lance Creek; the lower Niobrara River including Van Tassel Creek; and the Belle Fourche below Keyhole Reservoir and including Redwater Creek. Please refer to the Wyoming Game and Fish Department's Statewide Habitat Plan for narratives of each priority area.

Chapter 27: Platte River Basin

The Platte River Basin encompasses the North Platte and South Platte subregions (4-digit HUCs 1018 and 1019, respectively; *Figure 19*). The basin spans about one quarter of Wyoming, covering 24,200 square miles in Albany, Carbon, Converse, Fremont, Goshen, Laramie, Natrona, Niobrara, and Platte counties. Major river drainages in the basin include the North Platte, Encampment, Laramie, Sweetwater, and Medicine Bow rivers.

Figure 19. Map of Platte River Basin.

The Platte River Basin includes North Platte (101800) and South Platte (101900) basins (6-digit Hydrologic Unit Codes [HUCs]). The map includes priority aquatic conservation areas.



Elevation varies from 4,025 to 12,487 feet above sea level. Mean annual temperature in the basin is 43.4°F, and monthly temperatures vary from an average of 23.8°F in January to 67.5°F in July. Mean annual precipitation is 15.3 inches. All 11 terrestrial habitat types defined in this document occur in the Platte River Basin. Land use includes livestock grazing, timber production, energy development and mining, hay production, recreation, and residential. Land ownership is 29% federal, 61% private, 9% state, and 1% other. The basin contains approximately 65,134 miles of streams. There are approximately 28 miles of impaired rivers and streams and 4 impaired lakes or reservoirs. There are approximately 473 dams and 154 road-related barriers in the basin. Please refer to *Chapter 12* for details about data and data sources.

Species of Greatest Conservation Need (SGCN) in the Platte River Basin are listed in *Table 31*, *Table 32*, and *Appendix D*.

Table 31. Fishes present in the Platte River Basin.

Fishes present in the Platte River Basin. Species of Greatest Conservation Need (SGCN) are followed by an asterisk (*). "X" denotes species that were extirpated from the basin. "E" denotes federally endangered species. "NS" indicates species that are nonnative in the basin, but are SGCN in other basins. "AIS" indicates species that are designated as Aquatic Invasive Species.

Native game	Native nongame	Nonnative game	Nonnative nongame
Black Bullhead	Bigmouth Shiner *	Bonneville Cutthroat Trout (NS)	Brook Stickleback (AIS)
Channel Catfish	Brassy Minnow *	Black Crappie	Common Carp
Flathead Chub (X)	Central Stoneroller	Bluegill	Emerald Shiner
Greenback Cutthroat Trout (XE)	Common Shiner	Brook Trout	Gizzard Shad
Sauger *	Creek Chub	Brown Trout	Golden Shiner
Shovelnose Sturgeon *(X)	Fathead Minnow	Colorado River Cutthroat Trout (NS)	Goldfish
Stonecat	Flathead Chub *	Freshwater Drum	Grass Carp
	Goldeye *(X)	Golden Trout	Spottail Shiner
	Hornyhead Chub *	Grayling	
	Iowa Darter *	Green Sunfish	
	Johnny Darter	Kokanee Salmon	
	Lake Chub	Largemouth Bass	
	Longnose Dace	Pumpkinseed	
	Longnose Sucker	Rainbow Trout	
	Northern Plains Killifish *	Redear Sunfish	
	Orangethroat Darter *	Rock Bass	
	Plains Minnow *(X)	Smallmouth Bass	
	Plains Sucker	Snake River Cutthroat Trout (NS)	
	Plains Topminnow *	Splake	
	Quillback *	Tiger Muskie	
	Red Shiner	Tiger Trout	
	River Carpsucker	Walleye	
	Sand Shiner	White Crappie	
	Shorthead Redhorse	Yellow Perch	
	Sturgeon Chub *(X)	Yellowstone Cutthroat Trout (NS)	
	Suckermouth Minnow *		
	White Sucker		

Table 32. Turtles, mollusks, and crustaceans in Platte River Basin.

Other aquatic species present in the Platte River Basin. Species of Greatest Conservation Need (SGCN) are followed by an asterisk (*). +The Ornate Box Turtle is a terrestrial turtle, but is mentioned with other turtles for convenience. "NI" indicates species that are nonnative and/or introduced.

Turtles	Mollusks	Crustaceans
Western Painted Turtle *	Creeping Ancylid *	Calico Crayfish *
Northern Spiny Softshell *	Cylindrical Papershell *	Constricted Fairy Shrimp *
Ornate Box Turtle *+	Fatmucket *	Devil Crayfish/Great Plains Mudbug *
North American Snapping Turtle	Glossy Valvata *	Fairy Shrimp *
Red-eared Slider (NI)	Mossy Valvata *	Ringed Crayfish *
	Plain Pocketbook *	Rusty Crayfish
	Rocky Mountain Capshell *	Virile Crayfish
	Two-ridged Ramshorn *	
	Umbilicate Sprite *	
	Woodland Pondsnail *	

Challenges and Actions

The following challenges have been identified for the Platte River Basin and the SGCN that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this aquatic basin at a local scale, the challenges identified here are significant concerns across the basin. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Dams and other infrastructure to control the amount and timing of water can reduce movement and genetic connectivity, alter flow regimes, alter water temperatures, contribute to entrainment, reduce instream flows, increase erosion, affect community assemblage, and contribute to habitat fragmentation (Bergstedt and Bergersen 1997, Carlson and Rahel 2007, Compton et al. 2008, Hedden et al. 2021, Quist et al. 2005, Rosenthal et al. 2024). Voluntary actions to address this challenge include:

- Identify stream segments where habitat and available flow regimes indicate a need to file instream flow water rights for SGCN, referring to Wyoming Game and Fish Department's Water Management Unit Plan (Lobb and Dey 2025) for priority segments. As opportunities are identified, conduct needed studies and file for state-held instream flow water rights.
- Identify areas where SGCN fish passage is needed. As opportunities are identified, conduct needed studies and implement fish passage strategies.
- Pursue passage around barriers and year-round flows that are adequate for SGCN within the Lower Horse Creek drainage.
- Maintain ecological processes by allowing some level of flooding (i.e., riparian maintenance flows) and ensuring streams and riparian corridors are connected to a floodplain.
- Pursue adequate year-round flows (>15 cfs) on the Laramie River downstream of the Tunnel Diversion for SGCN.
- Conserve and/or enhance priority stream segments identified in Horse and Lodgepole creeks and the lower Laramie River as part of the prairie stream intermittency project (Compton and Hogberg 2017).
- Work with private landowners to secure access to and assess fish passage at water diversions in the basin.
- Establish regular meetings or a facilitated working group with representatives from irrigators, State En-

gineer's Office, Wyoming Game and Fish Department, and other key players to identify creative strategies to deliver water to irrigators and keep water in the Laramie River for fish. Strategies may include purchasing or transferring water rights.

- Pursue funding and/or personnel to maintain and operate current passage structures.

- Re-introduce extirpated native species (e.g., Flathead Chub, Plains Minnow, and Shovelnose Sturgeon) and conduct post-introduction monitoring to evaluate their ability to persist in the hydrologically-altered North Platte River drainage.

- Work with irrigators when they are shutting off canals or ditches to request a ramped-down approach that allows for entrained SGCN to return to the river of origin.

Shifts in temperature regimes can negatively affect timing of resource availability for aquatic species (Durant et al. 2007). Changes to the amount, form, and timing of precipitation can reduce aquatic habitat quality and quantity. Additionally, changes can lead to more frequent and intense storms or longer dry periods, both of which can destabilize riparian habitats. Changes in precipitation are often linked to changes in temperature, and these change can interact with and exacerbate other challenges (Lennox et al. 2019). Voluntary actions to address this challenge include:

- Enhance coordination among land managers, natural resource agencies, nonprofit conservation organizations, and landowners to employ in-stream and riparian habitat restoration projects that improve floodplain connectivity, improve subsurface water storage, and support stream flow that improves fish habitat.

- Promote best management practices with irrigators and livestock operators that reduce water use and enhance riparian habitats and stream cover.

- Increase conservation easement acquisition with willing landowners on riparian habitats where a clear value to SGCN can be made.

- Keep water in headwaters longer using natural approaches like beaver, beaver-dam analogs, small rock dams, and other Zeedyk structures.

- Complete stream and watershed restoration projects in areas predicted to be climate resilient (e.g., Isaak et al. 2017, Szcodronski et al. 2024).

- Conserve functioning habitats and maintain wildlife populations to promote resilience to climate change (e.g., Isaak et al. 2017, Szcodronski et al. 2024).

- Work to understand hydrology, intermittency, and how it impacts distribution, abundance, gene flow, and life history requirements of native SGCN. Where necessary, work to provide in-stream flow, refugia and connectivity.

- Identify stream corridor refugia, and restore and/or maintain connectivity to refugia (e.g., Isaak et al. 2017, Szcodronski et al. 2024). Where necessary, address issues such as invasive species, land use, and fragmentation that affect refugia.

- Implement management strategies that promote landscape resilience, water persistence, and habitat diversity. Conserve and manage riparian areas for native riparian vegetation by using riparian fencing, land use management, fire management, and invasive species control.

Priority aquatic conservation areas

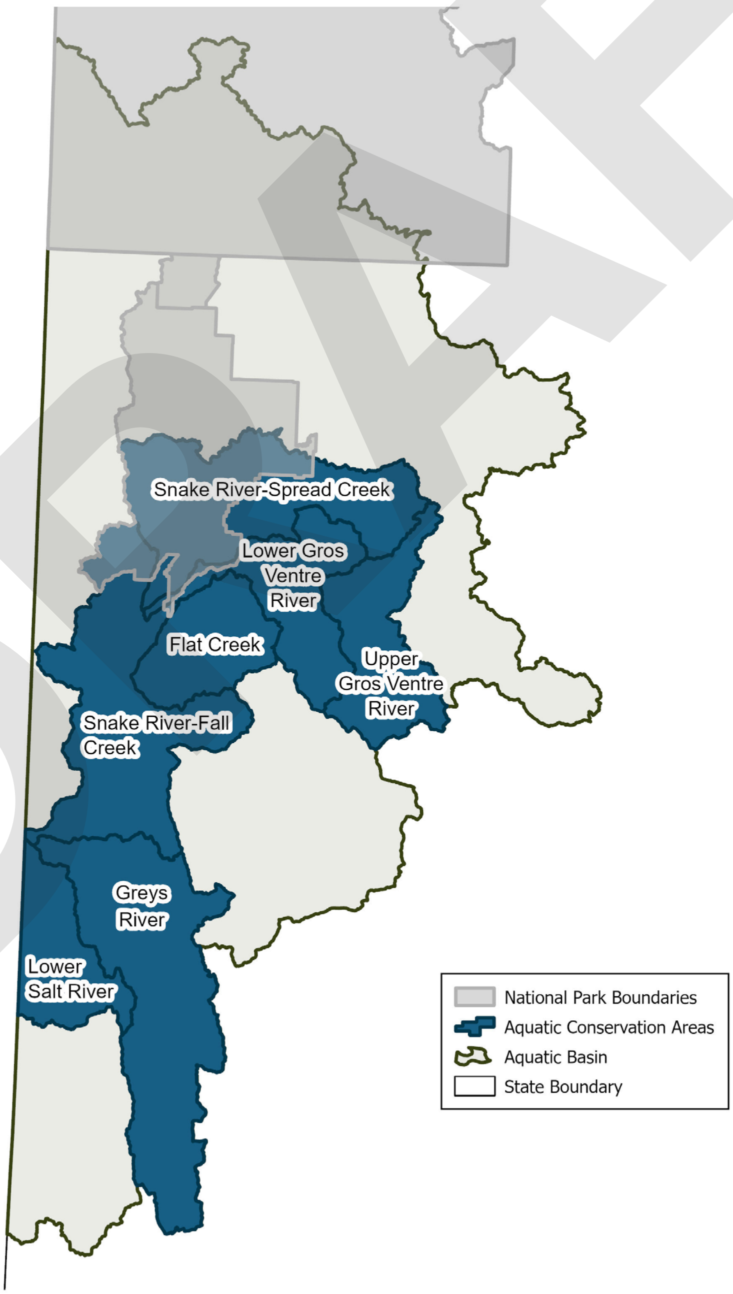
Priority conservation areas in the Platte River Basin are shown in *Figure 19*. Priority areas include drainages where native fish diversity is highest in the basin and includes streams where the density of rare species (e.g., Orangethroat Darter and Hornyhead Chub) are high. Priority waters include the lower mainstem portions of the North Platte and Laramie Rivers as well as Rawhide Creek, Horse Creek, Lower Lodgepole Creek, and North Laramie River. Please refer to the Wyoming Game and Fish Department's Statewide Habitat Plan for narratives of each priority area.

Chapter 28: Snake/Salt River Basin

The Snake/Salt River Basin corresponds with the Upper Snake subregion (4-digit HUC 1704) in Wyoming and spans an area of about 5,100 square miles in Lincoln, Teton, Sublette, and Park counties (*Figure 20*). Major river drainages in the basin include the Salt, Hoback, Gros Ventre, Greys, Buffalo Fork, and Snake Rivers.

Figure 20. Map of Snake/Salt River Basin.

The Snake/Salt River Basin includes Snake Headwaters (170401) and Upper Snake (170402) basins (6-digit Hydrologic Unit Codes [HUCs]). The map includes priority aquatic conservation areas.



Elevation varies from 5,580 to 13,763 feet above sea level. Mean annual temperature in the basin is 35.5°F, and monthly temperatures vary from an average of 16.7°F in January to 58.5°F in July. Mean annual precipitation is 33.5 inches. All 11 terrestrial habitat types defined in this document occur in the Salt and Snake River Basin. Land use is primarily livestock grazing, timber production, irrigated cropland, and recreation. Land ownership is 91% federal, 6% private, and 2% other. The basin contains approximately 12,279 miles of streams. There are approximately 7 miles of impaired rivers and streams and no impaired lakes or reservoirs. There are approximately 83 dams and 140 road-related barriers in the basin. Please refer to *Chapter 12* for details about data and data sources.

Species of Greatest Conservation Need (SGCN) in the Snake/Salt River Basin are listed in *Table 33*, *Table 34*, and *Appendix D*.

Table 33. Fishes present in the Snake/Salt River Basin.

Fishes present in the Snake/Salt River Basin. Species of Greatest Conservation Need (SGCN) are followed by an asterisk (*). "NS" indicates species that are nonnative in the basin, but are SGCN in other basins.

Native game	Native nongame	Nonnative game	Nonnative nongame
Mountain Whitefish Snake River Cutthroat Trout * Yellowstone Cutthroat Trout *	Green Sucker* Longnose Dace Mottled Sculpin Mountain Sucker Northern Leatherside * Paiute Sculpin Redside Shiner Speckled Dace Utah Chub Utah Sucker	Bear River Cutthroat Trout (NS) Brook Trout Brown Trout Golden Trout Grayling Kokanee Salmon Lake Trout Rainbow Trout	Fathead Minnow White Sucker

Table 34. Turtles, mollusks, and crustaceans in Snake/Salt River Basin.

Other aquatic species present in the Snake/Salt River Basin. Species of Greatest Conservation Need (SGCN) are followed by an asterisk (*).

Turtles	Mollusks	Crustaceans
No turtles	Glossy Valvata *	Fairy Shrimp *
	Great Basin Ramshorn *	Pilose Crayfish *
	Green River Pebblesnail *	
	Jackson Lake Springsnail *	
	Marsh Pondsnail *	
	Mossy Valvata *	
	New Zealand Mudsnail	
	Rocky Mountain Duskysnail *	
	Rotund Physa *	
	Threeridge Valvata *	
	Two-ridged Ramshorn*	
	Western Pearlshell*	
	Woodland Pondsnail *	

Challenges and Actions

The following challenges have been identified for Snake/Salt River Basin and the SGCN that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this aquatic basin at a local scale, the challenges identified here are significant concerns across the basin. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Invasive and nonnative species, including Aquatic Invasive Species (AIS), can degrade habitat, compete for resources with native species, and change community composition (Bernery et al. 2022, Koel et al. 2019, Prestes et al. 2024, Rahel 2000). Invasive nonnative species are often linked to other challenges, including climate change, dams, and more (Bell et al. 2021). Voluntary actions to address this challenge include:

- Engage stakeholders, landowners, and public land managers through workshops, inspector training, and outreach events to emphasize the importance of minimizing risks of spreading AIS.
- Use barriers to protect against upstream spread of nonnative species.
- Work to reduce or remove problematic non-natives that impact SGCN populations using all available methods.
- Investigate the efficacy of YY trojan males on reducing or eliminating nonnative threats to SGCN.
- Research and implement effective treatments to rehabilitate corridors and watersheds that have been altered by invasive and nonnative species.
- Reintroduce populations of SGCN in locations that are void of competition from, hybridization with, and predation from nonnative species.
- Work to identify and reduce impacts of hybridization on SGCN.
- Continue to operate watercraft checkstations, enforce regulations, and educate the general public to prevent the spread of AIS.

Pathogens such as whirling disease and bacterial kidney disease can hinder native fish species recovery and limit options for reintroduction (Bartholomew and Reno 2002, Kowalski 2022). Recent declines in Pilose Crayfish populations could be associated with pathogens such as porcelain disease or other pathogens (Newkirk et al. 2023). Voluntary actions to address this challenge include:

- Conduct disease analysis of Snake River Cutthroat Trout populations to assist with the understanding of the distribution and impacts of the whirling disease parasite and other pathogens.
- Monitor for new pathogens and disease in SGCN populations.
- Continue to investigate the impacts of porcelain disease and other potential pathogens on Pilose Crayfish populations.
- Engage water-based recreationalists in a communication campaign to limit spread and movement of pathogens.

Dams and other infrastructure to control the amount and timing of water can reduce movement and genetic connectivity, alter flow regimes, alter water temperatures, contribute to entrainment, reduce instream flows, increase erosion, affect community assemblage, and contribute to habitat fragmentation (Bergstedt and Bergersen 1997, Carlson and Rahel 2007, Compton et al. 2008, Hedden et al. 2021, Quist et al. 2005, Rosenthal et al. 2024). Voluntary actions to address this challenge include:

- Collaborate with irrigation districts, landowners, and land management agencies to improve fish passage at road crossings and diversion structures to improve connectivity among populations and ensure persistence.
- Identify stream segments where habitat and available flow regimes indicate a need to file instream flow water rights for SGCN, referring to Wyoming Game and Fish Department's Water Management Unit Plan (Lobb and Dey 2025) for priority segments. As opportunities are identified, conduct needed studies and file for state-held instream flow water rights.
- Continue to monitor timing, temperature, and flow from dams and how they impact habitat conditions downstream.
- Collaborate with stakeholders (Wyoming State Engineer's Office, Bureau of Reclamation, Wyoming Water Development Commission, Trout Unlimited, and the public) to provide flows in the Snake River that maintain life history expression and low flow refuge for SGCN.
- Work with partners to reduce entrainment.

Increased ambient air temperatures can increase in-stream temperatures, potentially affecting fish survival and community composition, contributing to range expansions or contractions, increasing stress load, and exacerbating disease susceptibility (Comte et al. 2013). Changes to the amount, form, and timing of precipitation can reduce habitat quality and quantity for aquatic species. Changes in temperature regimes are connected to changes in precipitation and hydrological regimes, and climate change can interact with and exacerbate other challenges (Barbarossa et al. 2021, Bell et al. 2021, Goode et al. 2012, Lennox et al. 2019, Rahel et al. 2008). Voluntary actions to address this challenge include:

- Implement management strategies that promote landscape resilience, water persistence, and habitat diversity. Conserve and manage riparian areas for native riparian vegetation by using riparian fencing, land use management, fire management, and invasive species control.
- Maintain and increase connectivity to high functioning and climate resilient habitats.
- Work to understand potential impacts to SGCN from climatic changes in the basin.
- Complete watershed scale restoration work that increases floodplain connectivity, promotes groundwater-surface water interactions, and creates self-sustaining diverse habitats through functioning riverine processes.
- Support stewardship activities such as off-stream watering, riparian exclusionary fencing with appropriate buffer widths, livestock water gaps, and supporting conservation easement acquisition.
- Keep water in headwaters longer using natural approaches like beaver, beaver dam analogs, small rock dams, and other zeedyk structures.
- Complete stream and watershed restoration projects in areas predicted to be climate resilient (e.g., Isaak et al. 2017, Szcodronski et al. 2024).
- Protect functioning habitats and maintain wildlife populations to promote resilience to climate change (e.g., Isaak et al. 2017, Szcodronski et al. 2024).

Priority aquatic conservation areas

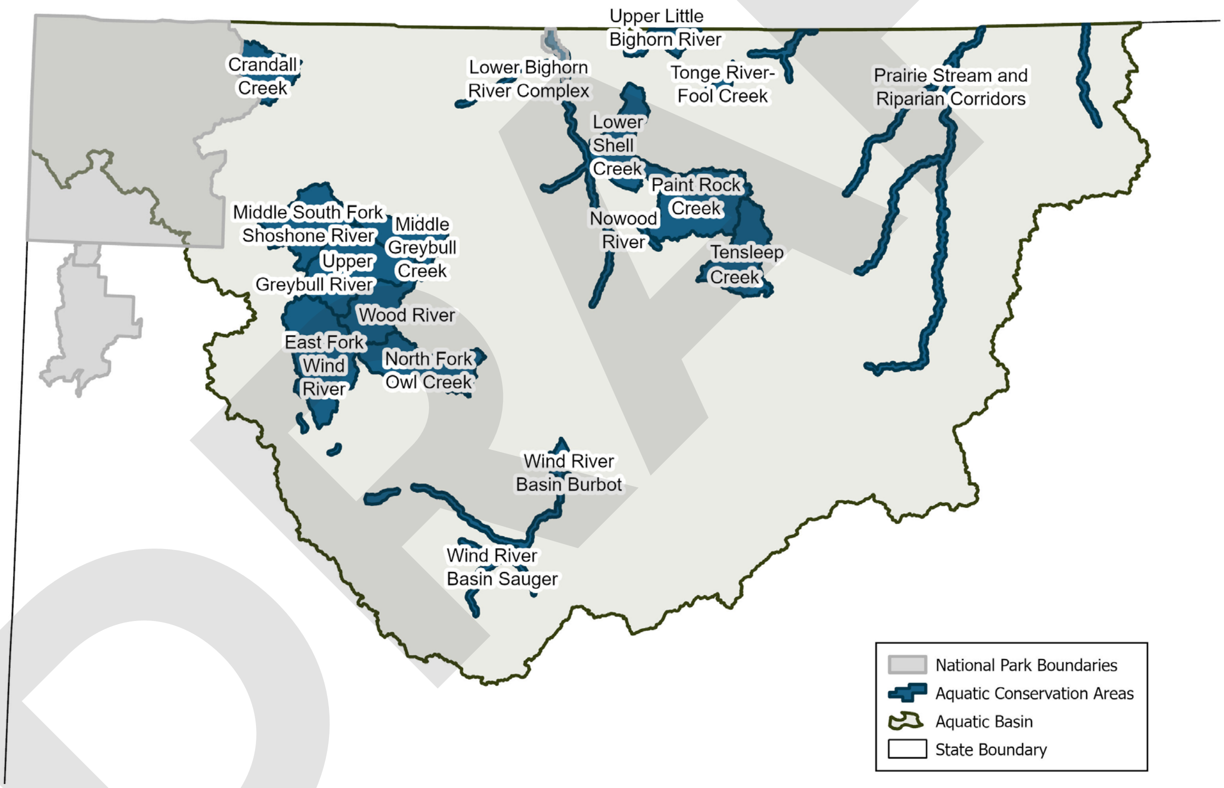
Priority conservation areas in the Snake/Salt River Basin are shown in *Figure 20*. Most of the Snake/Salt Basin is of high conservation value for SGCN. Aquatic conservation priorities in the watershed include, but are not limited to, the mainstem Snake and Salt River corridors, spring streams tributary to these rivers, the lower reaches of Pacific Creek, and Snake and Salt River tributaries that sustain wild Snake River Cutthroat Trout and Bluehead Sucker. Additionally the Gros Ventre River drainage is a priority for both Snake River Cutthroat Trout and Northern Leatherside. Please refer to the Wyoming Game and Fish Department's Statewide Habitat Plan for narratives of each priority area.

Chapter 29: Yellowstone River Basin

The Yellowstone River Basin includes portions of Missouri Headwaters, Upper Yellowstone, Big Horn, and Powder-Tongue subregions (4-digit HUCs 1002, 1007, 1008, and 1009, respectively; *Figure 21*). The basin spans over one-third of Wyoming, covering 34,167 square miles in Big Horn, Campbell, Fremont, Hot Springs, Johnson, Natrona, Park, Sheridan, and Washakie counties. Major river drainages in the basin include the Wind-Bighorn, Shoshone, Upper Yellowstone, Clarks Fork, Tongue, and Powder rivers.

Figure 21. Map of Yellowstone River Basin.

The Yellowstone River Basin includes Missouri Headwaters (100200), Upper Yellowstone (100700), Big Horn (100800), Tongue (100901), and Powder (100902) basins (6-digit Hydrological Unit Codes [HUCs]). The map includes priority aquatic conservation areas.



Elevation varies from 3,342 feet to 13,762 feet above sea level. Mean annual temperature in the basin is 41.6°F, and monthly temperatures vary from an average of 21.3°F in January to 66.1°F in July. Mean annual precipitation is 17.2 inches. Most streams in the basin experience snow-melt runoff and have consistently high peak flows in late spring and early summer. The lowlands within the interior of the Bighorn, Powder, and Tongue River basins are semi-arid to arid with variable annual peak flows caused by moderate to very intense rainstorms. All 11 terrestrial habitat types defined in this document occur in the Yellowstone River Basin. Land use includes livestock grazing, timber harvest, energy development and mining, recreation, and residential. Land ownership is 59% federal, 33% private, 6% state, and 1% other. The basin contains approximately 105,801 miles of streams. There are approximately 76 miles of impaired rivers and streams and 2 impaired lakes. There are approximately 975 dams and 114 road-related barriers in the basin. Please refer to *Chapter 12* for details about data and data sources.

Species of Greatest Conservation Need (SGCN) in the Yellowstone River Basin are listed in *Table 35*, *Table 36*, and *Appendix D*.

Table 35. Fishes present in the Yellowstone River Basin.

Fishes present in the Yellowstone River Basin. Species of Greatest Conservation Need (SGCN) are followed by an asterisk (*). “NS” indicates species that are nonnative in the basin, but are SGCN in other basins. “AIS” indicates species that are designated as Aquatic Invasive Species.

Native game	Native nongame	Nonnative game	Nonnative nongame
Burbot *	Brassy Minnow *	Bear River Cutthroat Trout (NS)	Brook Stickleback (AIS)
Channel Catfish	Creek Chub	Black Bullhead	Common Carp
Mountain Whitefish	Fathead Minnow	Black Crappie	Emerald Shiner
Sauger *	Flathead Chub *	Bluegill	Golden Shiner
Shovelnose Sturgeon*	Goldeye *	Brook Trout	Goldfish
Stonecat	Lake Chub	Brown Trout	Grass Carp
Yellowstone Cutthroat Trout *	Longnose Dace	Colorado River Cutthroat Trout (NS)	Johnny Darter
	Longnose Sucker	Golden Trout	Mottled Sculpin
	Plains Minnow *	Grayling	Northern Plains Killifish
	Plains Sucker	Green Sunfish	Spottail Shiner
	River Carpsucker	Lake Trout	Paiute Sculpin
	Sand Shiner	Largemouth Bass	
	Shorthead Redhorse	Pumpkinseed	
	Sturgeon Chub *	Rainbow Trout	
	Western Silvery Minnow *	Rock Bass	
	White Sucker	Smallmouth Bass	
		Snake River Cutthroat Trout (NS)	
		Splake	
		Tiger Muskie	
		Tiger Trout	
		Walleye	
		White Crappie	
		Yellow Perch	

Table 36. Turtles, mollusks, and crustaceans in Yellowstone River Basin.

Other aquatic species present in the Yellowstone River Basin. Species of Greatest Conservation Need (SGCN) are followed by an asterisk (*). "NI" indicates species that are nonnative and/or introduced.

Turtles	Mollusks	Crustaceans
Western Painted Turtle *	Bear Lake Springsnail *	Calico Crayfish *
Northern Spiny Softshell *	Button Sprite *	Virile Crayfish
North American Snapping Turtle	Cave Physa *	
Red-eared Slider (NI)	Cooper's Rocky Mountain Mountainsnail *	
	Creeping Ancylid *	
	Fatmucket *	
	Fragile Ancylid *	
	Giant Floater *	
	Glass Physa *	
	Glossy Valvata *	
	Marsh Pondsnail *	
	Pygmy Mountainsnail *	
	Umbilicate Sprite *	
	Western Glass-snail *	
	Wrinkled Marshsnail *	

Challenges and Actions

The following challenges have been identified for Yellowstone River Basin and the SGCN that live there, following the approach outlined in *Chapter 12*. Although other challenges may be relevant to this aquatic basin at a local scale, the challenges identified here are significant concerns across the basin. Voluntary actions that can contribute to the conservation of SGCN and their habitats are listed following each challenge.

Dams and other infrastructure to control the amount and timing of water can reduce movement and genetic connectivity, alter flow regimes, alter water temperatures, contribute to entrainment, reduce instream flows, increase erosion, affect community assemblage, and contribute to habitat fragmentation (Bergstedt and Bergersen 1997, Carlson and Rahel 2007, Compton et al. 2008, Hedden et al. 2021, Quist et al. 2005, Rosenthal et al. 2024). Voluntary actions to address this challenge include:

- Work collaboratively with landowners, irrigation districts, and land managers to improve water use efficiency (e.g., improve water delivery systems by using pipe and center pivots), maintain in-stream flows for fish habitat, and reduce fish entrainment in irrigation canals, ditches, and pipes.
- Collaborate with irrigation districts, landowners, and land management agencies to improve fish passage at road crossings and diversion structures to improve connectivity among populations and ensure persistence.
- Identify stream segments where habitat and available flow regimes indicate a need to file instream flow water rights for SGCN, referring to Wyoming Game and Fish Department's Water Management Unit Plan (Lobb and Dey 2025) for priority segments. As opportunities are identified, conduct needed studies and file for state-held instream flow water rights.

- Maintain ecological processes by allowing some level of flooding (i.e., riparian maintenance flows).

- Work to understand and address human related water quality degradation (including increased sediment loads) that negatively influence SGCN.

- Maintain and improve watershed health by conserving riparian corridors and wetlands. Implement stream buffers and other best management practices to minimize negative impacts of land management actions.

Invasive and nonnative species, including Aquatic Invasive Species (AIS), can degrade habitat, compete for resources with native species, and change community composition (Bernery et al. 2022, Koel et al. 2019, Prestes et al. 2024, Rahel 2000). Invasive nonnative species are often linked to other challenges, including climate change, dams, and more (Bell et al. 2021). Voluntary actions to address this challenge include:

- Engage stakeholders, landowners, and public land managers through workshops, inspector training, and outreach events to emphasize the importance of minimizing risks of spreading AIS.

- Use barriers to protect against upstream spread of nonnative species.

- Continue to pursue projects (e.g., barriers) to remove competing and hybridizing nonnative trout species to secure and restore Yellowstone Cutthroat Trout.

- Work to reduce or remove problematic non-natives that impact SGCN populations using all available methods.

- Restore Yellowstone Cutthroat Trout metapopulations.

- Continue to operate watercraft checkstations, enforce regulations, and educate the general public to prevent the spread of AIS.

- Research and implement effective treatments to rehabilitate corridors and watersheds that have been altered by invasive and nonnative species.

- Reintroduce populations of SGCN in locations that are void of competition from, hybridization with, and predation from nonnative species.

- Work to understand and/or expand native prairie fishes, such as Plains Sucker, chub species, and Sauger populations, in the Tongue and Powder River basins.

- Conduct disease analysis of Yellowstone Cutthroat Trout populations to assist with the understanding of the distribution and impacts of the whirling disease parasite and other pathogens.

- Monitor for new pathogens and disease in SGCN populations.

Shifts in temperature regimes can negatively affect timing of resource availability for aquatic species (Durant et al. 2007). Changes to the amount, form, and timing of precipitation can reduce aquatic habitat quality and quantity. Additionally, changes can lead to more frequent and intense storms or longer dry periods, both of which can destabilize riparian habitats. Changes in precipitation are often linked to changes in temperature, and climate change can interact with and exacerbate other challenges (Lennox et al. 2019). Voluntary actions to address this challenge include:

- Promote fish movement throughout the drainage by pursuing projects that maintain or improve connectivity.

- Complete stream and watershed restoration projects in areas predicted to be climate resilient (e.g., Isaak et al. 2017, Szcodronski et al. 2024).

- Conserve functioning habitats and maintain wildlife populations to promote resilience to climate change (e.g., Isaak et al. 2017, Szcodronski et al. 2024).

- Promote longer water storage on the landscape and cooler water temperatures through riparian stability and adequate floodplain connection.

- Conduct post-fire monitoring of aquatic organisms as well as instream and riparian habitat.

- Implement management strategies that promote landscape resilience, water persistence, and habitat diversity. Conserve and manage riparian areas for native riparian vegetation by using riparian fencing, land use management, fire management, and invasive species control.

Priority aquatic conservation areas

Priority conservation areas in the Yellowstone River Basin are shown in *Figure 21*. The Powder River conservation area includes the mainstem Powder River downstream of Kaycee, Clear Creek below Hwy 14/16, Crazy Woman Creek below Interstate 90, and the Little Powder River below the confluence of Cottonwood Creek. The Bighorn River and the lower Nowood River, below Big Trails, is an important conservation area for native nongame species in the Bighorn River drainage (Bear 2009). Coldwater habitats in the basin were prioritized following conservation populations identified in the Yellowstone Cutthroat Trout Conservation Strategy (RangeWide YCT Conservation Team 2009) and the known distribution of Burbot. Priority areas for the conservation of native Yellowstone Cutthroat Trout include Upper Little Bighorn River, headwaters of Tongue River, Upper Greybull River, Wood River, Lower Shell Creek (North and South Beaver Creeks), Tensleep Creek, the East Fork Wind River, and the Yellowstone River headwaters and tributaries and Crandall Creek and tributaries. Priority areas for the conservation of Burbot in the Wind-Bighorn River drainage include Bull Lake, Lower and Upper Dinwoody lakes, Torrey, Ring, and Trail lakes on Torrey Creek, Boysen Reservoir, Bighorn River and Big Horn Lake. Priority areas to conserve Sauger include Bighorn Lake, Bighorn River below the Lower Hanover Diversion, and the Boysen Reservoir to the upper extents of Sauger distribution. Please refer to the Wyoming Game and Fish Department's Statewide Habitat Plan for narratives of each priority area.

Burbot. Photo by Paul Gerrity/WGFD.

Chapter 30: Monitoring and Evaluation

Monitoring and evaluation are federally required, key components of State Wildlife Action Plans (SWAPs). Monitoring and evaluation efforts can be used to assess changes in species population or habitat status, determine whether actions are working as intended, and learn from previous efforts through adaptive management. Monitoring and evaluation are linked, but distinct, efforts, and there are many approaches and frameworks for both (Mascia et al. 2014). Monitoring focuses on collecting data on an indicator, such as abundance or other population measures through time, while evaluation focuses on determining whether efforts are making meaningful progress towards a specified goal. Together, these efforts ensure that conservation resources are used wisely and that lessons are shared.

Three types of monitoring and evaluation efforts are reflected in Wyoming's 2027 SWAP. First, the SWAP identifies opportunities to monitor distribution and abundance of Species of Greatest Conservation Need (SGCN) and their habitats. Priority monitoring needs for SGCN and their habitats were identified by technical experts and are listed as actions in taxonomic or habitat-specific chapters. Second, results from a public survey and documentation of projects that received State Wildlife Grant (SWG) funding summarize how the SWAP was implemented between 2017 and 2025. Finally, the process that will be used over the next 10 years to evaluate progress towards SGCN and habitat conservation and management is discussed. Additional details regarding these efforts are provided below.

Evaluating Wyoming's 2017 State Wildlife Action Plan

An evaluation of how the 2017 SWAP was implemented informed the 2027 revision approach. Informal surveys were conducted within the Wyoming Game and Fish Department, and feedback was also solicited via a public survey in spring 2025. The public survey received 185 responses; 40% of respondents were aware of the SWAP before starting the survey. Over half of respondents that had referenced the SWAP in the previous 10 years strongly agreed or agreed that the information in the SWAP is relevant to their work, is easy to understand, contains information that is easy to find, and that they can incorporate the information from the SWAP into their work. Respondents indicated that, out of all the components in the SWAP, they most commonly used the list of SGCN from the 2017 SWAP. Respondents also indicated that they most commonly referenced the 2017 SWAP to learn about wildlife, their habitats, and the issues affecting them.

Between state fiscal years 2017 and 2025, nearly 80 projects focused on the conservation and management of SGCN and their habitats received over $5.7 million in SWG program funding (*Table 37*). These projects included surveys to detect whether a species was present in an area, implementation of habitat interventions, research to investigate how challenges might affect species, and planning and coordination efforts. Some projects were funded multiple times or in multiple phases. Projects were also supported by a diversity of matching funds. The SWAP informs conservation efforts beyond these SWG-supported projects, but because the far-reaching effects of the SWAP can be hard to identify, only projects that received SWG funding are reported.

Table 37: State Wildlife Grant-supported projects.

Projects that received funding support through the State Wildlife Grant program, 2017 – 2025.

Project name
An assessment of the limiting factors for boreal toads in the La Barge Creek watershed
Assessing the distribution and abundance of River Otter
Assessment of effect of the Converse County Oil and Gas Project (CCOGP) on raptors
Black Rosy-finch population monitoring
Black-footed Ferret recovery assistance
Blacks Fork drainage Roundtail Chub surveys
Burbot predation by Brown Trout and Lake Trout
Comprehensive surveys for Black- and White-tailed Prairie Dogs in Wyoming
Conservation decision support for the Pilose Crayfish (Pacifastacus gambelii) in the Bear River watershed
Coordinated statewide Flammulated Owl surveys
Current status of Colorado River Cutthroat Trout in the Colorado River basin, Wyoming
Cutthroat database maintenance with Wyoming Geographic Information Science Center (WyGISC)

Project name
Decadal abundance trends of avian Species of Greatest Conservation Need in Wyoming's natural gas fields
Determining if hatchery-reared Saugers survived and reproduce by studying F1 (stocked) fish and F2 (progeny of stocked) fish
Developing and maintaining online species account system
Distribution and genetics of Spotted Skunks
Distribution models for Wyoming's amphibian and reptile Species of Greatest Conservation Need
East slope Bighorn Mountains Yellowstone Cutthroat Trout refugia implementation
Effects of climate on nongame sagebrush bird demography and populations
Effects of climate on NSSU small mammals at risk of Endangered Species Act (ESA) activity
Effects of Stickleback on native fishes
Finescale Dace potential reintroduction sites in Wyoming
Fire impacts on bird and mammal Species of Greatest Conservation Need
Full life-cycle effects of natural gas development on sagebrush songbirds
Genetic assessment of Yellowstone Cutthroat Trout
Genetic evaluation for Colorado River cutthroat trout populations in the Colorado River basin, Wyoming
Great Gray Owl habitat selection and home range characteristics
Habitat and climatic factors influencing pygmy rabbit distribution in Wyoming
Habitat associations for native aquatic species in a spring-fed prairie system
Identifying the distribution and reproduction of California Floater and Western Pearlshell mussels, Bear River drainage of Wyoming
Instream flow studies on native Cutthroat Trout streams
Integrated Monitoring in Bird Conservation Regions (IMBCR)
Investigating behaviors of Townsend's Big-eared Bat (Corynorhinus townsendii) in response to environmental changes

Project name
Large-bodied fish movements in Clear Creek above Kendrick
Limiting factors for declining Loggerhead Shrikes in western Wyoming
Long-term monitoring of grassland bird Species of Greatest Conservation Need
Midget Faded Rattlesnake population assessment and den identification & mapping
Monitoring and data management for avian Species of Greatest Conservation Need
Monitoring sagebrush obligate Species of Greatest Conservation Need response to habitat management practices
Monitoring Wyoming's bats
Muddy Creek Three Species restoration project – Phase 6
Native mussel project follow-up and eDNA investigation
North American Bat Monitoring project hub
Northern Goshawk response to changes in forest conditions in the Medicine Bow National Forest
Northern Long-eared Bat maternity roosts
Phase II of West Pass Creek eDNA investigations for Yellowstone Cutthroat Trout restoration
Pika monitoring
Pinyon Jay occupancy surveys and habitat selection
Population status of bats with an emphasis on Northern Long-eared Bat in the Black Hills of Wyoming
Pre- and post-fire analysis on nongame bird and mammal species
Preble's Jumping Mouse recovery assistance
Pygmy rabbit distribution and occupancy in Wyoming
Revision of Wyoming's State Wildlife Action Plan (2025)
Sage-grouse conservation efforts database steward with Wyoming Geographic Information Science Center (WyGISC)

Project name
Sagebrush obligate monitoring
Scent detection dogs for Black-footed Ferret monitoring
Spatial distribution of Yellowstone Cutthroat spawning
Species of Greatest Conservation Need in Wyoming lentic systems
Spiny Softshell Turtles in the Bighorn River
Statewide bat and white-nose syndrome monitoring
Sturgeon Chub in the Bighorn River drainage
Supplemental field effort for monitoring American Goshawk response to changes in forest conditions in southeastern Wyoming
Support for the revision of strategic bat plans of Wyoming
Surveying southeast Wyoming lizard and spadefoot presence and abundance
Survival of Boreal Toads across life stages
Swift fox distribution, occupancy, and response to energy development
Swimming and jumping abilities of small bodied Species of Greatest Conservation Need
The role of stock ponds in the persistence of amphibians in Thunder Basin National Grassland
Thermal constraints on the early life history of Sauger
Travel and equipment for statewide bat projects
Understanding the diversity, distribution and habitat requirements of aquatic snails in Wyoming
Update distribution models for bird and mammal Species of Greatest Conservation Need
Using redd counts to monitor Snake River Cutthroat Trout
West Pass creek barrier
Wood Frog habitat selection
Yellowstone Cutthroat Trout persistence in North Fork Shoshone drainage
Yellowstone Cutthroat Trout restoration crew – Cody region

To provide additional understanding of how the SWAP has informed conservation of SGCN and their habitats in Wyoming, summaries of select SWG-supported projects are provided below.

Addressing public concerns about population trends: Northern Spiny Softshell turtles are one of the largest turtle species in North America, and members of the public were concerned about the species declining in the Bighorn and Nowood rivers. Funds from the SWG program supported surveys to learn about the distribution and population trends for this species, and citizen science observations helped inform the surveys. These efforts provided important information on habitat preferences and population status of the species.

Evaluating management actions: Bypass channels can improve connectivity in streams where barriers can prevent movement of fish. Funding support from SWG helped biologists evaluate whether bypass channels restored connectivity for native fish like Goldeye, Sauger, and Shovelnose Sturgeon. This evaluation will help inform efforts to use these structures to improve connectivity in other waterways.

Informing listing decisions: The dollars granted from SWG supported research on disease ecology, reproduction, and habitat use of Western (Boreal) Toads, a species that was petitioned for listing under the Endangered Species Act. This research has had far-reaching implications, including contributing to a “not-warranted” decision.

Monitoring abundance and distribution: Little is known about native mussels like California Floater and Western Pearlshell, and they are hard to study because they burrow in the bottom of waterways. With SWG support, scientists at the Wyoming Natural Diversity Database used eDNA to determine the distribution and abundance of native mussels in western Wyoming. These surveys identified new locations for both species.

Monitoring distribution: American Pikas are vulnerable to changing climates, but their ecology also means that

American Pikas can be a bellwether for changes in their alpine habitat. Funding through SWG contributed to efforts to survey American Pikas across the mountain ranges of Wyoming. These surveys improved understanding of American Pika ecology and distribution, which can be used to inform conservation of the species and their habitat across the state.

Monitoring distribution: Swift Fox populations declined throughout their range because of conversion of native habitats and predator control efforts. Funds from SWG contributed to monitoring efforts that have helped inform research activities, reintroduction opportunities, and management actions.

Monitoring populations and disease: White-nose syndrome is a major threat to several species of bats in Wyoming, and this disease has contributed to some species being listed under the Endangered Species Act. Contribution of SWG dollars have supported monitoring of the disease throughout the state. These efforts allow managers to detect impacts early and use this information to identify actions to conserve bats throughout the state.

Multi-species monitoring of abundance and distribution: Many of Wyoming's birds can be tracked efficiently and effectively through broad-scale, multi-species monitoring programs, such as the Integrated Monitoring in Bird Conservation Regions program. Granted SWG funds contributed to this program, which provides critical information for monitoring SGCN population trends.

Supporting multi-organization conservation: Funds from SWG contributed to a multi-organization effort to investigate habitat use of Great Gray Owls. Researchers at the University of Wyoming, Teton Raptor Center, and Wyoming Game and Fish Department investigated habitat use of Great Gray Owls during the breeding season, nesting period, and post-fledgling period. This improved understanding of Great Gray Owl ecology will help inform habitat management practices.

Supporting recovery efforts: Black-footed Ferrets were nearly extirpated, but conservation efforts have resulted in two reintroduced populations in Wyoming. Funding support from SWG has contributed to a multi-agency effort to recover Black-footed Ferrets in Wyoming by helping to fund survey efforts using scent-detection dogs and mapping of prairie dog colonies, as well as management practices like releasing captive-bred ferrets and applying insecticide to manage plague.

Evaluating Wyoming's 2027 State Wildlife Action Plan

An evaluation of the implementation of Wyoming's 2027 SWAP, using multiple strategies that are focused on operations within the Wyoming Game and Fish Department, will be conducted. The SWAP is a plan for the entire state and will be implemented by diverse organizations, but focusing on operations within the Wyoming Game and Fish Department provides a bounded context for monitoring and evaluation.

First, summaries of final projects will be presented at the annual meeting of the Habitat Technical Advisory Group (HTAG). This will provide an opportunity to share findings and lessons learned. Stemming from this meeting, finished projects, findings, and lessons learned will be highlighted with a broader audience through publications such as *Wyoming Wildlife*. The reporting process for the final project will be revised so that recipients of SWG funding must provide a 1-paragraph plain-language summary of the project, how it addresses SWAP goals, and how it will inform conservation of SGCN or their habitats. Grant recipients will also be encouraged to include photos, publications, and reports that stemmed from the project. These summaries will be used to assess progress towards SWAP-related goals periodically over the next 10 years and will provide materials for a backward-looking evaluation during the next revision. Finally, during the next revision there is a plan to evaluate the effectiveness of the SWAP through informal interviews with a wide range of possible users and via a public survey.

Chapter 31: Public, Stakeholder, Partner, and Collaborator Engagement

Successful conservation and management requires the combined expertise, resources, and efforts of the entire state. Wyoming's 2027 State Wildlife Action Plan (SWAP) serves as a coordinated roadmap for conservation actions across diverse organizations, agencies, and interests. This revision prioritized stakeholder, partner, and collaborator engagement through all stages of the process to ensure that the plan was relevant to all of Wyoming. Public engagement and public awareness of the SWAP revision was emphasized throughout the process.

The revision was guided by the Interagency Advisory Team (IAT), a steering committee composed of representatives from organizations and agencies that are key to wildlife and habitat conservation and management in Wyoming, including federal, state, tribal, and academic organizations. Their role included communicating respective organizational expertise and concerns, identifying common priorities and opportunities, minimizing the duplication of efforts, facilitating information-sharing, conveying SWAP issues and activities to agency employees and constituencies, and reviewing draft documents. A list of IAT members can be found in the Acknowledgements.

Early in the revision, public feedback was solicited regarding the 2017 SWAP to inform the revision strategy. Results from this survey, summarized in *Chapter 30*, helped evaluate the efficacy of the SWAP over the past 10 years while providing an opportunity for public, stakeholder, partner, and collaborator engagement.

For the technical working group efforts (described in *Chapter 3* and 12), experts from over 20 agencies and institutions were consulted. This ensured a broad body of knowledge informed the revision. Additionally, technical experts that engaged in the working group will now be intimately familiar with the SWAP, which may support implementation efforts. A list of technical experts involved in the revision can be found in the Acknowledgments.

Additional opportunities for public, partner, stakeholder, and collaborator engagement were provided through 2 presentations to the Wyoming Game and Fish Commission (WGFC). Both presentations served as informational sessions and provided the opportunity for public comment, supporting efforts to ensure broad participation in and awareness of the revision. A public comment period followed the second WGFC meeting, where the public was invited to review and provide feedback on a full draft of the plan. Feedback from this public comment period was incorporated into the SWAP before it was finalized.

A new method to involve stakeholders and partners was achieved by partnering with the University of Wyoming to incorporate the SWAP and the revision process into undergraduate classrooms (Bartlett et al. 2025, Hults et al. 2025). This partnership ensured that emerging wildlife professionals, many of whom will be helping to implement the SWAP in myriad forms over the next 10 years, engaged with the revision process.

Many Species of Greatest Conservation Need (SGCN) are cryptic or otherwise overlooked, but building public support and appreciation for them could aid in implementing the goals of the SWAP. The Wyoming Game and Fish Department incorporated information about SGCN into their communications and education programming, ranging from drawing activities for young children to magazine features of ongoing projects in *Wyoming Wildlife*.

Communication was a priority throughout the SWAP revision process. The revision timeline and ways to engage were communicated through press releases, email announcements, targeted emails to key conservation listservs, social media, and other communication avenues. This communication will continue after the revision is finalized to ensure that the document will be referenced over the next 10 years.

Appendix A: Roadmap

This roadmap explicitly identifies how each component of the 8 federally required elements were met through Wyoming's 2027 State Wildlife Action Plan (SWAP). This roadmap includes where in the document each component and element can be found (*Table A1*), how the element was addressed, and whether the process was retained or revised relative to the 2017 SWAP.

Table A1. Location of elements in Wyoming's 2027 State Wildlife Action Plan.

Element	Location
Element 1: Provides and makes use of information on the distribution and abundance of species of wildlife, including low and declining populations as the state fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the state's wildlife.	The description of the process for evaluating SGCN is available in Chapter 3. The SGCN list is available in Table 1 and Appendix B. Distributions of all SGCN are presented in Appendix D. Information relating to SGCN is organized in chapters for each of the broad taxonomic groups (Chapters 4 – 11).
Element 2: Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1).	Descriptions of the process used to identify habitat types, map them, identify priority areas, and the data that were used in descriptions are all available in Chapter 12. All information related to each habitat type or aquatic basin is available in a standalone chapter (Chapters 13 – 29). Priority terrestrial habitat areas are identified in Chapter 12, and priority aquatic conservation areas are identified in aquatic basin chapters (Chapters 24 – 29).
Element 3: Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats.	Priority challenges or research needs were identified using the processes and criteria described in Chapter 3 for SGCN and Chapter 12 for habitats. Challenges are presented for each species in the relevant taxonomic chapters (Chapters 4 – 11) and for each terrestrial habitat type or aquatic basin in the relevant habitat chapter (Chapters 13 – 29).
Element 4: Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions.	The process for identifying priority actions is described in Chapter 3 for SGCN and Chapter 12 for habitats. Priority actions are presented for each species in the relevant taxonomic chapters (Chapter 4 – 11) and for each terrestrial habitat type or aquatic basin in the relevant habitat chapter (Chapters 13 – 29).
Element 5: Proposed plans for monitoring species identified in (1) and their habitats, or monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions.	Efforts for monitoring species and habitats were identified by technical experts during the action identification process described and reported in the "Voluntary actions" sections in the SGCN (Chapters 4 – 11) and habitat chapters (Chapters 13 – 29). The process for evaluating progress towards conserving SGCN and their habitats is provided in Chapter 30.
Element 6: Descriptions of procedures to review the plan at intervals not to exceed ten years.	The procedures for reviewing the plan in 2037, including progress that will be made on the plan before the revision begins, are described in Appendix G.

Element	Location
Element 7: Provides for coordination to the extent feasible during the development, implementation, review, and revision of the wildlife conservation plan with federal, state, and local agencies and Indian tribes that manage significant areas of land or water within the state, or administer programs that significantly affect the conservation of identified species or their habitats.	The overall approach to engagement is described in Chapter 31, and information regarding engagement with SGCN and habitat efforts are available in Chapter 3 and Chapter 12, respectively.
Element 8: Congress also affirmed through this legislation, that broad public participation is an essential element of developing and implementing these plans, the projects that are carried out while these plans are developed, and the Species in Greatest Need of Conservation that Congress has indicated such programs and projects are intended to emphasize.	The approach to public participation is described in Chapter 31.

Element 1: Identifying Species of Greatest Conservation Need (SGCN).

- **SGCN identification:** Each species that is legally considered wildlife by the state of Wyoming and breeds in the state was ranked using Native Species Status (NSS) approach. This approach has been used since 2005 and provides a numerical ranking that combines population status and the degree of severity of limiting factors. Wildlife and fish SGCN were also assigned a tier that reflects conservation priority. The ranking process from previous SWAP iterations was retained because it remains relevant and robust. Plants were considered for the SGCN list for the first time during this revision. Plants that are native, vascular, and occur regularly in Wyoming were evaluated for SGCN using a process that considers Wyoming's contribution to the species' rangewide persistence and the species' rarity throughout the state. This resulted in 253 species of wildlife and fish and 55 plant species being considered SGCN. *Chapter 3* contains detailed information about ranking processes.

- **Abundance and distribution:** For wildlife, abundance was considered during the SGCN ranking process when evaluating population status, and it is included in the presentation of SGCN through the NSS cell. For plants, abundance and distribution were considered through the "state ranking factors," which include measures of rarity and range extent. Ranking processes for wildlife and fish, as well as plants, are described in *Chapter 3*. The distributions of SGCN are summarized in a table that indicates the habitat or aquatic basin association for each SGCN (*Appendix D*). The distribution table is new to this revision, and this approach was selected because it provides distribution information in a condensed and accessible format. Species that are characteristic of a certain terrestrial habitat type are listed in each chapter (*Chapter 13* – 23), and all aquatic species within each basin, including SGCN, are listed in aquatic basin chapters (*Chapter 24* – 29).

- **Presentation of information:** The presentation of information related to SGCN has been revised from the 2017 SWAP. In the 2017 SWAP, abundance, distribution, and relevant ecology were in species accounts that were uploaded to the Wyoming Field Guides through the Wyoming Natural Diversity Database. The approach for the 2027 SWAP separated the field guides from the SWAP revision; information that is necessary for the SWAP is contained in data-rich tables in the document itself, and the Field Guides remain a useful, up-to-date resource that will be updated separately from the SWAP. For the 2027 SWAP, information relating to SGCN is organized in chapters for each of the broad taxonomic groups (amphibians, birds, crustaceans, fish, mammals, mollusks, plants, and reptiles) and contains an overview of the ecology of the group, as well as species-specific challenges and actions (*Chapter 4* – 11).

Element 2: Identifying habitats necessary for the conservation of SGCN.

- **Key habitat and community types:** Because species rely on many different habitat types, all habitat types were considered key for conservation of SGCN. Habitat types include 11 terrestrial habitat types and 6 aquatic basins that were identified in prior SWAPs, and they still represent appropriate categories for management in Wyoming. In both the 2017 and 2027 SWAPs, all information related to each habitat type or aquatic basin is available in standalone chapters that contain measures of relative condition, descriptions of the habitat type and its relevance to SGCN, a map to describe the location, a list of characteristic SGCN, and habitat-specific challenges and actions.

- **Priority areas:** Priority areas where conservation efforts may be most needed or could be most effective are identified for both terrestrial habitat types and aquatic basins. The process for identifying priority areas for terrestrial habitat types and aquatic basins remains the same as the process used in 2017, as the process provides useful and straightforward priority areas that were deemed to be relevant to conservation in Wyoming.

Element 3: Identifying challenges facing SGCN and their habitats.

- **Problems:** Problems are referred to as "challenges" throughout the SWAP. Following best practices recommended by the Association of Fish and Wildlife Agencies (2012), the 2027 considered challenges listed in the International Union for Conservation of Nature–Conservation Measures Partnership Classification of Direct Threats to Ecosystems and Species version 4.0 (Salafsky et al. 2024). Only priority challenges or research needs are included in the 2027 SWAP. *Chapter 3* and *Chapter 12* contain information about how challenges were identified for SGCN and habitats, respectively.

Element 4: Identifying actions to conserve SGCN and their habitats.

- **Actions:** Similar to the 2017 SWAP, the 2027 revision lists priority actions for conserving SGCN and their habitats. Similar to the approach for challenges in this revision, the scope of actions considered was broadened relative to the 2017 SWAP to encompass the categories outlined in the Conservation Measures Partnership Action Classification, which is in line with best practices recommended by AFWA (2012). *Chapter 3* and *Chapter 12* contain information about how actions were identified for SGCN and habitats, respectively.

Element 5: Plans for monitoring and evaluation.

- **Monitoring species and their habitats:** Similar to the 2017 SWAP, in this revision technical experts identified priority monitoring and evaluation efforts, and they are presented in relevant species and habitat chapters.

- **Evaluating effectiveness and adapting:** Evaluating effectiveness was addressed by summarizing progress made since 2017, including brief summaries of select projects, and detailing the process that will be used to evaluate progress over the next 10 years. This evaluation process includes opportunities to share insights, learn from efforts, and respond to changing conditions. This approach builds on the approach used in the 2017 SWAP.

Element 6: Reviewing the plan.

- **Procedures to review:** The 2027 revision was implemented following the review procedure laid out in 2017. The proposed procedures for initiating the next SWAP revision is mostly retained from the 2017 SWAP because it has been demonstrated to be an achievable and effective process.

Element 7: Engaging and coordinating with federal, state, and local agencies and Indian tribes.

- **Coordination and engagement:** The 2027 SWAP benefited from the broad engagement of diverse agencies, organizations, and technical experts throughout the state. Similar to the 2017 revision, all efforts were guided by a steering committee known as the Interagency Advisory Team (IAT). The IAT consisted of agencies and organizations that are key to implementing wildlife, fish, and habitat-related conservation work in Wyoming. Representatives of the agencies reviewed information at multiple stages throughout the revision (including a final review of the full document), and provided guidance on how to improve the plan for implementation. Similar to the 2017 revision, technical experts from over agencies and organizations throughout the state participated in working groups that identified priority challenges and actions for SGCN and their habitats.

Element 8: Public participation.

- **Public input and engagement:** Similar to the 2017 revision, public engagement was emphasized throughout the SWAP revision process. Public engagement efforts included multiple public comment periods, a public survey, and communication efforts that highlight SGCN and the SWAP.

Appendix B: List of Species of Greatest Conservation Need

Table B1. Species of Greatest Conservation Need (SGCN) in Wyoming.

Species of Greatest Conservation Need (SGCN) are organized by taxa, conservation priority tier (Tier), and Native Species Status and cell (NSS and Cell, respectively), and then alphabetized by common name. Detailed information about the cell, NSS rank, and conservation priority tier are available in the "Identifying SGCN" portion of *Chapter 3*. Changes from the 2017 list to the 2027 list are provided in *Appendix C*.

Common name	Scientific name	Cell	NSS	Tier
Amphibians (9 species)				
Western (Boreal) Toad	*Anaxyrus boreas*	Aa	1	I
Wyoming Toad	*Anaxyrus baxteri*	Aa	1	I
Wood Frog	*Lithobates sylvaticus*	Ba	2	II
Columbia Spotted Frog	*Rana luteiventris*	Bb	3	II
Great Plains Toad	*Anaxyrus cognatus*	Bb	3	II
Northern Leopard Frog	*Lithobates pipiens*	Bb	3	II
Great Basin Spadefoot	*Spea intermontana*	Bc	4	II
Plains Spadefoot	*Spea bombifrons*	Bc	4	II
Western Tiger Salamander	*Ambystoma mavortium*	Bc	4	III
Birds (89 species)				
Common Loon	*Gavia immer*	Aa	1	I
Yellow-billed Cuckoo	*Coccyzus americanus*	Ab	2	II
Brewer's Sparrow	*Spizella breweri*	Bb	3	I
Mountain Plover	*Anarhynchus montanus*	Bb	3	I
Sage Thrasher	*Oreoscoptes montanus*	Bb	3	I
American Bittern	*Botaurus lentiginosus*	Bb	3	II
Baird's Sparrow	*Centronyx bairdii*	Bb	3	II

Common name	Scientific name	Cell	NSS	Tier
Black Tern	*Chlidonias niger*	Bb	3	II
Black-crowned Night Heron	*Nycticorax nycticorax*	Bb	3	II
Bobolink	*Dolichonyx oryzivorus*	Bb	3	II
Boreal Owl	*Aegolius funereus*	Bb	3	II
Burrowing Owl	*Athene cunicularia*	Bb	3	II
Calliope Hummingbird	*Selasphorus calliope*	Bb	3	II
Caspian Tern	*Hydroprogne caspia*	Bb	3	II
Chestnut-collared Longspur	*Calcarius ornatus*	Bb	3	II
Clark's Nutcracker	*Nucifraga columbiana*	Bb	3	II
Evening Grosbeak	*Hesperiphona vespertina*	Bb	3	II
Forster's Tern	*Sterna forsteri*	Bb	3	II
Golden Eagle	*Aquila chrysaetos*	Bb	3	II
Grasshopper Sparrow	*Ammodramus savannarum*	Bb	3	II
Great Gray Owl	*Strix nebulosa*	Bb	3	II
Harlequin Duck	*Histrionicus histrionicus*	Bb	3	II
Lark Bunting	*Calamospiza melanocorys*	Bb	3	II
Loggerhead Shrike	*Lanius ludovicianus*	Bb	3	II
Long-billed Curlew	*Numenius americanus*	Bb	3	II
Pinyon Jay	*Gymnorhinus cyanocephalus*	Bb	3	II
Rufous Hummingbird	*Selasphorus rufus*	Bb	3	II
Sagebrush Sparrow	*Artemisiospiza nevadensis*	Bb	3	II
Snowy Egret	*Egretta thula*	Bb	3	II
Thick-billed Longspur	*Rhynchophanes mccownii*	Bb	3	II

Common name	Scientific name	Cell	NSS	Tier
Trumpeter Swan	*Cygnus buccinator*	Bb	3	II
Upland Sandpiper	*Bartramia longicauda*	Bb	3	II
Western Cattle-Egret	*Ardea ibis*	Bb	3	II
White-faced Ibis	*Plegadis chihi*	Bb	3	II
Willow Flycatcher	*Empidonax traillii*	Bb	3	II
Wilson's Phalarope	*Phalaropus tricolor*	Bb	3	II
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Bc	4	II
Plains Sharp-tailed Grouse	*Tympanuchus phasianellus jamesii*	Bc	4	II
Common Nighthawk	*Chordeiles minor*	Cb	4	II
Ferruginous Hawk	*Buteo regalis*	Cb	4	II
Greater Sage-Grouse	*Centrocercus urophasianus*	Bc	4	II
MacGillivray's Warbler	*Geothlypis tolmiei*	Cb	4	II
Peregrine Falcon	*Falco peregrinus*	Bc	4	II
Columbian Sharp-tailed Grouse	*Tympanuchus phasianellus colum-bianus*	Cb	4	II
Short-eared Owl	*Asio flammeus*	Bc	4	II
Swainson's Hawk	*Buteo swainsoni*	Cb	4	II
American Kestrel	*Falco sparverius*	Bc	4	III
American Pipit	*Anthus rubescens*	Bc	4	III
American White Pelican	*Pelecanus erythrorhynchos*	Bc	4	III
Ash-throated Flycatcher	*Myiarchus cinerascens*	Bc	4	III
Bald Eagle	*Haliaeetus leucocephalus*	Cb	4	III
Bewick's Wren	*Thryomanes bewickii*	Bc	4	III
Black-throated Gray Warbler	*Setophaga nigrescens*	Bc	4	III

Common name	Scientific name	Cell	NSS	Tier
Blue Grosbeak	*Passerina caerulea*	Bc	4	III
Blue-gray Gnatcatcher	*Polioptila caerulea*	Bc	4	III
Bushtit	*Psaltriparus minimus*	Bc	4	III
Canyon Wren	*Catherpes mexicanus*	Bc	4	III
Common Yellowthroat	*Geothlypis trichas*	Cb	4	III
Great Blue Heron	*Ardea herodias*	Bc	4	III
Juniper Titmouse	*Baeolophus ridgwayi*	Bc	4	III
Northern Pintail	*Anas acuta*	Bc	4	III
Northern Pygmy-Owl	*Glaucidium gnoma*	Bc	4	III
Pygmy Nuthatch	*Sitta pygmaea*	Bc	4	III
Red Crossbill	*Loxia curvirostra*	Cb	4	III
Red-eyed Vireo	*Vireo olivaceus*	Bc	4	III
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Cb	4	III
Virginia's Warbler	*Leiothlypis virginiae*	Bc	4	III
Williamson's Sapsucker	*Sphyrapicus thyroideus*	Bc	4	III
Woodhouse's Scrub-Jay	*Aphelocoma woodhouseii*	Bc	4	III
Black Rosy-Finch	*Leucosticte atrata*	U	U	I
American Goshawk	*Astur atricapillus*	U	U	II
Black-backed Woodpecker	*Picoides arcticus*	U	U	II
Brown-capped Rosy-Finch	*Leucosticte australis*	U	U	II
Clark's Grebe	*Aechmophorus clarkii*	U	U	II
Field Sparrow	*Spizella pusilla*	U	U	II
Flammulated Owl	*Psiloscops flammeolus*	U	U	II

Common name	Scientific name	Cell	NSS	Tier
Franklin's Gull	*Leucophaeus pipixcan*	U	U	II
Lewis's Woodpecker	*Melanerpes lewis*	U	U	II
Snowy Plover	*Anarhynchus nivosus*	U	U	II
Western Grebe	*Aechmophorus occidentalis*	U	U	II
American Barn Owl	*Tyto furcata*	U	U	III
Black-chinned Hummingbird	*Archilochus alexandri*	U	U	III
Dickcissel	*Spiza americana*	U	U	III
Gray Vireo	*Vireo vicinior*	U	U	III
Merlin	*Falco columbarius*	U	U	III
Purple Martin	*Progne subis*	U	U	III
Scott's Oriole	*Icterus parisorum*	U	U	III
Virginia Rail	*Rallus limicola*	U	U	III
White-winged Crossbill	*Loxia leucoptera*	U	U	III
Crustaceans (8 species, 1 group)				
Pilose Crayfish	*Pacifastacus gambelii*	Aa	1	I
Constricted Fairy Shrimp	*Branchinecta constricta*	Ab	2	II
Fairy Shrimp	*Branchinecta serrata*	Bb	3	II
Ringed Crayfish	*Faxonius neglectus*	Bc	4	II
Calico/Papershell Crayfish	*Faxonius immunis*	Bc	4	III
Beavertail Fairy Shrimp	*Thamnocephalus platyurus*	Bc	4	III
Fairy shrimp (Mackin Fairy Shrimp)	*Streptocephalus mackini*	U	U	II
Devil Crayfish/Great Plains Mudbug	*Lacunicambarus nebrascensis*	U	U	III
Other shrimp group (17 species)		U	U	II

Common name	Scientific name	Cell	NSS	Tier
Fish (29 species)				
Bluehead Sucker	*Pantosteus discobolus*	Aa	1	I
Flannelmouth Sucker	*Catostomus latipinnis*	Aa	1	I
Kendall Warm Springs Dace	*Rhinichthys osculus thermalis*	Aa	1	I
Northern Pearl Dace	*Margariscus nachtriebi*	Aa	1	I
Green Sucker	*Pantosteus virescens*	Ab	2	I
Hornyhead Chub	*Nocomis biguttatus*	Ab	2	II
Sturgeon Chub	*Macrhybopsis gelida*	Ab	2	II
Suckermouth Minnow	*Phenacobius mirabilis*	Ab	2	II
Western Silvery Minnow	*Hybognathus argyritis*	Ab	2	II
Colorado River Cutthroat Trout	*Oncorhynchus clarkii pleuriticus*	Ba	2	II
Roundtail Chub	*Gila robusta*	Ba	2	II
Yellowstone Cutthroat Trout	*Oncorhynchus clarkii bouvieri*	Bb	3	I
Finescale Dace	*Chrosomus neogaeus*	Bb	3	II
Goldeye	*Hiodon alosoides*	Bb	3	II
Iowa Darter	*Etheostoma exile*	Bb	3	II
Northern Leatherside	*Lepidomeda copei*	Bb	3	II
Northern Plains Killifish	*Fundulus kansae*	Bb	3	II
Plains Minnow	*Hybognathus placitus*	Bb	3	II
Plains Topminnow	*Fundulus sciadicus*	Bb	3	II
Burbot	*Lota lota*	Bc	4	II
Sauger	*Sander canadensis*	Bc	4	II
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*	Bc	4	II

Common name	Scientific name	Cell	NSS	Tier
Snake River Cutthroat Trout	*Oncorhynchus clarkii behnkei*	Bc	4	II
Brassy Minnow	*Hybognathus hankinsoni*	Bc	4	III
Flathead Chub	*Platygobio gracilis*	Bc	4	III
Quillback	*Carpiodes cyprinus*	Bc	4	III
Bonneville Cutthroat Trout	*Oncorhynchus clarkii utah*	Cb	4	II
Bigmouth Shiner	*Ericymba dorsalis*	Cb	4	II
Orangethroat Darter	*Etheostoma spectabile*	Cb	4	III
Mammals (55 species)				
Black-footed Ferret	*Mustela nigripes*	Aa	1	I
Canada Lynx	*Lynx canadensis*	Aa	1	I
Little Brown Myotis	*Myotis lucifugus*	Ab	2	I
Northern Long-eared Myotis	*Myotis septentrionalis*	Ab	2	I
Wyoming Pocket Gopher	*Thomomys clusius*	Ab	2	I
Tricolored Bat	*Perimyotis subflavus*	Ab	2	II
American Pika	*Ochotona princeps*	Ba	2	II
Pygmy Rabbit	*Brachylagus idahoensis*	Ba	2	II
Hoary Bat	*Lasiurus cinereus*	Bb	3	I
Bighorn Sheep	*Ovis canadensis*	Bb	3	II
Dwarf Shrew	*Sorex nanus*	Bb	3	II
Eastern Red Bat	*Lasiurus borealis*	Bb	3	II
Fringed Myotis	*Myotis thysanodes*	Bb	3	II
Idaho Pocket Gopher	*Thomomys idahoensis*	Bb	3	II
Long-legged Myotis	*Myotis volans*	Bb	3	II

Common name	Scientific name	Cell	NSS	Tier
Mule Deer	*Odocoileus hemionus*	Bb	3	II
Pallid Bat	*Antrozous pallidus*	Bb	3	II
Plains Harvest Mouse	*Reithrodontomys montanus*	Bb	3	II
Plains Spotted Skunk	*Spilogale interrupta*	Bb	3	II
Preble's Meadow Jumping Mouse	*Zapus hudsonius preblei*	Bb	3	II
Sand Hills Pocket Gopher	*Geomys lutescens*	Bb	3	II
Spotted Bat	*Euderma maculatum*	Bb	3	II
North American Water Vole	*Microtus richardsoni*	Bb	3	II
Wolverine	*Gulo gulo*	Bb	3	II
Yuma Myotis	*Myotis yumanensis*	Bb	3	II
Northern River Otter	*Lontra canadensis*	Bc	4	II
Abert's Squirrel	*Sciurus aberti*	Bc	4	III
Canyon Deermouse	*Peromyscus crinitus*	Bc	4	III
Cliff Chipmunk	*Neotamias dorsalis*	Bc	4	III
Meadow Jumping Mouse	*Zapus hudsonius*	Bc	4	III
Piñon Deermouse	*Peromyscus truei*	Bc	4	III
Spotted Ground Squirrel	*Xerospermophilus spilosoma*	Bc	4	III
Uinta Chipmunk	*Neotamias umbrinus*	Bc	4	III
Western Spotted Skunk	*Spilogale gracilis*	Bc	4	III
Yellow-pine Chipmunk	*Neotamias amoenus*	Bc	4	III
Black-tailed Prairie Dog	*Cynomys ludovicianus*	Cb	4	II
Long-eared Myotis	*Myotis evotis*	Cb	4	II
Northern Flying Squirrel	*Glaucomys sabrinus*	Cb	4	II

Common name	Scientific name	Cell	NSS	Tier
Sagebrush Vole	*Lemmiscus curtatus*	Cb	4	II
Silver-haired Bat	*Lasionycteris noctivagans*	Cb	4	II
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Cb	4	II
Western Small-footed Myotis	*Myotis ciliolabrum*	Cb	4	II
White-tailed Prairie Dog	*Cynomys leucurus*	Cb	4	II
Olive-backed Pocket Mouse	*Perognathus fasciatus*	Cb	4	III
Swift Fox	*Vulpes velox*	Cb	4	III
California Myotis	*Myotis californicus*	U	U	III
Great Basin Pocket Mouse	*Perognathus mollipilosus*	U	U	III
Hayden's Shrew	*Sorex haydeni*	U	U	III
Hispid Pocket Mouse	*Chaetodipus hispidus*	U	U	III
Least Weasel	*Mustela nivalis*	U	U	III
Plains Pocket Mouse	*Perognathus flavescens*	U	U	III
Preble's Shrew	*Sorex preblei*	U	U	III
Ringtail	*Bassariscus astutus*	U	U	III
Silky Pocket Mouse	*Perognathus flavus*	U	U	III
Western Pygmy Shrew	*Sorex eximius*	U	U	III
Mollusks (35 species, 2 groups)				
California Floater	*Anodonta californiensis*	Aa	1	I
Great Basin Ramshorn	*Helisoma newberryi*	Aa	1	I
Ambersnail	*Mediappendix gelida*	Ab	2	I
Bear Lake Springsnail	*Pyrgulopsis pilsbryana*	Ab	2	I
Cylindrical Papershell	*Anodontoides ferussacianus*	Ab	2	I

Common name	Scientific name	Cell	NSS	Tier
Glass Physa	*Physa skinneri*	Ab	2	I
Plain Pocketbook	*Lampsilis cardium*	Ab	2	I
Threeridge Valvata	*Valvata tricarinata*	Ab	2	I
Cave Physa	*Physa spelunca*	Ab	2	II
Glossy Valvata	*Valvata humeralis*	Ab	2	II
Green River Pebblesnail	*Fluminicola coloradoensis*	Ab	2	II
Jackson Lake Springsnail	*Pyrgulopsis robusta*	Ab	2	II
Mossy Valvata	*Valvata sincera*	Ab	2	II
Obtuse Physa	*Physa jennessi*	Ab	2	II
Rocky Mountain Capshell	*Acroloxus coloradensis*	Ab	2	II
Rocky Mountain Duskysnail	*Colligyrus greggi*	Ab	2	II
Swamp Lymnaea	*Lymnaea stagnalis*	Ab	2	II
Wrinkled Marshsnail	*Hinkleyia caperata*	Ab	2	II
Yavapai Mountainsnail	*Oreohelix yavapai*	Ab	2	II
Pygmy Mountainsnail	*Oreohelix pygmaea*	Ba	2	II
Button Sprite	*Menetus opercularis*	Bb	3	II
Giant Floater	*Pyganodon grandis*	Bb	3	II
Marsh Pondsnail	*Ladislavella elodes*	Bb	3	II
Rotund Physa	*Physella columbiana*	Bb	3	II
Star Gyro	*Gyraulus crista*	Bb	3	II
Two-ridged Ramshorn	*Helisoma anceps*	Bb	3	II
Western Pearlshell	*Margaritifera falcata*	Bb	3	II
Fatmucket	*Lampsilis siliquoidea*	Bc	4	II

Common name	Scientific name	Cell	NSS	Tier
Sharp Sprite	*Promenetus exacuous*	Bc	4	II
Umbilicate Sprite	*Promenetus umbilicatellus*	Cb	4	II
Woodland Pondsnail	*Ladislavella catascopium*	Cb	4	II
Other aquatic mollusks group (7 species)		U	U	II
Fragile Ancylid	*Ferrissia californica*	Bb	3	III
Cooper's Rocky Mountain Mountain-snail	*Oreohelix strigosa cooperi*	Bc	4	III
Creeping Ancylid	*Ferrissia rivularis*	U	U	III
Other terrestrial snails group (30 species)		U	U	III
Western Glass-snail	*Vitrina pellucida*	U	U	III
Reptiles (25 species)				
Midget Faded Rattlesnake	*Crotalus oreganus concolor*	Aa	1	I
Hernandez's Short-horned Lizard	*Phrynosoma hernandesi hernandesi*	Ab	2	II
Northern Spiny Softshell	*Apalone spinifera spinifera*	Ba	2	II
Great Basin Gophersnake	*Pituophis catenifer deserticola*	Ba	2	II
Northern Tree Lizard	*Urosaurus ornatus wrighti*	Ab	2	II
Great Plains Earless Lizard	*Holbrookia maculata maculata*	Ba	3	II
Northern Rubber Boa	*Charina bottae bottae*	Bb	3	II
Prairie Lizard	*Sceloporus consobrinus*	Bb	3	II
Red-bellied Snake	*Storeria occipitomaculata*	Bb	3	II
Smooth Greensnake	*Opheodrys vernalis*	Bb	3	II
Valley Gartersnake	*Thamnophis sirtalis fitchi*	Bb	3	II
Western Milksnake	*Lampropeltis gentilis*	Bb	3	II

Common name	Scientific name	Cell	NSS	Tier
Prairie Racerunner	*Aspidoscelis sexlineatus viridis*	Bb	3	II
Plateau Fence Lizard	*Sceloporus tristichus*	Bc	4	II
Plains Short-horned Lizard	*Phrynosoma hernandesi brevirostris*	Bc	4	II
Plains Hog-nosed Snake	*Heterodon nasicus nasicus*	Bc	4	III
Prairie Rattlesnake	*Crotalus viridis*	Bc	4	III
Western Painted Turtle	*Chrysemys picta bellii*	Bc	4	III
Great Basin Skink	*Plestiodon skiltonianus utahensis*	U	U	II
Northern Many-lined Skink	*Plestiodon multivirgatus multivirga-tus*	U	U	II
Plains Black-headed Snake	*Tantilla nigriceps*	U	U	II
Ornate Box Turtle	*Terrapene ornata*	U	U	II
Plains Gartersnake	*Thamnophis radix*	U	U	II
Red-sided Gartersnake	*Thamnophis sirtalis parietalis*	U	U	II
Desert Striped Whipsnake	*Masticophis taeniatus taeniatus*	U	U	III

Common name	Scientific name	WY Contribution	S-rank
Plants (55 species)			
Comb-hair Draba	*Draba pectinipila*	VHigh	S1
Desert Yellowhead	*Yermo xanthocephalus*	VHigh	S1
Farrar Moonwort	*Botrychium farrarii*	VHigh	S1
Gibbens' Beardtongue	*Penstemon gibbensii*	VHigh	S1
Green River Greenthread	*Thelesperma caespitosum*	VHigh	S1
Hairy Greenthread	*Thelesperma pubescens*	VHigh	S1
Hyattville (Starveling) Milkvetch	*Astragalus jejunus* var. *articulatus*	VHigh	S1
Mystery (Biennial) Wormwood	*Artemisia biennis var. diffusa*	VHigh	S1

Common name	Scientific name	WY Contribution	S-rank
Owl Creek Miner's Candle	*Oreocarya subcapitata*	VHigh	S1
Prairie Dodder	*Cuscuta plattensis*	VHigh	S1
Ross' Bentgrass	*Agrostis rossiae*	VHigh	S1
Small (Fremont County) Rockcress	*Boechera pusilla*	VHigh	S1
Smallheaded Townsend Daisy	*Townsendia microcephala*	VHigh	S1
Smooth Summer Milkvetch	*Astragalus hyalinus var. glabratus*	VHigh	S1
Winward's Goldenweed	*Ericameria winwardii*	VHigh	S1
Yellowstone Sand Verbena	*Abronia ammophila*	VHigh	S1
Sessileflower (Indian) Springparsley	*Cymopterus sessiliflorus*	High	S1
Slender Spiderflower	*Peritoma multicaulis*	High	S1
Thickleaf Bladderpod	*Physaria pachyphylla*	High	S1
Thickleaf Pepperweed	*Lepidium integrifolium*	High	S1
Barneby's Clover	*Trifolium barnebyi*	VHigh	S1S2
Long-awned Alkali Wildrye	*Leymus simplex var. luxurians*	VHigh	S1S2
Alkali Wildrye	*Leymus simplex var. simplex*	VHigh	S2
Blowout Beardtongue	*Penstemon haydenii*	VHigh	S2
Desert Glandular Phacelia	*Phacelia glandulosa var. deserta*	VHigh	S2
Dorn's (Tunp Range) Twinpod	*Physaria dornii*	VHigh	S2
Dubois (Plains) Milkvetch	*Astragalus gilviflorus var. purpureus*	VHigh	S2
Kirkpatrick's (Spiked) Ipomopsis	*Ipomopsis spicata var. robruthiorum*	VHigh	S2
Laramie (Alpine) Clover	*Trifolium dasyphyllum var. anemophilum*	VHigh	S2
Large-fruited Bladderpod	*Physaria macrocarpa*	VHigh	S2
Precocious Milkvetch	*Astragalus proimanthus*	VHigh	S2

Common name	Scientific name	WY Contribution	S-rank
Teton Wirelettuce	*Stephanomeria fluminea*	VHigh	S2
Wyoming Tansymustard	*Descurainia torulosa*	VHigh	S2
Colorado Tansyaster	*Xanthisma coloradoense*	High	S2
Dropleaf Buckwheat	*Eriogonum exilifolium*	High	S2
Foothill Milkvetch	*Astragalus tridactylicus*	High	S2
Grassyslope Sedge	*Carex oreocharis*	High	S2
Meadow Milkvetch	*Astragalus diversifolius*	High	S2
Parasol Bladderpod	*Physaria subumbellata*	High	S2
Payson's Milkvetch	*Astragalus paysonii*	High	S2
Prostrate (Low) Bladderpod	*Physaria prostrata*	High	S2
Stemless Beardtongue	*Penstemon acaulis*	High	S2
Trelease's Milkvetch	*Astragalus racemosus var. treleasei*	High	S2
Ute Ladies' Tresses	*Spiranthes diluvialis*	High	S2
Woodrush Sedge	*Carex luzulina var. atropurpurea*	High	S2
Cedar Rim (Desert) Thistle	*Cirsium pulcherrimum var. aridum*	VHigh	S2?
Fremont Bladderpod	*Physaria fremontii*	VHigh	S2S3
Laramie Columbine	*Aquilegia laramiensis*	VHigh	S2S3
Shoshonea	*Shoshonea pulvinata*	VHigh	S2S3
Snow Indian Paintbrush	*Castilleja nivea*	VHigh	S2S3
Woolly (Common) Twinpod	*Physaria didymocarpa var. lanata*	VHigh	S2S3
Colorado Butterfly Plant	*Oenothera coloradensis*	High	S2S3
Payson's Draba	*Draba paysonii*	High	S2S3
Tapertip Desertparsley	*Lomatium attenuatum*	High	S2S3
Whitebark Pine	*Pinus albicaulis*	Med	S4

Appendix C: Changes to Species of Greatest Conservation Need since 2017 State Wildlife Action Plan

Due to the addition of the plant taxonomic group, new research, and updated population status, 13 species were removed and 75 species were added relative to the 2017 SWAP (*Table C1*, *Table C2*).

Table C1: Species of Greatest Conservation Need removed during the 2027 revision. The reason the species or group was removed is indicated with an "X."

Taxonomic group	Common name	Scientific name	Change in information	Change in population status or limiting factors
Fish	Common Shiner	*Luxilus cornutus*	X	
Mammal	Moose	*Alces americanus*		X
Mollusk	Ash Gyro	*Gyraulus parvus*	X	
Mollusk	Dusky Fossaria	*Fossaria dalli*	X	
Mollusk	Forest Disc	*Discus whitneyi*	X	
Mollusk	Marsh Rams-horn	*Planorbella trivolvis*	X	
Mollusk	Mountain Snails (group)		X	
Mollusk	Multirib Vallonia	*Vallonia gracilicosta*	X	
Mollusk	Pewter Physa	*Physa acuta*	X	
Mollusk	Prairie Fossaria	*Fossaria bulimoides*	X	
Mollusk	Quick Gloss	*Zonitoides arboreus*	X	
Mollusk	Rocky Mountain Mountain Snail	*Oreohelix strigosa*	X	
Mollusk	Subalpine Mountain Snail	*Oreohelix subrudis*	X	
Mollusk	Tadpole Physa	*Physa gyrina*	X	

Table C2: Species of Greatest Conservation Need added during the 2027 revision.

Taxonomic group	Common name	Scientific name
Bird	American Barn Owl	*Tyto furcata*
Bird	Evening Grosbeak	*Hesperiphona vespertina*
Bird	Field Sparrow	*Spizella pusilla*
Bird	Lark Bunting	*Calamospiza melanocorys*
Bird	Northern Pintail	*Anas acuta*
Bird	Pinyon Jay	*Gymnorhinus cyanocephalus*
Bird	Plains Sharp-tailed Grouse	*Tympanuchus phasianellus jamesii*
Bird	White-winged Crossbill	*Loxia leucoptera*
Bird	Wilson's Phalarope	*Phalaropus tricolor*
Fish	Green Sucker	*Pantosteus virescens*
Fish	Quillback	*Carpiodes cyprinus*
Mammal	California Myotis	*Myotis californicus*
Mammal	Hoary Bat	*Lasiurus cinereus*
Mammal	Mule Deer	*Odocoileus hemionus*
Mammal	Silver-haired Bat	*Lasionycteris noctivagans*
Mammal	Tricolored Bat	*Perimyotis subflavus*
Mollusk	Fatmucket	*Lampsilis siliquoidea*
Mollusk	Western Pearlshell	*Margaritifera falcata*
Plants	All 55 species of plants (see Table 1 or Appendix B).	

Appendix D: Habitat associations for Species of Greatest Conservation Need

Table D1. Terrestrial habitat associations for Wyoming's Species of Greatest Conservation Need.

This table summarizes the terrestrial habitat associations for Species of Greatest Conservation Need. Please refer to *Chapter 3* for information regarding how associations were identified.

Common name	Scientific name	Aspen Deciduous Forest	Montane and Subalpine Forest	Xeric and Lower Montane Forest	Desert Shrublands	Foothills Shrublands	Sagebrush Shrublands	Prairie Grasslands	Mountain Grassland and Alpine Tundra	Wetlands	Riparian Areas	Cliffs, Caves, Canyons, and Rock Outcrops
Amphibians (9 species)												
Western (Boreal) Toad	*Anaxyrus boreas*	X	X			X			X	X	X	
Wyoming Toad	*Anaxyrus baxteri*					X		X		X	X	
Wood Frog	*Lithobates sylvaticus*	X	X			X			X	X	X	
Columbia Spotted Frog	*Rana luteiventris*	X	X			X			X	X	X	
Great Plains Toad	*Anaxyrus cognatus*				X		X	X		X	X	
Northern Leopard Frog	*Lithobates pipiens*	X	X	X		X	X	X	X	X	X	
Great Basin Spadefoot	*Spea intermontana*				X	X	X			X	X	
Plains Spadefoot	*Spea bombifrons*				X	X	X	X		X	X	
Western Tiger Salamander	*Ambystoma mavortium*	X	X	X	X	X	X	X	X	X	X	
Birds (89 species)												
Common Loon	*Gavia immer*									X		
Yellow-billed Cuckoo	*Coccyzus americanus*										X	
Brewer's Sparrow	*Spizella breweri*				X	X	X					
Mountain Plover	*Anarhynchus montanus*				X		X	X				

Common name	Scientific name	Aspen Deciduous Forest	Montane and Subalpine Forest	Xeric and Lower Montane Forest	Desert Shrublands	Foothills Shrublands	Sagebrush Shrublands	Prairie Grasslands	Mountain Grassland and Alpine Tundra	Wetlands	Riparian Areas	Cliffs, Caves, Canyons, and Rock Outcrops
Sage Thrasher	*Oreoscoptes montanus*				X	X	X					
American Bittern	*Botaurus lentiginosus*									X		
Baird's Sparrow	*Centronyx bairdii*							X				
Black Tern	*Chlidonias niger*									X		
Black-crowned Night Heron	*Nycticorax nycticorax*									X		
Bobolink	*Dolichonyx oryzivorus*							X		X		
Boreal Owl	*Aegolius funereus*	X	X									
Burrowing Owl	*Athene cunicularia*				X		X	X		X		
Calliope Hummingbird	*Selasphorus calliope*		X	X		X			X	X	X	
Caspian Tern	*Hydroprogne caspia*									X		
Chestnut-collared Longspur	*Calcarius ornatus*							X				
Clark's Nutcracker	*Nucifraga columbiana*		X	X		X						
Evening Grosbeak	*Hesperiphona vespertina*	X	X	X		X					X	
Forster's Tern	*Sterna forsteri*									X		
Golden Eagle	*Aquila chrysaetos*		X	X	X	X	X	X			X	X
Grasshopper Sparrow	*Ammodramus savannarum*						X	X				
Great Gray Owl	*Strix nebulosa*		X						X			
Harlequin Duck	*Histrionicus histrionicus*		X							X	X	
Lark Bunting	*Calamospiza melanocorys*						X	X				

Common name	Scientific name	Aspen Deciduous Forest	Montane and Subalpine Forest	Xeric and Lower Montane Forest	Desert Shrublands	Foothills Shrublands	Sagebrush Shrublands	Prairie Grasslands	Mountain Grassland and Alpine Tundra	Wetlands	Riparian Areas	Cliffs, Caves, Canyons, and Rock Outcrops
Loggerhead Shrike	*Lanius ludovicianus*				X		X	X				
Long-billed Curlew	*Numenius americanus*						X	X		X		
Pinyon Jay	*Gymnorhinus cyanocephalus*			X		X	X					
Rufous Hummingbird	*Selasphorus rufus*					X			X	X	X	
Sagebrush Sparrow	*Artemisiospiza nevadensis*				X		X					
Snowy Egret	*Egretta thula*									X	X	
Thick-billed Longspur	*Rhynchophanes mccownii*						X	X				
Trumpeter Swan	*Cygnus buccinator*									X	X	
Upland Sandpiper	*Bartramia longicauda*							X		X		
Western Cattle-Egret	*Ardea ibis*							X		X	X	
White-faced Ibis	*Plegadis chihi*									X		
Willow Flycatcher	*Empidonax traillii*					X				X	X	
Wilson's Phalarope	*Phalaropus tricolor*									X		
Black-billed Cuckoo	*Coccyzus erythropthalmus*										X	
Plains Sharp-tailed Grouse	*Tympanuchus phasianellus jamesii*					X	X	X				
Common Nighthawk	*Chordeiles minor*				X	X	X	X		X	X	
Ferruginous Hawk	*Buteo regalis*				X		X	X				X
Greater Sage-Grouse	*Centrocercus urophasianus*					X	X	X			X	
MacGillivray's Warbler	*Geothlypis tolmiei*		X			X					X	

Common name	Scientific name	Aspen Deciduous Forest	Montane and Subalpine Forest	Xeric and Lower Montane Forest	Desert Shrublands	Foothills Shrublands	Sagebrush Shrublands	Prairie Grasslands	Mountain Grassland and Alpine Tundra	Wetlands	Riparian Areas	Cliffs, Caves, Canyons, and Rock Outcrops
Peregrine Falcon	*Falco peregrinus*					X						X
Columbian Sharp-tailed Grouse	*Tympanuchus phasianellus colum-bianus*				X	X	X				X	
Short-eared Owl	*Asio flammeus*						X	X		X		
Swainson's Hawk	*Buteo swainsoni*						X	X		X		
American Kestrel	*Falco sparverius*	X				X	X	X			X	
American Pipit	*Anthus rubescens*								X			X
American White Pelican	*Pelecanus erythro-rhynchos*									X	X	
Ash-throated Flycatcher	*Myiarchus cineras-cens*			X								
Bald Eagle	*Haliaeetus leuco-cephalus*	X	X			X	X	X		X	X	
Bewick's Wren	*Thryomanes be-wickii*			X		X						
Black-throated Gray Warbler	*Setophaga ni-grescens*			X		X						
Blue Grosbeak	*Passerina caerulea*							X		X	X	
Blue-gray Gnatcatcher	*Polioptila caerulea*			X		X						
Bushtit	*Psaltriparus minimus*			X		X						
Canyon Wren	*Catherpes mexi-canus*					X						X
Common Yellowthroat	*Geothlypis trichas*									X	X	
Great Blue Heron	*Ardea herodias*									X	X	
Juniper Titmouse	*Baeolophus ridgwayi*			X		X						
Northern Pintail	*Anas acuta*							X		X		

Common name	Scientific name	Aspen Deciduous Forest	Montane and Subalpine Forest	Xeric and Lower Montane Forest	Desert Shrublands	Foothills Shrublands	Sagebrush Shrublands	Prairie Grasslands	Mountain Grassland and Alpine Tundra	Wetlands	Riparian Areas	Cliffs, Caves, Canyons, and Rock Outcrops
Northern Pygmy-Owl	*Glaucidium gnoma*	X	X			X						
Pygmy Nuthatch	*Sitta pygmaea*		X	X								
Red Crossbill	*Loxia curvirostra*		X	X		X						
Red-eyed Vireo	*Vireo olivaceus*	X	X			X					X	
Red-headed Woodpecker	*Melanerpes erythrocephalus*							X			X	
Virginia's Warbler	*Leiothlypis virginiae*			X		X						
Williamson's Sapsucker	*Sphyrapicus thyroideus*	X	X	X		X						
Woodhouse's Scrub-Jay	*Aphelocoma woodhouseii*			X		X						
Black Rosy-Finch	*Leucosticte atrata*								X			X
American Goshawk	*Accipiter gentilis*	X	X	X		X						
Black-backed Woodpecker	*Picoides arcticus*		X	X								
Brown-capped Rosy-Finch	*Leucosticte australis*								X			X
Clark's Grebe	*Aechmophorus clarkii*									X		
Field Sparrow	*Spizella pusilla*	X					X	X			X	
Flammulated Owl	*Psiloscops flammeolus*	X	X	X								
Franklin's Gull	*Leucophaeus pipixcan*									X		
Lewis's Woodpecker	*Melanerpes lewis*		X	X		X					X	
Snowy Plover	*Anarhynchus nivosus*									X		
Western Grebe	*Aechmophorus occidentalis*									X		

Common name	Scientific name	Aspen Deciduous Forest	Montane and Subalpine Forest	Xeric and Lower Montane Forest	Desert Shrublands	Foothills Shrublands	Sagebrush Shrublands	Prairie Grasslands	Mountain Grassland and Alpine Tundra	Wetlands	Riparian Areas	Cliffs, Caves, Canyons, and Rock Outcrops
American Barn Owl	*Tyto furcata*						X	X		X	X	
Black-chinned Hummingbird	*Archilochus alexandri*			X		X					X	
Dickcissel	*Spiza americana*							X		X		
Gray Vireo	*Vireo vicinior*			X	X							
Merlin	*Falco columbarius*			X		X		X			X	
Purple Martin	*Progne subis*	X				X					X	
Scott's Oriole	*Icterus parisorum*			X								
Virginia Rail	*Rallus limicola*									X		
White-winged Crossbill	*Loxia leucoptera*		X	X		X						
Mammals (55 species)												
Black-footed Ferret	*Mustela nigripes*				X		X	X				
Canada Lynx	*Lynx canadensis*		X			X						
Little Brown Myotis	*Myotis lucifugus*	X	X	X	X	X	X	X	X	X	X	X
Northern Long-eared Myotis	*Myotis septentrionalis*	X		X		X	X	X			X	X
Wyoming Pocket Gopher	*Thomomys clusius*				X		X					
Tricolored Bat	*Perimyotis subflavus*	X		X		X	X				X	X
American Pika	*Ochotona princeps*		X						X			X
Pygmy Rabbit	*Brachylagus idahoensis*						X					
Hoary Bat	*Lasiurus cinereus*	X	X	X	X	X	X	X	X	X	X	
Bighorn Sheep	*Ovis canadensis*					X			X			X

Common name	Scientific name	Aspen Deciduous Forest	Montane and Subalpine Forest	Xeric and Lower Montane Forest	Desert Shrublands	Foothills Shrublands	Sagebrush Shrublands	Prairie Grasslands	Mountain Grassland and Alpine Tundra	Wetlands	Riparian Areas	Cliffs, Caves, Canyons, and Rock Outcrops
Dwarf Shrew	*Sorex nanus*		X			X			X	X		
Eastern Red Bat	*Lasiurus borealis*	X	X	X		X					X	
Fringed Myotis	*Myotis thysanodes*		X	X	X	X	X	X		X	X	X
Idaho Pocket Gopher	*Thomomys idahoen-sis*					X	X					
Long-legged Myotis	*Myotis volans*	X	X	X		X	X		X	X	X	X
Mule Deer	*Odocoileus hemio-nus*	X	X	X	X	X	X	X	X	X	X	
Pallid Bat	*Antrozous pallidus*			X	X	X	X	X		X	X	X
Plains Harvest Mouse	*Reithrodontomys montanus*							X				
Plains Spotted Skunk	*Spilogale interrupta*					X	X	X				
Preble's Meadow Jumping Mouse	*Zapus hudsonius preblei*									X	X	
Sand Hills Pocket Gopher	*Geomys lutescens*							X				
Spotted Bat	*Euderma maculatum*	X	X	X	X	X	X	X	X	X	X	X
North American Water Vole	*Microtus richardsoni*		X						X	X	X	
Wolverine	*Gulo gulo*	X	X						X			X
Yuma Myotis	*Myotis yumanensis*		X	X	X	X	X	X		X	X	X
Northern River Otter	*Lontra canadensis*		X			X	X				X	
Abert's Squirrel	*Sciurus aberti*			X								
Canyon Deermouse	*Peromyscus crinitus*			X								X
Cliff Chipmunk	*Neotamias dorsalis*			X		X	X					X

Common name	Scientific name	Aspen Deciduous Forest	Montane and Subalpine Forest	Xeric and Lower Montane Forest	Desert Shrublands	Foothills Shrublands	Sagebrush Shrublands	Prairie Grasslands	Mountain Grassland and Alpine Tundra	Wetlands	Riparian Areas	Cliffs, Caves, Canyons, and Rock Outcrops
Meadow Jumping Mouse	*Zapus hudsonius*									X	X	
Piñon Deermouse	*Peromyscus truei*			X			X					X
Spotted Ground Squirrel	*Xerospermophilus spilosoma*							X				
Uinta Chipmunk	*Neotamias umbrinus*		X			X						
Western Spotted Skunk	*Spilogale gracilis*					X	X					
Yellow-pine Chipmunk	*Neotamias amoenus*		X									
Black-tailed Prairie Dog	*Cynomys ludovi-cianus*						X	X				
Long-eared Myotis	*Myotis evotis*	X	X	X	X	X	X	X	X	X	X	X
Northern Flying Squirrel	*Glaucomys sabrinus*		X									
Sagebrush Vole	*Lemmiscus curtatus*						X					
Silver-haired Bat	*Lasionycteris noc-tivagans*	X	X	X		X	X	X	X	X	X	X
Townsend's Big-eared Bat	*Corynorhinus townsendii*		X	X	X	X	X	X		X	X	X
Western Small-footed Myotis	*Myotis ciliolabrum*	X	X	X	X	X	X	X	X	X	X	X
White-tailed Prairie Dog	*Cynomys leucurus*				X		X					
Olive-backed Pocket Mouse	*Perognathus fascia-tus*				X	X	X	X				
Swift Fox	*Vulpes velox*						X	X				
California Myotis	*Myotis californicus*			X	X	X	X			X	X	X
Great Basin Pocket Mouse	*Perognathus mollip-ilosus*				X		X					
Hayden's Shrew	*Sorex haydeni*		X							X	X	

Common name	Scientific name	Aspen Deciduous Forest	Montane and Subalpine Forest	Xeric and Lower Montane Forest	Desert Shrublands	Foothills Shrublands	Sagebrush Shrublands	Prairie Grasslands	Mountain Grassland and Alpine Tundra	Wetlands	Riparian Areas	Cliffs, Caves, Canyons, and Rock Outcrops
Hispid Pocket Mouse	*Chaetodipus hispi-dus*							X				
Least Weasel	*Mustela nivalis*			X				X		X		
Plains Pocket Mouse	*Perognathus fla-vescens*							X				
Preble's Shrew	*Sorex preblei*									X	X	
Ringtail	*Bassariscus astutus*			X							X	X
Silky Pocket Mouse	*Perognathus flavus*					X		X				
Western Pygmy Shrew	*Sorex eximius*	X	X							X	X	
Reptiles (25 species)												
Midget Faded Rattlesnake	*Crotalus oreganus concolor*			X	X	X	X				X	X
Hernandez's Short-horned Lizard	*Phrynosoma her-nandesi hernandesi*					X		X	X			
Northern Spiny Softshell	*Apalone spinifera spinifera*									X	X	
Great Basin Gophersnake	*Pituophis catenifer deserticola*		X	X	X	X	X			X	X	X
Northern Tree Lizard	*Urosaurus ornatus wrighti*			X	X	X	X					X
Great Plains Earless Lizard	*Holbrookia maculata maculata*							X		X	X	
Northern Rubber Boa	*Charina bottae bottae*	X	X	X		X	X	X		X	X	X
Prairie Lizard	*Sceloporus conso-brinus*			X		X	X	X		X	X	
Red-bellied Snake	*Storeria occipito-maculata*	X		X			X	X		X	X	
Smooth Greensnake	*Opheodrys vernalis*	X	X	X		X		X	X	X	X	
Valley Gartersnake	*Thamnophis sirtalis fitchi*		X			X			X	X	X	

Common name	Scientific name	Aspen Deciduous Forest	Montane and Subalpine Forest	Xeric and Lower Montane Forest	Desert Shrublands	Foothills Shrublands	Sagebrush Shrublands	Prairie Grasslands	Mountain Grassland and Alpine Tundra	Wetlands	Riparian Areas	Cliffs, Caves, Canyons, and Rock Outcrops
Western Milksnake	*Lampropeltis gentilis*			X	X	X	X	X		X	X	X
Prairie Racerunner	*Aspidoscelis sexlineatus viridis*							X		X	X	
Plateau Fence Lizard	*Sceloporus tristichus*			X	X	X	X					X
Plains Short-horned Lizard	*Phrynosoma hernandesi brevirostris*				X	X	X	X	X			
Plains Hog-nosed Snake	*Heterodon nasicus nasicus*				X		X	X		X	X	
Prairie Rattlesnake	*Crotalus viridis*			X	X	X	X	X		X	X	X
Western Painted Turtle	*Chrysemys picta bellii*									X	X	
Great Basin Skink	*Plestiodon skiltonianus utahensis*					X	X			X	X	
Northern Many-lined Skink	*Plestiodon multivirgatus multivirgatus*							X		X	X	
Plains Black-headed Snake	*Tantilla nigriceps*			X	X	X	X	X			X	X
Ornate Box Turtle	*Terrapene ornata*							X				
Plains Gartersnake	*Thamnophis radix*						X	X		X	X	
Red-sided Gartersnake	*Thamnophis sirtalis parietalis*			X		X	X	X		X	X	
Desert Striped Whipsnake	*Masticophis taeniatus taeniatus*				X		X					X
Plants (55 species)												
Yellowstone Sand Verbena	*Abronia ammophila*									X		
Ross' Bentgrass	*Agrostis rossiae*									X		
Laramie Columbine	*Aquilegia laramiensis*		X									X
Mystery (Biennial) Wormwood	*Artemisia biennis var. diffusa*				X					X		

Common name	Scientific name	Aspen Deciduous Forest	Montane and Subalpine Forest	Xeric and Lower Montane Forest	Desert Shrublands	Foothills Shrublands	Sagebrush Shrublands	Prairie Grasslands	Mountain Grassland and Alpine Tundra	Wetlands	Riparian Areas	Cliffs, Caves, Canyons, and Rock Outcrops
Meadow Milkvetch	*Astragalus diversifolius*				X					X		
Dubois (Plains) Milkvetch	*Astragalus gilviflorus var. purpureus*				X							X
Smooth Summer Milkvetch	*Astragalus hyalinus var. glabratus*				X							X
Hyattville (Starveling) Milkvetch	*Astragalus jejunus var. articulatus*				X							X
Payson's Milkvetch	*Astragalus paysonii*		X									
Precocious Milkvetch	*Astragalus proimanthus*				X		X					X
Trelease's Milkvetch	*Astragalus racemosus var. treleasei*				X							X
Foothill Milkvetch	*Astragalus tridactylicus*							X				
Small (Fremont County) Rockcress	*Boechera pusilla*						X					X
Farrar Moonwort	*Botrychium farrarii*		X						X			
Woodrush Sedge	*Carex luzulina var. atropurpurea*									X		
Grassyslope Sedge	*Carex oreocharis*							X	X			
Snow Indian Paintbrush	*Castilleja nivea*		X						X			X
Cedar Rim (Desert) Thistle	*Cirsium pulcherrimum var. aridum*				X		X					X
Prairie Dodder	*Cuscuta plattensis*							X				
Sessileflower (Indian) Springparsley	*Cymopterus sessiliflorus*			X								X
Wyoming Tansymustard	*Descurainia torulosa*											X
Payson's Draba	*Draba paysonii*								X			X
Comb-hair Draba	*Draba pectinipila*			X	X		X					X

Common name	Scientific name	Aspen Deciduous Forest	Montane and Subalpine Forest	Xeric and Lower Montane Forest	Desert Shrublands	Foothills Shrublands	Sagebrush Shrublands	Prairie Grasslands	Mountain Grassland and Alpine Tundra	Wetlands	Riparian Areas	Cliffs, Caves, Canyons, and Rock Outcrops
Winward's Goldenweed	*Ericameria winwardii*				X							X
Dropleaf Buckwheat	*Eriogonum exilifolium*				X							X
Kirkpatrick's (Spiked) Ipomopsis	*Ipomopsis spicata var. robruthiorum*		X						X			X
Thickleaf Pepperweed	*Lepidium integrifolium*									X	X	
Long-awned Alkali Wildrye	*Leymus simplex var. luxurians*						X					
Alkali Wildrye	*Leymus simplex var. simplex*						X			X		
Tapertip Desertparsley	*Lomatium attenuatum*		X				X					X
Colorado Butterfly Plant	*Oenothera coloradensis*							X			X	
Owl Creek Miner's Candle	*Oreocarya subcapitata*				X							X
Stemless Beardtongue	*Penstemon acaulis*						X					X
Gibbens' Beardtongue	*Penstemon gibbensii*				X							X
Blowout Beardtongue	*Penstemon haydenii*						X	X				
Slender Spiderflower	*Peritoma multicaulis*									X		
Desert Glandular Phacelia	*Phacelia glandulosa var. deserta*				X							X
Woolly (Common) Twinpod	*Physaria didymocarpa var. lanata*		X	X								X
Dorn's (Tunp Range) Twinpod	*Physaria dornii*				X	X						X
Fremont Bladderpod	*Physaria fremontii*						X		X			X
Large-fruited Bladderpod	*Physaria macrocarpa*				X							
Thickleaf Bladderpod	*Physaria pachyphylla*				X		X					X

Common name	Scientific name	Aspen Deciduous Forest	Montane and Subalpine Forest	Xeric and Lower Montane Forest	Desert Shrublands	Foothills Shrublands	Sagebrush Shrublands	Prairie Grasslands	Mountain Grassland and Alpine Tundra	Wetlands	Riparian Areas	Cliffs, Caves, Canyons, and Rock Outcrops
Prostrate (Low) Bladderpod	*Physaria prostrata*			X			X					X
Parasol Bladderpod	*Physaria subumbellata*						X					X
Whitebark Pine	*Pinus albicaulis*		X									X
Shoshonea	*Shoshonea pulvinata*		X									X
Ute Ladies' Tresses	*Spiranthes diluvialis*							X		X	X	
Teton Wirelettuce	*Stephanomeria fluminea*										X	
Green River Greenthread	*Thelesperma caespitosum*				X							X
Hairy Greenthread	*Thelesperma pubescens*						X					X
Smallheaded Townsend Daisy	*Townsendia microcephala*								X			X
Barneby's Clover	*Trifolium barnebyi*			X			X					X
Laramie (Alpine) Clover	*Trifolium dasyphyllum var. anemophilum*						X		X			X
Colorado Tansyaster	*Xanthisma coloradoense*						X		X			X
Desert Yellowhead	*Yermo xanthocephalus*				X		X					

Table D2. Aquatic basin associations for Wyoming's Species of Greatest Conservation Need.

This table summarizes the aquatic basin associations for Species of Greatest Conservation Need. Please refer to *Chapter 3* for information regarding how associations were identified.

Common name	Scientific name	Bear River	Green River	North-eastern Missouri River	Platte River	Snake Salt River	Yellow-stone River
Crustaceans (8 species, 1 group)							
Beavertail Fairy Shrimp	*Thamnocephalus platyurus*			X			
Calico/Papershell Crayfish	*Faxonius immunis*		X	X	X		X
Constricted Fairy Shrimp	*Branchinecta constricta*				X		
Devil Crayfish/Great Plains Mudbug	*Lacunicambarus nebrascensis*				X		
Fairy Shrimp	*Branchinecta serrata*				X	X	
Fairy shrimp (Mackin Fairy Shrimp)	*Streptocephalus mackini*			X			
Pilose Crayfish	*Pacifastacus gambelii*	X				X	
Ringed Crayfish	*Faxonius neglectus*				X		
Other Shrimp (17 species)		—	—	—	—	—	—
Fish (29 species)							
Bluehead Sucker	*Pantosteus discobolus*		X				
Flannelmouth Sucker	*Catostomus latipinnis*		X				
Kendall Warm Springs Dace	*Rhinichthys osculus thermalis*		X				
Northern Pearl Dace	*Margariscus nachtriebi*			X			
Green Sucker	*Pantosteus virescens*	X				X	
Hornyhead Chub	*Nocomis biguttatus*				X		
Sturgeon Chub	*Macrhybopsis gelida*				X		X

Common name	Scientific name	Bear River	Green River	North-eastern Missouri River	Platte River	Snake Salt River	Yellow-stone River
Suckermouth Minnow	*Phenacobius mirabilis*				X		
Western Silvery Minnow	*Hybognathus argyritis*			X			X
Colorado River Cut-throat Trout	*Oncorhynchus clarkii pleuriticus*		X				
Roundtail Chub	*Gila robusta*		X				
Yellowstone Cut-throat Trout	*Oncorhynchus clarkii bouvieri*					X	X
Finescale Dace	*Chrosomus neogaeus*			X			
Goldeye	*Hiodon alosoides*			X	X		X
Iowa Darter	*Etheostoma exile*			X	X		
Northern Leatherside	*Lepidomeda copei*	X				X	
Northern Plains Killifish	*Fundulus kansae*				X		
Plains Minnow	*Hybognathus placitus*			X	X		X
Plains Topminnow	*Fundulus sciadicus*			X	X		
Burbot	*Lota lota*						X
Sauger	*Sander canadensis*			X	X		X
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*				X		X
Snake River Cut-throat Trout	*Oncorhynchus clarkii behnkei*					X	
Brassy Minnow	*Hybognathus hankinsoni*			X	X		X
Flathead Chub	*Platygobio gracilis*			X	X		X
Quillback	*Carpiodes cyprinus*				X		
Bonneville Cutthroat Trout	*Oncorhynchus clarkii utah*	X					
Bigmouth Shiner	*Ericymba dorsalis*				X		

Common name	Scientific name	Bear River	Green River	North-eastern Missouri River	Platte River	Snake Salt River	Yellow-stone River
Orangethroat Darter	*Etheostoma spectabile*				X		
Mollusks (35 species, 2 groups)							
Ambersnail	*Mediappendix gelida*			X			
Bear Lake Springsnail	*Pyrgulopsis pilsbryana*	X					X
Button Sprite	*Menetus opercularis*						X
California Floater	*Anodonta californiensis*	X					
Cave Physa	*Physa spelunca*						X
Cooper's Rocky Mountain Mountainsnail	*Oreohelix strigosa cooperi*			X			X
Creeping Ancylid	*Ferrissia rivularis*		X		X		X
Cylindrical Papershell	*Anodontoides ferussacianus*				X		
Fatmucket	*Lampsilis siliquoidea*			X	X		X
Fragile Ancylid	*Ferrissia californica*	X					X
Giant Floater	*Pyganodon grandis*			X			X
Glass Physa	*Physa skinneri*						X
Glossy Valvata	*Valvata humeralis*				X	X	X
Great Basin Ramshorn	*Helisoma newberryi*					X	
Green River Pebblesnail	*Fluminicola coloradoensis*		X			X	
Jackson Lake Springsnail	*Pyrgulopsis robusta*					X	
Marsh Pondsnail	*Ladislavella elodes*	X	X			X	X
Mossy Valvata	*Valvata sincera*	X	X		X	X	

Common name	Scientific name	Bear River	Green River	North-eastern Missouri River	Platte River	Snake Salt River	Yellow-stone River
Obtuse Physa	*Physa jennessi*		X				
Plain Pocketbook	*Lampsilis cardium*				X		
Pygmy Mountainsnail	*Oreohelix pygmaea*						X
Rocky Mountain Capshell	*Acroloxus coloradensis*				X		
Rocky Mountain Duskysnail	*Colligyrus greggi*	X				X	
Rotund Physa	*Physella columbiana*					X	
Sharp Sprite	*Promenetus exacuous*	X					
Star Gyro	*Gyraulus crista*		X				
Swamp Lymnaea	*Lymnaea stagnalis*	X	X				
Threeridge Valvata	*Valvata tricarinata*					X	
Two-ridged Ramshorn	*Helisoma anceps*				X	X	
Umbilicate Sprite	*Promenetus umbilicatellus*		X		X		X
Western Glass-snail	*Vitrina pellucida*			X			X
Western Pearlshell	*Margaritifera falcata*		X			X	
Woodland Pondsnail	*Ladislavella catascopium*	X	X		X	X	
Wrinkled Marshsnail	*Hinkleyia caperata*						X
Yavapai Mountainsnail	*Oreohelix yavapai*			X			
Other Aquatic Mollusks (7 species)		—	—	—	—	—	—
Other Terrestrial Snails (30 species)		—	—	—	—	—	—

Appendix E: Terrestrial habitat crosswalk

Following Wyoming's 2017 State Wildlife Action Plan (SWAP), all NatureServe Terrestrial Ecological Systems (TES) that occur in Wyoming were assigned to one of the 11 terrestrial habitat types identified in the 2017 SWAP. TES were mapped using LANDFIRE 2023. A comparison was conducted between the 96 vegetation types used in the 2017 SWAP, assigned to each of the 11 terrestrial habitat types by terrestrial habitat experts, and the 126 vegetation types in the 2023 LANDFIRE model. The 62 TES vegetation types that were unchanged between 2017 and 2023 remained within the same terrestrial habitat type that was previously identified. The 64 remaining vegetation types were either assigned to one of the 11 terrestrial habitat types by a committee of Wyoming Game and Fish Department terrestrial habitat biologists or excluded. The excluded TES are primarily composed of developed landscapes. The 11 terrestrial habitat types and the TES assigned to each are listed below.

Aspen/Deciduous Forests

- Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland
- Rocky Mountain Aspen Forest and Woodland
- Rocky Mountain Bigtooth Maple Ravine Woodland
- Western Great Plains Dry Bur Oak Forest and Woodland

Cliffs, Canyons, Caves, and Rock Outcrops

- Inter-Mountain Basins Cliff and Canyon
- North American Glacier and Ice Field
- Rocky Mountain Alpine Bedrock and Scree
- Rocky Mountain Alpine Fell-Field
- Rocky Mountain Cliff Canyon and Massive Bedrock
- Western Great Plains Cliff and Outcrop

Desert Shrublands

- Colorado Plateau Mixed Bedrock Canyon and Tableland
- Great Basin & Intermountain Introduced Annual and Biennial Forbland
- Inter-Mountain Basins Greasewood Flat
- Inter-Mountain Basins Mat Saltbush Shrubland
- Inter-Mountain Basins Mixed Salt Desert Scrub
- Inter-Mountain Basins Semi-Desert Shrub-Steppe
- Inter-Mountain Basins Shale Badland
- Northwestern Great Plains Shrubland
- Western Great Plains Badlands
- Western Great Plains Sandhill Steppe

Foothills shrublands

- Great Plains Wooded Draw and Ravine Shrubland
- Great Plains Wooded Draw and Ravine Woodland
- Interior Western North American Temperate Ruderal Shrubland
- Inter-Mountain Basins Curl-leaf Mountain Mahogany Shrubland
- Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland
- Inter-Mountain Basins Montane Sagebrush Steppe
- Northern Rocky Mountain Montane-Foothill Deciduous Shrubland
- Northern Rocky Mountain Subalpine Deciduous Shrubland
- Rocky Mountain Gambel Oak-Mixed Montane Shrubland
- Rocky Mountain Lower Montane-Foothill Shrubland
- Western Cool Temperate Developed Deciduous Forest
- Western Cool Temperate Developed Mixed Forest

Montane/Subalpine Forests

- Great Basin Pinyon-Juniper Woodland
- Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland
- Middle Rocky Mountain Montane Douglas-fir Forest and Woodland
- Northern Rocky Mountain Subalpine Woodland and Parkland
- Northwestern Great Plains Highland White Spruce Woodland
- Rocky Mountain Lodgepole Pine Forest
- Rocky Mountain Poor-Site Lodgepole Pine Forest
- Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
- Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland

Mountain Grassland

- Great Basin & Intermountain Introduced Perennial Grassland and Forbland
- Interior Western North American Temperate Ruderal Grassland
- Northern Rocky Mountain Subalpine-Upper Montane Grassland
- Rocky Mountain Alpine Dwarf-Shrubland
- Rocky Mountain Alpine Turf
- Rocky Mountain Subalpine-Montane Mesic Meadow
- Southern Rocky Mountain Montane-Subalpine Grassland

Prairie Grasslands

- Central Mixedgrass Prairie Grassland
- Central Mixedgrass Prairie Shrubland
- Great Basin & Intermountain Introduced Annual Grassland
- Great Basin & Intermountain Ruderal Shrubland
- Inter-Mountain Basins Semi-Desert Grassland
- Northern & Central Plains Ruderal & Planted Grassland
- Northern & Central Plains Ruderal & Planted Shrubland
- Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland
- Northwestern Great Plains Mixedgrass Prairie
- Western Cool Temperate Developed Herbaceous
- Western Cool Temperate Urban Herbaceous
- Western Cool Temperate Urban Shrubland
- Western Great Plains Foothill and Piedmont Grassland
- Western Great Plains Sand Prairie
- Western Great Plains Tallgrass Prairie

Riparian Areas

- Great Basin Foothill and Lower Montane Riparian Herbaceous
- Great Basin Foothill and Lower Montane Riparian Shrubland
- Great Basin Foothill and Lower Montane Riparian Woodland
- Interior West Ruderal Riparian Forest
- Interior West Ruderal Riparian Scrub
- Northwestern Great Plains Floodplain Forest and Woodland
- Northwestern Great Plains Floodplain Herbaceous
- Northwestern Great Plains Floodplain Shrubland
- Northwestern Great Plains Riparian Forest
- Northwestern Great Plains Riparian Herbaceous
- Northwestern Great Plains Riparian Shrubland
- Rocky Mountain Lower Montane-Foothill Riparian Shrubland
- Rocky Mountain Lower Montane-Foothill Riparian Woodland
- Rocky Mountain Subalpine-Montane Riparian Shrubland
- Rocky Mountain Subalpine-Montane Riparian Woodland
- Western Great Plains Floodplain Forest and Woodland
- Western Great Plains Floodplain Herbaceous
- Western Great Plains Floodplain Shrubland
- Western Great Plains Riparian Herbaceous
- Western Great Plains Riparian Shrubland
- Western Great Plains Riparian Woodland
- Western North American Ruderal Wet Shrubland

Sagebrush Shrublands

- Columbia Plateau Steppe and Grassland
- Great Basin Xeric Mixed Sagebrush Shrubland
- Inter-Mountain Basins Active and Stabilized Dune
- Inter-Mountain Basins Big Sagebrush Shrubland
- Inter-Mountain Basins Big Sagebrush Steppe
- Wyoming Basins Dwarf Sagebrush Shrubland and Steppe

Wetlands

- Inter-Mountain Basins Alkaline Closed Depression
- Inter-Mountain Basins Playa
- North American Arid West Emergent Marsh
- Open Water
- Rocky Mountain Alpine-Montane Wet Meadow
- Western Cool Temperate Close Grown Crop
- Western Cool Temperate Pasture and Hayland
- Western Cool Temperate Row Crop
- Western Cool Temperate Row Crop - Close Grown Crop
- Western Great Plains Closed Depression Wetland
- Western Great Plains Open Freshwater Depression Wetland
- Western Great Plains Saline Depression Wetland
- Western North American Ruderal Wet Meadow & Marsh

Xeric Forests

- Colorado Plateau Pinyon-Juniper Woodland
- Northwestern Great Plains-Black Hills Ponderosa Pine Woodland and Savanna
- Rocky Mountain Foothill Limber Pine-Juniper Woodland
- Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland
- Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland
- Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland
- Southern Rocky Mountain Ponderosa Pine Savanna
- Southern Rocky Mountain Ponderosa Pine Woodland
- Western Cool Temperate Developed Evergreen Forest

Excluded

- Developed-High Intensity
- Developed-Low Intensity
- Developed-Medium Intensity
- Developed-Roads
- Quarries-Strip Mines-Gravel Pits-Well and Wind Pads
- Western Cool Temperate Developed Shrubland
- Western Cool Temperate Fallow/Idle Cropland
- Western Cool Temperate Orchard
- Western Cool Temperate Urban Deciduous Forest
- Western Cool Temperate Urban Evergreen Forest
- Western Cool Temperate Urban Mixed Forest
- Western Cool Temperate Vineyard
- Western Cool Temperate Wheat

Appendix F: Habitat intactness methodology

Table H1. Habitat intactness input descriptions.

Habitat condition for terrestrial habitat types was assessed using a measure of habitat intactness described in *Chapter 12* and following Copeland et al. 2007.

Impact	Weight	Distance decay function	Distance cutoff
Urban development – high/medium	500	Gradual	2000 m
Urban development – low	300	Gradual	2000 m
Agriculture – tilled	300	Moderate-abrupt	600 m
Agriculture – untilled	200	Moderate-abrupt	250 m
Roads – primary/secondary	500	Moderate	1250 m
Roads – local/primitive	300	Abrupt	250 m
Oil and gas wells – active	400	Moderate	1250 m
Oil and gas wells – inactive	200	Moderate-abrupt	600 m
Pipelines	100	Abrupt	250 m
Powerlines	200	Moderate-abrupt	600 m
Wind turbines	400	Moderate	1250 m
Surface mines – active	500	Moderate	1250 m
Surface mines – inactive	300	Moderate	600 m
Meteorological towers and cell towers	200	Moderate	600 m

Appendix G: Reviewing and updating Wyoming's State Wildlife Action Plan

Congressional guidelines for State Wildlife Action Plans (SWAPs) require that states revise their plans at least every 10 years. Wyoming's SWAP is currently planned to be revised in 2037. The formal revision of the SWAP will begin 18 months prior to the date the SWAP is to be submitted to the U. S. Fish and Wildlife Service (USFWS) for approval. The revision process will include:

1. The Wyoming Game and Fish Department (WGFD) will submit a letter of intent to the USFWS 18 months before the revision is due.

2. The WGFD will publicly announce its intentions to revise the SWAP on its website and through news releases. Announcements will include information on how to submit suggestions on potential SWAP changes and improvements.

3. Any changes to federal SWAP revision guidelines, including the eight required congressional elements for SWAPs, will be reviewed and incorporated.

4. Key individuals within the WGFD, partnering agencies, and stakeholders will be surveyed regarding 2027 SWAP successes and areas of improvement.

5. Progress towards conserving Species of Greatest Conservation Need (SGCN) and their habitats will be evaluated.

6. Wildlife and fish species in Wyoming will be reviewed for potential changes in SGCN designation, status, and conservation priority.

7. Priority area maps will be re-evaluated based upon updated SGCN designations, distribution information, and available GIS data layers.

8. Technical experts from the WGFD, as well as cooperating agencies and organizations, will be convened into working groups to identify challenges and actions for SGCN and their habitats.

9. All aspects of the document, including frontmatter and appendices, will be reviewed and updated to incorporate new information and changing contexts.

10. Drafts of the revised SWAP will go through an internal and external comment period before the final version is submitted to the Wyoming Game and Fish Commission (WGFC) and USFWS for approval.

The WGFD's Habitat Technical Advisory Group (HTAG) annually reviews and makes funding recommendations for the State Wildlife Grant (SWG) program and other sensitive species projects. HTAG will likely continue its role in facilitating interagency coordination on SWAP-related issues, including providing recommendations to the WGFD's administration on potential updates to Wyoming's SWAP in response to research, changing threats, partnership opportunities, and state or federal initiatives or directives.

Changes to SGCN designations will be considered on an ongoing basis as compelling information becomes available. Decisions regarding SGCN re-classifications will be made by the WGFD Director's Office and reviewed by the WGFC before being submitted to the USFWS for approval. Progress in surveying SGCN is reported annually in the WGFD Governor's report of agency performance measures.

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