

MONTANA STATE WILDLIFE ACTION PLAN

MONTANA FISH, WILDLIFE & PARKS
2025

RECOMMENDED CITATION

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COVER PHOTOS

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APPROVAL

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MONTANA FISH, WILDLIFE & PARKS MISSION

Montana Fish, Wildlife & Parks, through its employees and citizen commission and board, provides for the stewardship of the fish, wildlife, parks, and recreational resources of Montana, while contributing to the quality of life for present and future generations (FWP 2016).

MONTANA FISH, WILDLIFE & PARKS VISION

Montana is a place where people have abundant opportunities to connect with the world-renowned fish, wildlife, and state parks resources that define our state, and where a responsive and relevant FWP has the resiliency and public support it needs to lead the way in making sure these resources remain an essential part of Montana's culture, economy, and high quality of life (FWP 2016).

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DRAFT

EXECUTIVE SUMMARY

The 2025 Montana State Wildlife Action Plan (SWAP) is the third generation of the SWAP, and the most comprehensive and collaborative fish and wildlife planning process ever completed for the state. The first SWAP was completed in 2005 (FWP 2005), reviewed and revised in 2015 (FWP 2015), and this version is the 2025 revision. For 20 years, Montana Fish, Wildlife and Parks (FWP) and its partners have used the SWAP to guide conservation work in Montana, drawing upon the plan to prioritize projects, apply for funding, and implement actions that address specific threats to wildlife, fish, and their habitats. The 2025 SWAP continues with those efforts but with a stronger focus on the entire breadth of organisms that keep Montana's ecosystems functional, including invertebrates and plants. Additionally, the 2025 SWAP puts a heavier focus on identifying threats to species and habitats and associated conservation actions to address those threats.

FWP is responsible for leading the development of the SWAP, but the 2025 revision was a collaborative effort, involving 95 individuals and staff from 15 organizations, as well as hundreds of partners that provided guidance and feedback. The 2025 SWAP uses the best available science to provide a roadmap for conserving at-risk species and habitats in Montana. It is intended to guide conservation work for FWP, but also foster collaborations with and among partners to collectively implement conservation measures for Montana's at-risk species and habitats.

Montana's 2025 SWAP identifies 52 Habitats of Greatest Conservation Need (HGCN). Terrestrial HGCN were identified by selecting categories from the U.S. National Vegetation Classification and aquatic HGCN were identified by selecting categories from the Montana Natural Heritage Program's (MTNHP)'s aquatic community classification system. These selected HGCN represent habitats in the state that support the largest number and diversity of at-risk species and face significant threats that can be addressed by FWP and its partners.

Montana's 2025 SWAP identifies 375 Species of Greatest Conservation Need (SGCN) and 98 Species of Greatest Information Need (SGIN). SGCN and SGIN were identified using NatureServe's methodology for tracking and assessing the conservation status of species in the state. In addition to vertebrates previously included in the SWAP, Montana included invertebrates and plants for the first time in the 2025 SWAP. Aquatic and terrestrial invertebrate SGCN and SGIN were identified by teams of experts from 12 agencies and organizations across the state. Plant SGCN were adopted from the Montana Native Plant Conservation Strategy (Pipp et al. 2024), which was developed in a separate collaborative process that was led by the MTNHP.

Through SWAP technical teams and input from external partners, we developed the most comprehensive list of threats and conservation actions for SGCN and HGCN ever compiled

for Montana. Thousands of threats and conservation actions were identified at the species level and for the habitats on which species rely. We first identified and focused on habitat-related threats and actions, recognizing that actions at the habitat level will almost always help address threats to many SGCN. Next, we included threats and actions for SGCN that were specific to a particular species and were not covered by those developed for HGCN.

Montana's 2025 SWAP includes four new chapters containing information that is highly relevant to conservation of the state's SGCN and their habitats. Chapter 7 identifies beavers, woodpeckers, and prairie dogs as critical ecosystem engineers in Montana whose activities have an outsized, positive impact for multiple SGCN through the creation or modification of habitat. Chapter 8 highlights the importance of connectivity between intact habitats for the long-term persistence of Montana's flora and fauna. Chapter 9 includes an in-depth analysis conducted by the U.S. Geological Survey on 19 wildlife diseases in the state that could negatively impact SGCN. Chapter 10 outlines a vision and strategy for bolstering communication, education, citizen science, and wildlife viewing as critical components of fish and wildlife conservation in Montana. This chapter was developed recognizing that conservation of SGCN and HGCN hinges on people caring about Montana's wildlife resources, knowing about threats that could negatively impact them, and feeling empowered in understanding what they can do to help conserve at-risk species and habitats in the state. These additional chapters are important to ensure the 2025 SWAP is comprehensive in covering the range of issues related to wildlife conservation in Montana.

The 2025 SWAP represents FWP's most intensive effort to date in providing guidance for nongame wildlife and native fish conservation in Montana. However, we recognize that simply identifying at-risk species and habitats and what we can do to help them does not ensure the work will get done effectively and in strategic places. Monitoring is therefore a major component of the 2025 SWAP. While it is impossible to monitor the effects of all the different forms of conservation work in the state, we provide a strategy for tracking and evaluating the success of conservation actions on SGCN and HGCN.

Montana's 2025 SWAP is a blueprint for restoring, maintaining, and enhancing the incredible biological diversity that makes Montana one of the most outstanding states in the nation for natural resources and outdoor recreation. Through implementation of the SWAP, Montana's fishing, hunting, and wildlife watching resources will be maintained and improved, and the sectors of the economy that depend on them will be strengthened. The ecosystem services humans rely on from healthy, intact habitats and the species within them will be perpetuated into the future. And those of us who call Montana home will continue to be proud of the wild and scenic nature of The Last Best Place.

ACKNOWLEDGEMENTS

It is important to first acknowledge the outstanding contributions of those who worked on Montana's Comprehensive Fish and Wildlife Conservation Strategy (2005) and Montana's 2015 SWAP. These documents have been successfully guiding nongame and native fish conservation in Montana for 20 years, and they provided the foundation from which we built the 2025 SWAP. The development of Montana's 2025 SWAP involved contributions from numerous individuals across agencies and organizations, and we are deeply thankful to all of you for the time and expertise you devoted to helping create this plan. We thank the SWAP Steering Committee, whose leadership supported the revision through monthly meetings where key decisions were made that influenced the structure and function of this document. The SWAP Steering Committee also played a crucial role in setting a tone of importance for the SWAP, elevating its relevancy among agency personnel, lawmakers, and other Montanans. We greatly appreciate the work of the technical teams, who tapped into decades worth of experience with Montana's wildlife and their habitats and pored over an incredible amount of information to develop recommendations for Species of Greatest Conservation Need (SGCN) and Habitats of Greatest Conservation Need (HGCN) and the threats and conservation actions that affect them. The list on the following pages outlines those who served on the SWAP Steering Committee or SWAP technical teams at any time during the revision process. Finally, we are grateful to the external partners and subject matter experts who devoted their time and energy to offering input and critique of the 2025 SWAP (Appendix C). The dedication of Montanans from all corners of the conservation world was truly humbling, and we look forward to taking the connections we made during the development of the SWAP and turning them into meaningful actions on the ground in support of our state's natural heritage.

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CHAPTER 1:

INTRODUCTION

1.1 Introduction

Montana is comprised of diverse habitats ranging from the grassland and sagebrush seas of the northern great plains to the mosaic of wetlands across the prairie pothole region to the towering forests and alpine plateaus of the Rocky Mountains. And we are incredibly fortunate here in Montana that much of this habitat remains relatively intact. The incredible diversity of healthy habitats in Montana are home to an equally incredible diversity of plant and animal populations. There are 470 native vertebrate species in Montana, as well as more than 7,230 invertebrates, and more than 2,000 species of vascular plants.

Montana's fish and wildlife populations are some of the wildest and strongest in the nation, but still approximately one third of vertebrate species in the state are considered in need of conservation. Montana's State Wildlife Action Plan (SWAP) is a strategy to identify those species, threats to their populations and their habitats, and actions to address those threats. This plan will help Montana focus limited resources to address the highest priorities: Species of Greatest Conservation Need and Habitats of Greatest Conservation Need.

Montana Fish, Wildlife and Parks (FWP) is the state agency with statutorily assigned responsibility for the stewardship of Montana's fish and wildlife resources for present and future generations (MCA 87-1-201). While FWP is the lead wildlife conservation agency, comprehensive conservation of fish and wildlife cannot be achieved without collaboration and cooperation among willing partners. As such, FWP has a long history of working closely with state and federal agencies, tribes, private landowners, and conservation organizations to manage, conserve, protect, and enhance fish and wildlife populations and their habitats.

The first comprehensive strategies for fish and wildlife conservation were developed in 2005 by all 56 states and territories at the direction of Congress. These strategies came to be known as State Wildlife Action Plans (SWAPs), and they use the best available science to identify the threats and conservation actions for the species and habitats in greatest need of conservation. Year 2025 marks the 20th anniversary of SWAPs and Montana's third revision is the most comprehensive, science-based, partner-driven planning process ever completed for the state. It is intended to guide conservation work not just for FWP but also conservation partners, in a joint mission to implement conservation for Montana's at-risk species and habitats. Continued conservation success cannot occur without collaboration and support among partners.

1.2 Purpose of the SWAP

The U.S. Department of the Interior and Related Agencies Appropriations Act of 2002 (Public Law 107-63, Title 1) established the State Wildlife Grants Program, which provides annual funding for conserving species with the greatest conservation need and their habitats (Federal Register 2001). The State Wildlife Grants Program provides funding to states for projects that work to stabilize, restore, enhance, and protect species and habitats. Congress stipulated that each state fish and wildlife agency is required to submit a State Wildlife Action Plan (SWAP) every 10 years to be eligible for State Wildlife Grants.

More importantly, Montana's SWAP and associated State Wildlife Grant funding supports Montana Fish, Wildlife and Parks (FWP) mission to provide "stewardship of the fish, wildlife, parks, and recreational resources of Montana, while contributing to the quality of life for present and future generations" (FWP 2016). The SWAP helps FWP's Wildlife and Fisheries Divisions identify and prioritize conservation actions to conserve Montana's most at-risk species and their habitats. Proactive conservation is critical in helping keep species off the endangered species list and avoiding costly and burdensome endangered species recovery efforts.

At its core, the SWAP identifies threats and conservation actions for Species of Greatest Conservation Need and Habitats of Greatest Conservation Need that help inform FWP's priorities. However, we hope the plan can assist other agencies and organizations in Montana with focusing their conservation efforts as well. Although FWP is responsible for leading the development of Montana's SWAP, the work identified in this plan far exceeds the available funding and capacity of FWP. Conservation partners are encouraged to use the SWAP to address conservation threats and create a unified effort to restore, maintain, and enhance Montana's tremendous biodiversity and vast public lands. The SWAP is intended to foster greater coordination between FWP and its conservation partners, enabling us to collectively address the conservation needs of Montana's at-risk species and habitats.

1.3 SWAP Development Process

The process for completing a comprehensive review and revision for Montana's 2025 SWAP included the following steps:

1. The SWAP Steering Committee guided the revision through monthly meetings from April 2023 to August 2025.
2. The SWAP technical teams met many times between September 2023 to August 2025 to produce content for the revision and provide recommendations to the SWAP Steering Committee.

3. The SWAP coordinator and nongame wildlife bureau chief gathered feedback for the revision from FWP wildlife managers, FWP regional supervisors, and FWP regional staff throughout the revision.
4. The SWAP coordinator gathered feedback from external partners for the revision through presentations at the 2024 and 2025 Montana Chapter of The Wildlife Society annual conferences, the 2024 Montana Chapter of the American Fisheries Society annual meeting, the 2024 Montana Pollinator Summit, and the 2024 Montana Natural Heritage Program partner meeting.
5. The SWAP Steering Committee sent a survey to external partners in July 2024 to gather feedback on how to make the SWAP more useful for these partners.
6. The SWAP coordinator gathered feedback from external partners on the major components of the revision during three meetings in December 2024, June 2025, and August 2025.
7. FWP held a 20-day public comment period for the revision from August 25 to September 16, 2025.
8. The SWAP coordinator incorporated feedback received from the public comment period into the revision.
9. FWP submitted the final revision to the U.S. Fish and Wildlife Service on October 1, 2025.

1.4 Eight Required Elements

SWAPs must include eight required elements (Table 1), as mandated in the Wildlife Conservation and Restoration Program enacting legislation and adopted for use in the State and Tribal Wildlife Grants Program (2017 Guidance on Wildlife Action Plan Review and Revision).

Table 1. Eight required elements for State Wildlife Action Plans from the 2017 Guidance for Wildlife Action Plan Review and Revision (USFWS 2017).

Required Element	Description
Element 1. Species	The distribution and abundance of species of wildlife, including low and declining populations as each State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's Species of Greatest Conservation Need (SGCN)
Element 2. Habitats	The location and relative condition of key habitats and community types essential to the conservation of each State's SGCN
Element 3. Threats/Stressors	The problems that may adversely affect SGCN or their habitats, and priority research and surveys needed to identify factors that may assist in restoration and improved conservation of SGCN and their habitats
Element 4. Actions	The actions necessary to conserve SGCN and their habitats and the priorities for implementing such conservation actions
Element 5. Monitoring	The provisions for periodic monitoring of SGCN and their habitats, for monitoring the effectiveness of conservation actions, and for adapting conservation actions as appropriate to respond to new information or changing conditions
Element 6. Review and Revision	Each State's provisions to review its Plan at intervals not to exceed 10 years
Element 7. Partner Involvement	Each State's provisions for coordination during the development, implementation, review, and revision of its 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 species or their habitats
Element 8. Public Involvement	Each State's provisions to provide the necessary public participation in the development, revision, and implementation of the Plan

1.5 Roadmap to the Eight Required Elements

Montana's 2025 SWAP adequately addresses the eight required elements and is eligible for State Wildlife Grant funding. Table 2 provides a roadmap to the locations of the eight required elements in the SWAP and describes how the SWAP addresses these elements.

Table 2. Roadmap to the locations of the eight required elements in Montana's 2025 State Wildlife Action Plan.

Required Element	Location
Element 1. Species	Chapter 3 and Chapter 4 provide information on Species of Greatest Conservation Need and Species of Greatest Information Need (SGIN), which highlights the distribution and conservation status of at-risk wildlife and plant species in Montana.
Element 2. Habitats	Chapter 2 provides information on Habitats of Greatest Conservation Need (HGCN), outlining the location and relative condition of key habitats and community types that support SGCN in the state.
Element 3. Threats/Stressors	Chapter 5 describes threats to the short-term and long-term viability of SGCN and HGCN in Montana.
Element 4. Actions	Chapter 5 outlines conservation actions FWP and its partners can take to address identified threats to SGCN and HGCN.
Element 5. Monitoring	Chapter 11 outlines how FWP and its partners will conduct monitoring of SGCN and HGCN to assess their status over time, and for monitoring the breadth and effectiveness of conservation actions as they are taken to address threats.
Element 6. Review and Revision	Chapter 12 provides provisions to review Montana's SWAP every 10 years.
Element 7. Partner Involvement	Chapter 13 provides an overview of coordination that occurred between FWP and its partners across the state and tribal nations during the development, implementation, review, and revision of the SWAP.
Element 8. Public Involvement	Chapter 13 outlines the methods used to provide public participation in the development, revision, and implementation of the SWAP.

1.6 Summary of Significant Changes in the SWAP

For the 2025 SWAP revision, FWP benefited from a significant investment in the Nongame Wildlife Program brought about through legislation that appropriated a portion of tax funding to nongame conservation from the sale of marijuana in Montana. This funding increase allowed the Nongame Wildlife Program to hire new staff, work with contractors,

and devote more time of existing staff to the development of the SWAP. Most critically, FWP was able to hire a SWAP coordinator position, which allowed for greater participation in SWAP development by other FWP employees, partner agencies, and organizations through technical teams, SWAP partner workshops, and other forms of outreach. FWP also received more data and information to inform this SWAP revision than any past revision, and the combined work of the SWAP coordinator and another new position, the nongame biometrician, allowed us to incorporate these data into the 2025 SWAP and the forthcoming SWAP dashboard. As a result of these new funding sources and the enhanced capacity they provided, as well as FWP's ongoing close partnership with MTNHP, major updates were made to species, habitats, and threats and conservation actions in the 2025 SWAP (Table 3). Additionally, we were able to include new chapters in the SWAP beyond what is required by the USFWS, and these chapters expand the reach of the SWAP to other critical areas of the natural world and also expand the scope of the partnerships we engage in to do effective conservation work in Montana.

Table 3. List of significant changes from the 2015 SWAP to the 2025 SWAP and the rationale for those changes.

Significant Change	Rationale
Element 1: Species	
The name “Species of Greatest Inventory Need” was changed to “Species of Greatest Information Need”.	The new name better captures all information needs for understudied species.
A species is classified as SGCN or SGIN and cannot be on both the SGCN and SGIN lists.	A SGCN may still have information needs, but those needs are not significant enough to preclude a species status rank.
The 2025 SWAP includes 57 terrestrial invertebrate SGCN and 35 terrestrial invertebrate SGIN. The 2025 SWAP includes 56 aquatic invertebrate SGCN and 26 aquatic invertebrate SGIN.	At-risk invertebrates are a conservation concern in Montana. The list of invertebrate species in the 2015 SWAP (FWP 2015, Appendix O) did not meet the required standards to be considered for federal grants.
The 2025 SWAP includes 109 plant SGCN.	At-risk plants are a conservation concern in Montana. There were no plants in the 2015 SWAP.
FWP and MTNHP re-assessed state species conservation status ranks and selected new criteria for which species were included on the 2025 SGCN and SGIN lists.	FWP and MTNHP had 10 years of new data, brought in many additional partners and experts, and refined methods to assess state species conservation status ranks.
Element 2: Habitats	
The name “Community Types of Greatest Conservation Need” was changed to “Habitats of Greatest Conservation Need”.	New name better reflects the habitat categories.
Terrestrial HGCN were selected from U.S. National Vegetation Classification.	MTNHP moved to the U. S. National Vegetation Classification system for their classification of habitats in the state, and our close partnership with MTNHP made it

	efficient to also use this system for the 2025 SWAP.
Aquatic HGCN were selected from the Montana Natural Heritage Program's water community classification system for standing and flowing waters	MTNHP uses the water community classification system, and our close partnership with MTNHP made it efficient to also use this system for the 2025 SWAP.
Removed prioritization system (i.e., tiers) for HGCN.	Prioritization will happen outside of the 10-year life of the SWAP in a separate SWAP Implementation Plan that is updated on a 3-year cycle.
Elements 3 & 4: Threats/Stressors and Actions	
The 2015 SWAP included threats and actions for S1-S2 species and did not include threats and actions for S3 species. In the 2025 SWAP, we are including threats and actions for all SGCN.	We believe it is important to include threats and actions for all S1, S2, and S3 SGCN. Greater staff capacity further facilitated inclusion of more SGCN threats and actions.
The 2015 SWAP identified broad threats and actions for HGCN. The 2025 SWAP includes these broad threats and actions for HGCN and includes specific threats and actions for individual HGCN when appropriate.	Some HGCN had important threats and actions that were specific to those habitats. Greater staff capacity further facilitated inclusion of more HGCN threats and actions.
Included lists of threats and actions for both terrestrial and aquatic invertebrates in the 2025 SWAP.	With the inclusion of invertebrates in the SWAP, it was prudent to include threats and actions for these new species.
Element 5: Monitoring	
Added information on adapting conservation actions to respond to changing conditions.	Conditions could change within the lifespan of a SWAP that could affect the recommendations in the document and so we included a strategy for responding to those changes.
Added information on monitoring the effectiveness of the SWAP.	FWP and partners expressed a desire for tracking how well the SWAP addresses at-risk species and habitat conservation work.
Added information on partnering with FWP to address monitoring needs.	Need to express to partners the best ways for them to engage with FWP on nongame conservation via the priorities laid out in the 2025 SWAP.
New Chapters	
Added a chapter on ecosystem engineers.	In some cases, single-species management can address threats to many SGCN at once, even if those species may not be classified as SGCN or may not even be classified as nongame species in Montana.
Added a chapter on wildlife connectivity.	Habitat restoration, maintenance, and enhancement can only go so far if species are not able to move between patches of high-quality habitat, so connectivity is vital for nongame conservation.

Added a chapter on wildlife diseases with the potential to impact SGCN populations.	Wildlife disease is a critical threat to SGCN yet remains understudied and underrepresented in the SWAP.
Added a chapter on wildlife viewing and education.	Conservation of SGCN and their habitats can be enhanced through communication, education, citizen science, and wildlife viewing.

Chapter 1 Literature Cited

Federal Register. 2001. Office of the Federal Register 66(16): 7565-7702. Washington, D. C. January 24, 2001.

U. S. Fish and Wildlife Service and the Association of Fish and Wildlife Agencies. 2017. Guidance for Wildlife Action Plan Review and Revision. Washington, D. C.

CHAPTER 2:

HABITATS OF GREATEST CONSERVATION NEED

Element 2. Habitats

The location and relative condition of key habitats and community types essential to the conservation of each State's SGCN

2.1 Introduction

Montana covers 146,923 square miles and is renowned for its vast and varied landscapes that support an incredible diversity of habitats (Figure 1). West of the Continental Divide, mountain ranges are separated by sagebrush and grassland valley bottoms, through which large rivers carve floodplains full of cottonwood forests and willow-dominant shrub communities. East of the Continental Divide, the Rocky Mountains give way to rolling prairie and sagebrush-steppe ecosystems occasionally broken up by unique island mountain ranges and vast badlands. Montana's immense variety of aquatic habitats support some of the most coveted and diverse populations of fish and other aquatic species in North America. The state's ecological diversity not only defines Montana's natural beauty but also plays a crucial role in providing ecosystem services to humans such as clean air and water, forage for livestock, pollination for crops, timber resources, and outdoor recreation opportunities, all while helping maintain state and regional biodiversity.

Montana's landscapes play an important role in conserving many at-risk plant and animal species. Habitats of Greatest Conservation Need (HGCN) are identified in the State Wildlife Action Plan (SWAP) to call attention to specific habitats in Montana that support the greatest number and diversity of Species of Greatest Conservation Need (SGCN) and/or are at risk due to natural and human-caused factors. While all habitats are important for plants and wildlife in Montana, the purpose of the SWAP is to focus conservation investments in time, money, and energy where they will have the highest impact on conserving the state's flora and fauna.

Restoring, maintaining, and enhancing intact habitats provides resources for hundreds of plant and wildlife species at once. While in some cases single-species conservation actions may be needed to conserve at-risk species, addressing threats to HGCN is often the most efficient use of conservation resources in Montana. Nearly half (48%) of all identified conservation actions for SGCN in Chapter 5 were addressed by actions to protect and conserve habitat, which further supports using a habitat-focused approach in most cases. This emphasizes the need to address threats to species at the most

fundamental level, the basic resources they need to survive and reproduce on Montana's landscapes.

Overlaid on Montana's diverse landscapes is a variety of landownership types. Just over 54% of the state is privately owned, while another 18% is managed by the U.S. Forest Service, 9% is managed by the Bureau of Land Management, 6% is managed by the State of Montana, and 1% is managed by the National Park Service. Tribal Nations make up 9% of the land base. The remaining 3% of Montana is owned or managed by local governments and other ownership types. Conservation easements on private lands held by nonprofit or state and federal government agencies account for 2.8% of the land base (2.6 million acres). The diversity of landownership in Montana highlights the importance of cross-boundary conservation work. HGCN and SGCN do not recognize or adhere to these boundaries, yet they are substantially affected by differences in management between ownership types.

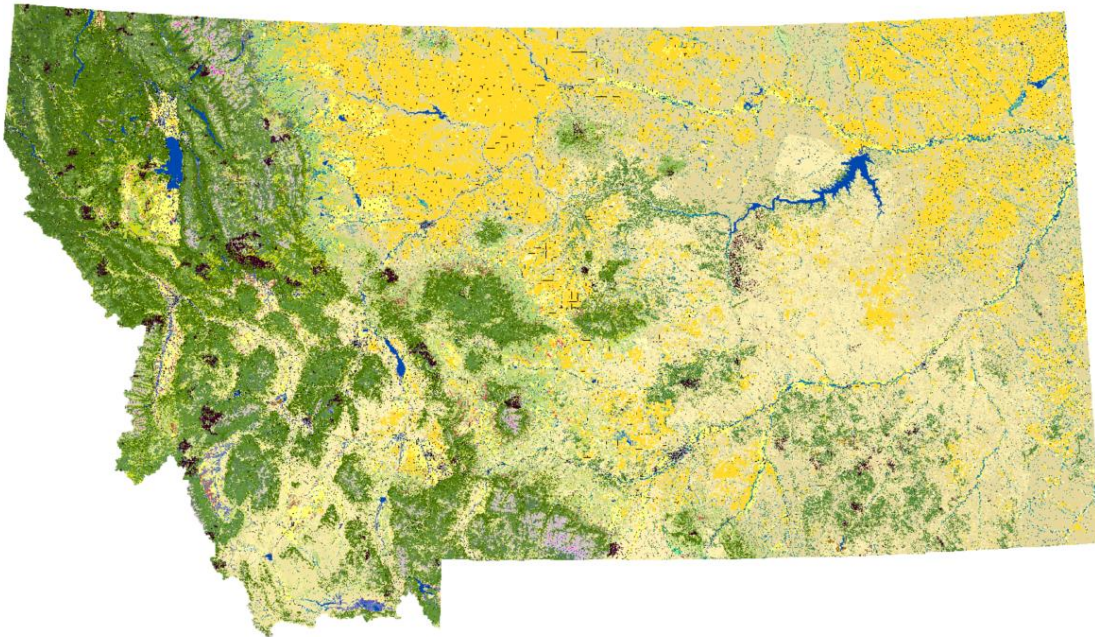


Figure 1. Map of land cover in Montana using existing natural vegetation communities as described at the Group level under the National Vegetation Classification system. Other land cover types include disturbances (e.g., burned areas, invasive plant communities), human land-use activities, and larger bodies of water (see https://msl.mt.gov/geoinfo/msdi/land_use_land_cover/ for additional information).

2.2 Methods

Selecting Terrestrial HGCN

In 2025, the Montana Natural Heritage Program (MTNHP) implemented mapping of Montana's terrestrial and wetland habitats using the U.S. National Vegetation Classification (NVC) system at the Group level to better align with national and international vegetation classification and mapping efforts and allow both global and state conservation status ranks to be assigned to vegetation communities (USNVC 2022). The NVC uses a consistent national approach to the classification of existing vegetation in the United States and is consistent with vegetation mapping and classification efforts being implemented in Canada. NVC is a hierarchical system designed to classify existing vegetation based on physiognomic and floristic criteria (USNVC 2022). For additional information on the application of the NVC in Montana see <https://mtnhp.mt.gov/resources/ecology/nvcs/>

Because FWP and MTNHP are so closely aligned in their work in Montana, especially on the development and implementation of the SWAP, the SWAP Habitat Team decided to use the NVC to identify terrestrial HGCN for the 2025 SWAP. The SWAP Habitat Team was first tasked with deciding at what level to include classifications from the NVC as HGCN. The NVC hierarchy consists of upper level (levels 1-3), mid level (levels 4-6), and lower level (levels 7-8) classifications, with greater specificity on plant communities at the lower level of classifications. In reviewing all habitats across the NVC levels, the team decided to select HGCN at Level 6 or "Group" level since this was the level vegetation communities would be mapped at in the 2025 land cover layer. Because all types of habitats in the riparian and wetland category support a disproportionately large number of SGCN, all subcategories are included as HGCN.

After the initial selection of the NVC level at which to classify HGCN in Montana, the SWAP Habitat Team decided which of the 59 Group classifications of native vegetation communities to include as HGCN in the 2025 SWAP. The team selected which habitats supported the most SGCN and which habitats were most in need of conservation investments to assure their continued ecological integrity in Montana into the future. After the initial list was developed, we compared the HGCN list to the SGCN list to confirm major habitats that support SGCN were not missed in the HGCN selection process.

Mapping Terrestrial HGCN

Terrestrial HGCN are mapped in the 2025 land cover layer which is a digital raster map of existing natural vegetation communities mapped at the NVC Group level, disturbances such as wildland fire, and human land use activities mapped at a scale of 30-meter x 30-meter pixels. The base mapping NVC Groups was adapted from a NatureServe version of existing vegetation communities derived from the LandFire 2020 update that used 30-meter resolution Landsat multispectral imagery that represented circa 2016 ground

conditions. The LandFire mapping used decision tree models, field data, Landsat imagery, elevation, and biophysical gradient data. For more information, see the detailed metadata for the 2025 land cover layer on the state GIS Data List at:

https://mslservices.mt.gov/geographic_information/data/datalist/

Because wetlands are too small to be represented in the land cover layer which is mapped using 30-meter x 30-meter pixels we recommend managers use the National Wetland Inventory (NWI) mapping that is available from the MTNHP's [Map Viewer](#) web application and the statewide GIS Data List when initially planning management actions for these HGCN. NWI mapping is available for approximately 87% of Montana. Aerial imagery, particularly color infrared imagery, can be used to identify the presence of wetlands in areas where NWI mapping is not yet available. NWI mapping and aerial imagery should not be used in place of on-site evaluations of these habitats. For more information on wetland mapping in Montana, see the Montana Wetland Framework from the Montana Spatial Data Infrastructure at: <https://msl.mt.gov/geoinfo/msdi/wetlands/>.

Selecting Aquatic HGCN

Although open water is mapped in the 2025 land cover layer many small streams, lakes, ponds, and wetlands are too small to be represented in the land cover layer which uses 30-meter x 30-meter pixels. The SWAP Habitat Team therefore needed another method for selecting aquatic HGCN for the SWAP. The team considered using aquatic HGCN from the 2015 SWAP (formally called Community Types of Greatest Conservation Need) but decided that a more fine-scale consideration of aquatic habitats was needed for the 2025 SWAP.

MTNHP was in the process of developing an aquatic community classification system for standing and flowing waters with mapping from the medium resolution National Hydrography Dataset (NHD) as well as accounts describing these communities in the *Montana Field Guide*. The SWAP Habitat Team decided to use these aquatic communities to identify aquatic HGCN for the 2025 SWAP and worked with the MTNHP to finalize classification, mapping, and descriptions. The team first went through the list of aquatic communities and combined, removed, or renamed the categories based on expertise from around the state on the breadth of aquatic habitats, hydrology and geomorphology of waterbodies, and SGCN associations. The aquatic community classification separates flowing waters (lotic habitats) from standing waters (lentic habitats). Flowing water communities were categorized using: geographic areas (Statewide, Northern Rockies, Middle Rockies, Glaciated Plains, Northern Great Plains), stream size (small, medium, large), and flow type (perennial or intermittent). Alpine and subalpine streams were also added as separate categories for the Northern Rockies and Middle Rockies. Finally, small, medium, and large volume springs were added as habitat classifications, but these were not broken into geographic regions. The team selected all flowing water communities as HGCN except for the springs.

Standing water communities were not categorized by geographic region and included large lakes, small lakes/ponds, alpine lakes with fish, alpine lakes without fish, large reservoirs, small permanent reservoirs, and small seasonal reservoirs. The team selected large lakes and large reservoirs as HGCN.

The broad inclusion of most waterbody types in Montana as HGCN was done in recognition of the outsized importance of waterbodies in Montana, both for the SGCN they contain and support, and their role on the larger landscape supporting upland SGCN and HGCN, as well as human populations. Waterbodies and the riparian areas, floodplains, and wetlands they support contain the largest number and diversity of plant and animal species of any habitats in the state, and they are also a critically important source of water resources for agriculture and other human land uses.

Mapping Aquatic HGCN

The medium resolution National Hydrography Dataset (NHD) was used as a base GIS layer for mapping of aquatic communities. The aquatic communities described above were classified on this mapping using lake and reservoir size (> 13 acres), Continental Divide and ecoregional boundaries, digital elevation models, stream order, aerial imagery, National Wetland Inventory (NWI) mapping, Beaver Restoration Assessment Tool (BRAT) metrics and attributes, and known fish and aquatic invertebrate community data from the MTNHP. For more information on Montana's Hydrography Framework from the Montana Spatial Data Infrastructure see: <https://msl.mt.gov/geoinfo/msdi/wetlands/>

2.3 Terrestrial HGCN List

Table 4. Terrestrial Habitats of Greatest Conservation Need (HGCN) selected for the 2025 Montana State Wildlife Action Plan at the NVC Group level organized in the same way as shown for accounts on the [Montana Field Guide](#). Question mark indicates an inexact numeric rank (see Table 6).

Terrestrial Habitat of Greatest Conservation Need	State Rank	Global Rank
GRASSLAND		
Lowland - Prairie Grassland		
Rocky Mountain Low Elevation - Dry Grassland	S3	G4G5
Great Plains Dry Mixedgrass Prairie	S4	G3?
Great Plains Mesic Mixedgrass Prairie	S3	G3?
Great Plains Sand Prairie	S3S4	G3?
SHRUBLAND		
Foothills - Montane Shrubland		
Lowland - Montane Shrubland	S4S5	G4G5

Mountain Mahogany Woodland and Shrubland	S4	G4G5
Sagebrush Shrubland		
Basin and Wyoming Big (Threetip) Sagebrush Shrubland	S3	G3?
Mountain Big Sagebrush Shrubland	S4	G4G5
FOREST AND WOODLAND		
Deciduous Forest and Woodland		
Great Plains Aspen Forest and Woodland	SU	G1G3
Great Plains Mesic Forest and Woodland	S3	G3?
Rocky Mountain Aspen Forest and Woodland	S3S4	G4G5
Low Elevation - Xeric Forest and Woodland		
Great Plains Ponderosa Pine Forest and Woodland	S4S5	G4G5
Rocky Mountain Ponderosa Pine Forest and Woodland	S4S5	G4G5
Montane - Subalpine Forest and Woodland		
Cedar - Hemlock Forest	S4	G4G5
Whitebark Pine - Subalpine Larch Forest and Woodland	S3	G4G5
WETLAND AND RIPARIAN		
Alkaline - Saline Wetlands		
Intermountain Alkaline - Saline Grassland and Meadow	S3S4	G4G5
Great Plains Saline Marsh and Wet Meadow	S4	GNR
Greasewood Shrubland	S4	G4G5
Alpine Riparian and Wetland		
Alpine - Subalpine Herbaceous and Dwarf-Shrub Riparian and Wetland	S3S4	G4G5
Peatland		
Great Plains Alkaline Fen	S2?	GNR
Rocky Mountain Acidic Fen	S3	G4G5
Rocky Mountain Alkaline Fen	S3S4	G3?
Riparian and Wetland Forest		
Great Plains Floodplain Forest	S2	G3?
Lowland - Montane Riparian Deciduous Forest	S3S4	G3?
Montane - Subalpine Riparian Forest	S4	G4G5
Montane Forested Wetland	S4?	G4G5
Riparian Shrubland		
Lowland - Montane Riparian Shrubland	S4	G4G5
Montane - Subalpine Riparian and Seep Shrubland	S5	G4G5
Great Plains Floodplain Shrubland and Herbland	S2S3	G3
Wet Meadow and Marsh		
Arid West Freshwater Marsh and Wet Meadow	S3S4	G4G5
Great Plains Wet Meadow, Marsh and Shrub Swamp	S3S4	GNR
Montane Wet Meadow and Marsh	S4	G4G5

2.4 Aquatic HGCN List

Table 5. Aquatic Habitats of Greatest Conservation Need selected for the 2025 Montana State Wildlife Action Plan.

Aquatic Habitat of Greatest Conservation Need	State Rank
NORTHERN ROCKIES	
Northern Rockies Large Perennial River	S4
Northern Rockies Medium Perennial River	S4S5
Northern Rockies Small Perennial Stream	S4
Northern Rockies Small Intermittent Stream	S5
Northern Rockies Small Alpine and Subalpine Stream	S3
MIDDLE ROCKIES	
Middle Rockies Large Perennial River	S4
Middle Rockies Medium Perennial River	S4S5
Middle Rockies Small Perennial Stream	S5
Middle Rockies Small Intermittent Stream	S5
Middle Rockies Small Alpine and Subalpine Stream	S4S5
GLACIATED PLAINS	
Glaciated Plains Large Perennial River	S3
Glaciated Plains Medium Perennial River	S4
Glaciated Plains Small Perennial Stream	S3S4
Glaciated Plains Small Intermittent Stream	S3
NORTHERN GREAT PLAINS	
Northern Great Plains Large Perennial River	S3S4
Northern Great Plains Medium Perennial River	S4
Northern Great Plains Small Perennial Stream	S4
Northern Great Plains Small Intermittent Stream	S5
LAKES & RESERVOIRS	
Large Lake	S4
Large Reservoir	SNA

Chapter 2 Literature Cited

USNVC (United States National Vegetation Classification) Database, Version 2.04. 2022.
 Federal Geographic Data Committee, Vegetation Subcommittee. Washington, D.C.
 Accessed 25 July 2025.

CHAPTER 3:

SPECIES OF GREATEST CONSERVATION NEED

Element 1. Species.

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

3.1 Introduction

One of Montana's greatest features is the incredible diversity of terrestrial and aquatic species that call the state home. Montana is one of the least populated states in the United States, with vast, intact landscapes and healthy ecosystems that support large numbers of native species alongside human land uses. It is with great pride that Montanans enjoy rich biological diversity while maintaining working landscapes and a thriving outdoor recreation economy. As the state becomes more popular and the human population expands, this biological diversity will face new challenges as development encroaches on native habitats and demand for natural resources accelerates. However, conservation of Montana's natural heritage is important to those who live and visit the state, and this shared admiration and respect for wild things and wild places crosses political, social, and economic divides.

Montana's native species include: 56 fish, 13 amphibians, 17 reptiles, 335 regularly occurring birds, 108 mammals, at least 7,230 invertebrates, as well as more than 2,000 species of vascular plants, over 2,500 species of non-vascular plants, algae, and diatoms, over a 1,000 species of lichens, and over 1,600 species of non-lichenizing fungi. The job of documenting and conserving all these species is truly overwhelming, emphasizing the need for careful consideration of where limited resources and time can be most effective in maintaining and enhancing this astounding biodiversity.

Montana's 2025 State Wildlife Action Plan (SWAP) is a critical planning document for outlining the breadth of biological diversity in the state and forging a vision for how to restore, maintain, and enhance this diversity into the future. The 2025 SWAP identifies 375 Species of Greatest Conservation Need (SGCN), including 153 vertebrate species, 113 invertebrate species, and 109 plant species. The SGCN list comprises species from all major taxonomic groups mentioned above and is the most comprehensive list of at-risk species in Montana's SWAP to-date.

3.2 Methods

Role of Conservation Status Ranks in Identifying SGCN

The Montana Natural Heritage Program (MTNHP) manages the conservation status ranks for species in Montana, which is the foundation for identifying which species are SGCN in the 2025 SWAP. MTNHP uses NatureServe's standardized conservation status ranking methodology to determine the state and global conservation status ranks of species (Salafsky et al. 2008; NatureServe 2020; Faber-Langendoen et al. 2012; Master et al. 2012). Conservation status ranks are calculated for each species using the best available science and most up-to-date data from three major categories:

1. **Rarity:** Assesses how widespread and/or common the species is within Montana.
2. **Trends:** Assesses the change in a meaningful metric using population, habitat, or range through time. Both the short-term and long-term trends can be evaluated.
3. **Threats:** Assesses the proximate activity or process that has caused, is causing, or may cause the destruction, degradation, and/or impairment to the species. Threats may be related to human activities or may be natural.

MTNHP and FWP are fortunate to have a long-term close partnership working on conservation efforts in the state, and the two agencies coordinate closely on the assignment of state conservation status ranks for animals. Each state rank for vertebrate species is assessed and approved by Montana's Species of Concern Committee, which is comprised of staff from MTNHP and FWP with input from species experts and members of the Montana Chapter of the American Fisheries Society. State ranks are now continually updated as new data and information become available, and the Species of Concern Committee meets annually to assess possible changes in ranks. If there are changes to ranks that affect a species' inclusion on the SGCN list, we will submit a SWAP minor revision to account for those changes prior to the 2035 SWAP revision.

Species that are at-risk in Montana are referred to as Species of Concern by MTNHP and SGCN by FWP and the SWAP. Although the Species of Concern and SGCN lists are very similar, the separation is needed because the SWAP-specific criteria for inclusion as SGCN varies slightly from MTNHP's Species of Concern list. Regardless of whether species are referred to as Species of Concern or SGCN, species are assigned status ranks ranging from S1 to S5 that reflect the relative degree of risk to the species' viability in the state of Montana (Table 6). NatureServe also assigns conservation status ranks ranging from G1 to G5 that reflect the relative degree of risk to the species' viability globally (Table 6). Some species are declining globally and we are seeing those effects here in Montana as reflected in their state rank. Conversely, some species may be doing well at a global scale but struggling here in Montana due to region-specific stressors to a species or its habitats. See

the State Conservation Rank Criteria (MTNHP 2021; https://mtnhp.mt.gov/docs/Montana_State_Rank_Criteria_20211201.pdf) for more comprehensive information on the species status ranking process.

Table 6. Definitions of conservation status rank and rank qualifiers for state and global ranks (MTNHP 2021).

S Rank	G Rank	Definition
S1	G1	Critically Imperiled - At high risk because of extremely limited and/or rapidly declining population numbers, range and/or habitat, making it highly vulnerable to global extinction or extirpation in the state.
S2	G2	Imperiled - At risk because of very limited and/or potentially declining population numbers, range and/or habitat, making it vulnerable to global extinction or extirpation in the state.
S3	G3	Vulnerable - Potentially at risk because of limited and/or declining numbers, range and/or habitat, even though it may be abundant in some areas.
S4	G4	Apparently Secure - Apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining.
S5	G5	Secure - Common, widespread, and abundant (although it may be rare in parts of its range). Not vulnerable in most of its range.
SNR	GNR	Unranked - Not ranked as of yet.
SU	GU	Unrankable - Species currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
S#S#	G#G#	Range Rank - Indicates a range of uncertainty about the status of the species (e.g., S1S3 = State Rank ranges between S1 and S3).
S#T#	G#T#	Subspecies Rank - Rank of a subspecies or variety. Appended to the state rank of the full species (e.g., S4T3), where rank reflects the status of the entire species and the T-rank reflects the status of just the subspecies.
Qualifiers		Definition
?		Inexact Numeric Rank - Denotes uncertainty; inexactness.
B		Breeding - Rank refers to the breeding population of the species in Montana (S#B) or the nation (G#B).
M		Migratory - Species occurs in Montana (S#B) or the nation (G#B) only during migration.

Criteria for Identifying SGCN

Vertebrate SGCN

The SWAP Steering Committee and SWAP terrestrial and aquatic teams, comprised of FWP and MTNHP staff, worked together to develop criteria for inclusion of vertebrate SGCN in the 2025 SWAP. The SWAP Committee produced draft criteria as the product of a full-day Structured Decision Making exercise facilitated by the Montana Cooperative Wildlife Research Unit. The SWAP terrestrial and aquatic teams reviewed the draft criteria and

made recommendations for adjustments that were then re-evaluated and accepted or rejected by the SWAP Steering Committee.

The vertebrate SGCN list matches MTNHP's Species of Concern list that includes species with a state rank that includes an S1, S2, or S3 (Table 7). The vertebrate SGCN list deviates from the Species of Concern list by also including species with a state rank of S4 for which Montana has high stewardship responsibility because a substantial portion ($\geq 10\%$) of the species' global population or range is in Montana (Table 7). MTNHP and FWP conducted a thorough review and update of Montana's state ranks in the years leading up to the 2025 SWAP revision to make sure the underlying data used to develop the SGCN list was as comprehensive and current as possible.

Invertebrate SGCN

New to the 2025 SWAP, we are including terrestrial and aquatic invertebrates as SGCN. This is in recognition of the critical role of invertebrates as a food source for many vertebrate SGCN and in overall ecosystem function, which supports all of Montana's fish and wildlife species. FWP has management authority for invertebrates under the definition of nongame wildlife as "any wild mammal, bird, amphibian, reptile, fish, mollusk, crustacean, or other animal not otherwise legally classified by statute or regulation of this state" (§§ 87-2-101(8) and 87-5-102(6)(2025), MCA). The SWAP terrestrial and aquatic invertebrate teams led efforts to develop criteria for inclusion of invertebrate SGCN in the 2025 SWAP. In addition to FWP and MTNHP staff, the invertebrate teams were comprised of staff from 10 other agencies and organizations and relied heavily on the expertise of these experts from across Montana and the western United States.

The terrestrial and aquatic invertebrate SGCN list matches the MTNHP's Species of Concern list that includes all species with state rank that included an S1 or S2 (Table 7). The terrestrial invertebrate SGCN list also includes species with a global rank that included a G1, G2, or G3, regardless of the state rank (Table 7). This addition showcases that aquatic invertebrates have higher quality ranks than the terrestrial invertebrates where global ranks are filling in gaps in our understanding of their status.

Plant SGCN

The selection of plant SGCN for the 2025 SWAP followed a different pathway than that for vertebrate and invertebrate SGCN. Selection methods and criteria for plant SGCN originated from the [Montana Native Plant Conservation Strategy](#) (Pipp et al. 2024). In developing this strategy, a committee of botanists, biologists, and ecologists from federal and state agencies, non-governmental organizations, and academia sought input and developed criteria for defining plant SGCN for vascular plants. The committee compiled information on distribution, population sizes, habitat conditions, threats, and other data from the MTNHP botany database, scientific literature, and professional expertise to refine

the list of SGCN (Table 7). Important factors considered included the MTNHP's Species of Concern list, real or highly probable threats to the species in the short and long term, association with unique habitats or plant communities, and professional opinions on the status of common plants shared and expressed by different federal and state management agencies. Furthermore, species considered for inclusion had to be well documented in the state and lack any taxonomic problems. With approval from the larger partnership that guided the development of the Montana Native Plant Conservation Strategy, the committee created two pathways and sets of criteria for identifying Plant SGCN (Table 7).

Table 7. Criteria used to identify Species of Greatest Conservation Need (SGCN) categories for vertebrates, terrestrial invertebrates, aquatic invertebrates, and plants for the 2025 Montana State Wildlife Action Plan.

SGCN Category	Criteria
Vertebrate SGCN	1. State conservation status rank includes S1, S2, or S3. 2. State conservation status rank of S4 for which Montana has a high stewardship responsibility for the species because a substantial portion ($\geq 10\%$) of the species' global population or range is in Montana.
Terrestrial Invertebrate SGCN	1. State conservation status rank includes S1 or S2. 2. Global conservation status rank includes G1, G2, or G3.
Aquatic Invertebrate SGCN	1. State conservation status rank includes S1 or S2.
Vascular Plant SGCN	1. Global conservation status rank includes G1, G2, or G3 or state conservation status rank includes S1, S2, or S3 AND 2. Faces a direct or indirect threat as determined by the Montana state threat score or is associated with a unique habitat or plant community of greatest conservation need or is poorly documented or has information needs AND 3. Lacks taxonomic problems or large locational ambiguity OR 4. A vascular non-Species of Concern plant that was nominated by several partners representing different organizations as being "of management concern" because the species is facing significant threats and potential decline.

Mapping for SGCN

Several types of spatial information are managed for all species tracked by the MTNHP, including SGCN. These types of spatial information include:

Structured Surveys

The MTNHP records information on the locations where more than 80 different types of well-defined repeatable survey protocols capable of detecting a species or suite of species have been conducted by state, federal, tribal, university, or private consulting biologists. Examples of structured survey protocols tracked by MTNHP include: vegetation plot surveys for vascular plants, visual encounter and dip net surveys for pond breeding amphibians, point counts for birds, call playback surveys for selected bird species, visual surveys of migrating raptors, kick net stream reach surveys for macroinvertebrates, visual encounter cover object surveys for terrestrial mollusks, bat acoustic or mist net surveys, pitfall and/or snap trap surveys for small terrestrial mammals, track or camera trap surveys for large mammals, and trap surveys for turtles. Whenever possible, photographs of survey locations are stored in MTNHP databases.

Observations

The MTNHP manages information on over 6 million animal and plant observations that have been reported by professional biologists and private citizens from across Montana. The majority of these observations are submitted in digital format from standardized databases associated with research or monitoring efforts and spreadsheets of incidental observations submitted by professional biologists and amateur naturalists. At a minimum, accepted observation records must contain a credible species identification (i.e. appropriate geographic range, date, and habitat and, if species are difficult to identify, a photograph and/or notes on key identifying features), a date or date range, observer name, locational information (ideally with latitude and longitude in decimal degrees), notes on numbers observed, and species behavior or habitat use (e.g., is the observation likely associated with reproduction). Bird records are also required to have information associated with date-appropriate breeding or overwintering status of the species observed. MTNHP reviews observation records to ensure that they are mapped correctly, occur within date ranges when the species is known to be present or detectable, occur within the known seasonal geographic range of the species, and occur in appropriate habitats. MTNHP also assigns each record a locational uncertainty value in meters to indicate the spatial precision associated with the record's mapped coordinates.

Species of Concern Occurrences

The MTNHP evaluates plant and animal observation records for species of higher conservation concern to determine whether they are worthy of inclusion in a Species

Occurrence or "SO" (also known as an 'Element Occurrence'). An SO is an area depicting only what is known from direct observation with a defined level of certainty regarding the spatial location of a species or biological community. If an observation can be associated with a map feature that can be tracked (e.g., a wetland) then this polygon feature is used to represent the SO. Areas that can be inferred as probable occupied habitat based on direct observation of a species location and what is known about the foraging area or home range size of the species may be incorporated into the Species Occurrence.

Geographic Range Polygons

Range polygons have been created for native vascular plants and vertebrate animal species with sufficient data and are being created for other taxa as MTNHP staff time is available. Range polygons are refined over time with assistance of additional survey and observation data and predicted habitat suitability models. Range polygons are classified as native year-round, summer, winter, migratory, historical, and non-native year-round. Range polygons for native species and non-native aquatic species typically bound the extent of known or likely occupied habitats for non-migratory and relatively sedentary species and the regular extent of known or likely occupied habitats for migratory and long-distance dispersing species; polygons may include unsuitable intervening habitats. Unless predicted invasion risk models indicate unsuitable habitat for large portions of Montana, range polygons for non-native vascular plant species are typically mapped as statewide to reflect their possible invasion across Montana; please see relative density maps for reported distributions of these species. For most species, a single polygon can represent the year-round or seasonal range, but breeding ranges of some colonial nesting water birds and some non-native species are represented more patchily when supported by data. Some ranges are mapped more broadly than actual distributions in order to be visible on statewide maps (e.g., streams with fish are buffered for visibility).

Predicted Suitable Habitat Models

The MTNHP constructs two types of predicted habitat suitability models for individual plant and animal species: (1) rule-based associations with terrestrial habitats for terrestrial species and streams and other water bodies for fish and other aquatic species; and (2) mathematically complex Maximum Entropy models (Phillips et al. 2006, *Ecological Modeling* 190:231-259) constructed from a variety of statewide biotic and abiotic layers and presence only data for individual species contributed to MTNHP databases for most terrestrial species. Model outputs are viewable on the [Map Viewer](#) web application and full model write ups for individual species that discuss model goals, inputs, outputs, and evaluations in much greater detail are posted on the MTNHP's [Predicted Suitable Habitat Models](#) page. Evaluations of predictive accuracy and specific limitations are also included with the metadata for models of individual species.

The MTNHP also combines outputs from individual species models to construct overall predictive biodiversity layers for selected groups of species and maps and tabular outputs for these can be viewed on the [Habitat Suitability for Biodiversity](#) task of the Map Viewer web application.

3.3 Vertebrate SGCN List

We included 153 vertebrate species as SGCN in the 2025 SWAP. Of these identified SGCN, 137 species had a rank that included S1, S2, or S3, and 16 species ranked S4 for which Montana makes up a substantial portion ($\geq 10\%$) of the species' global population or range. The vertebrate SGCN list includes 7 amphibians, 82 birds, 23 fish, 31 mammals, and 10 reptiles (Table 8).

Table 8. List of vertebrate Species of Greatest Conservation Need (SGCN) included in Montana's 2025 State Wildlife Action Plan. Species are arranged alphabetically by group, then by state rank, and then alphabetically by common name.

Group	Common Name	Scientific Name	State Rank
Amphibians	Coeur d'Alene Salamander	<i>Plethodon idahoensis</i>	S2
Amphibians	Idaho Giant Salamander	<i>Dicamptodon aterrimus</i>	S2
Amphibians	Western Toad	<i>Anaxyrus boreas</i>	S2
Amphibians	Great Plains Toad	<i>Anaxyrus cognatus</i>	S3
Amphibians	Northern Leopard Frog	<i>Lithobates pipiens</i>	S3S4
Amphibians	Rocky Mountain Tailed Frog	<i>Ascaphus montanus</i>	S3S4
Amphibians	Plains Spadefoot	<i>Spea bombifrons</i>	S4
Birds	Whooping Crane	<i>Grus americana</i>	S1M
Birds	Black Rosy-Finch	<i>Leucosticte atrata</i>	S2
Birds	Gray-crowned Rosy-Finch	<i>Leucosticte tephrocotis</i>	S2
Birds	Greater Sage-Grouse	<i>Centrocercus urophasianus</i>	S2
Birds	Black Swift	<i>Cypseloides niger</i>	S2B
Birds	Caspian Tern	<i>Hydroprogne caspia</i>	S2B
Birds	Chestnut-collared Longspur	<i>Calcarius ornatus</i>	S2B
Birds	Harlequin Duck	<i>Histrionicus histrionicus</i>	S2B
Birds	Least Tern	<i>Sternula antillarum</i>	S2B
Birds	Lewis's Woodpecker	<i>Melanerpes lewis</i>	S2B
Birds	Mountain Plover	<i>Anarhynchus montanus</i>	S2B
Birds	Piping Plover	<i>Charadrius melodus</i>	S2B
Birds	Solitary Sandpiper	<i>Tringa solitaria</i>	S2B
Birds	Black-backed Woodpecker	<i>Picoides arcticus</i>	S3
Birds	Boreal Chickadee	<i>Poecile hudsonicus</i>	S3
Birds	Brown Creeper	<i>Certhia americana</i>	S3
Birds	Cassin's Finch	<i>Haemorhous cassinii</i>	S3
Birds	Clark's Nutcracker	<i>Nucifraga columbiana</i>	S3

Birds	Evening Grosbeak	<i>Coccothraustes vespertinus</i>	S3
Birds	Golden Eagle	<i>Aquila chrysaetos</i>	S3
Birds	Great Blue Heron	<i>Ardea herodias</i>	S3
Birds	Northern Hawk Owl	<i>Surnia ulula</i>	S3
Birds	Pacific Wren	<i>Troglodytes pacificus</i>	S3
Birds	Pileated Woodpecker	<i>Dryocopus pileatus</i>	S3
Birds	Pinyon Jay	<i>Gymnorhinus cyanocephalus</i>	S3
Birds	Trumpeter Swan	<i>Cygnus buccinator</i>	S3
Birds	White-tailed Ptarmigan	<i>Lagopus leucura</i>	S3
Birds	Alder Flycatcher	<i>Empidonax alnorum</i>	S3B
Birds	American Bittern	<i>Botaurus lentiginosus</i>	S3B
Birds	American White Pelican	<i>Pelecanus erythrorhynchos</i>	S3B
Birds	Baird's Sparrow	<i>Centronyx bairdii</i>	S3B
Birds	Black Tern	<i>Chlidonias niger</i>	S3B
Birds	Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	S3B
Birds	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	S3B
Birds	Black-necked Stilt	<i>Himantopus mexicanus</i>	S3B
Birds	Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	S3B
Birds	Bobolink	<i>Dolichonyx oryzivorus</i>	S3B
Birds	Brewer's Sparrow	<i>Spizella breweri</i>	S3B
Birds	Burrowing Owl	<i>Athene cunicularia</i>	S3B
Birds	Clark's Grebe	<i>Aechmophorus clarkii</i>	S3B
Birds	Common Loon	<i>Gavia immer</i>	S3B
Birds	Common Tern	<i>Sterna hirundo</i>	S3B
Birds	Ferruginous Hawk	<i>Buteo regalis</i>	S3B
Birds	Flammulated Owl	<i>Psiloscops flammeolus</i>	S3B
Birds	Forster's Tern	<i>Sterna forsteri</i>	S3B
Birds	Franklin's Gull	<i>Leucophaeus pipixcan</i>	S3B
Birds	Green-tailed Towhee	<i>Pipilo chlorurus</i>	S3B
Birds	Horned Grebe	<i>Podiceps auritus</i>	S3B
Birds	LeConte's Sparrow	<i>Ammospiza leconteii</i>	S3B
Birds	Loggerhead Shrike	<i>Lanius ludovicianus</i>	S3B
Birds	Long-billed Curlew	<i>Numenius americanus</i>	S3B
Birds	Nelson's Sparrow	<i>Ammospiza nelsoni</i>	S3B
Birds	Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	S3B
Birds	Sage Thrasher	<i>Oreoscoptes montanus</i>	S3B
Birds	Sagebrush Sparrow	<i>Artemisiospiza nevadensis</i>	S3B
Birds	Sedge Wren	<i>Cistothorus stellaris</i>	S3B
Birds	Sprague's Pipit	<i>Anthus spragueii</i>	S3B
Birds	Thick-billed Longspur	<i>Rhynchophanes mccownii</i>	S3B
Birds	Varied Thrush	<i>Ixoreus naevius</i>	S3B
Birds	Veery	<i>Catharus fuscescens</i>	S3B
Birds	White-faced Ibis	<i>Plegadis chihi</i>	S3B

Birds	Yellow Rail	Coturnicops noveboracensis	S3B
Birds	Yellow-billed Cuckoo	Coccyzus americanus	S3B
Birds	Eastern Screech-Owl	Megascops asio	S3S4
Birds	Great Gray Owl	Strix nebulosa	S3S4
Birds	Sharp-tailed Grouse	Tympanuchus phasianellus	S3S4
Birds	Western Screech-Owl	Megascops kennicottii	S3S4
Birds	Boreal Owl	Aegolius funereus	S3S4B
Birds	Chimney Swift	Chaetura pelagica	S3S4B
Birds	Gray Flycatcher	Empidonax wrightii	S3S4B
Birds	Plumbeous Vireo	Vireo plumbeus	S3S4B
Birds	Tennessee Warbler	Leiothlypis peregrina	S3S4B
Birds	Dusky Grouse	Dendragapus obscurus	S4
Birds	Prairie Falcon	Falco mexicanus	S4
Birds	Cassin's Vireo	Vireo cassinii	S4B
Birds	Grasshopper Sparrow	Ammodramus savannarum	S4B
Birds	Hammond's Flycatcher	Empidonax hammondii	S4B
Birds	Lark Bunting	Calamospiza melanocorys	S4B
Birds	Marbled Godwit	Limosa fedoa	S4B
Birds	Red-naped Sapsucker	Sphyrapicus nuchalis	S4B
Birds	Upland Sandpiper	Bartramia longicauda	S4B
Birds	Williamson's Sapsucker	Sphyrapicus thyroideus	S4B
Fish	Arctic Grayling	Thymallus arcticus	S1
Fish	Columbia River Redband Trout	Oncorhynchus mykiss gairdneri	S1
Fish	Pallid Sturgeon	Scaphirhynchus albus	S1
Fish	White Sturgeon	Acipenser transmontanus	S1
Fish	Northern Redbelly X Finescale Dace	Chrosomus eos x Chrosomus neogaeus	S1S2
Fish	Blue Sucker	Cycleptus elongatus	S2
Fish	Bull Trout	Salvelinus confluentus	S2
Fish	Columbia Slimy Sculpin	Cottus cognatus	S2
Fish	Lake Trout	Salvelinus namaycush	S2
Fish	Northern Pearl Dace	Margariscus nachtriebi	S2
Fish	Northern Redbelly Dace	Chrosomus eos	S2
Fish	Sicklefin Chub	Macrhybopsis meeki	S2
Fish	Westslope Cutthroat Trout	Oncorhynchus lewisi	S2
Fish	Yellowstone Cutthroat Trout	Oncorhynchus virginalis bouvieri	S2
Fish	Sturgeon Chub	Macrhybopsis gelida	S2S3
Fish	Iowa Darter	Etheostoma exile	S3
Fish	Northern Pikeminnow	Ptychocheilus oregonensis	S3
Fish	Peamouth	Mylocheilus caurinus	S3
Fish	Sauger	Sander canadensis	S3
Fish	Shortnose Gar	Lepisosteus platostomus	S3

Fish	Torrent Sculpin	<i>Cottus rhotheus</i>	S3
Fish	Cedar Sculpin	<i>Cottus schitsuumsh</i>	S3S4
Fish	Paddlefish	<i>Polyodon spathula</i>	S3S4
Mammals	Black-footed Ferret	<i>Mustela nigripes</i>	S1
Mammals	White-tailed Prairie Dog	<i>Cynomys leucurus</i>	S1
Mammals	Northern Myotis	<i>Myotis septentrionalis</i>	S1S2
Mammals	Northern Bog Lemming	<i>Synaptomys borealis</i>	S2
Mammals	Little Brown Myotis	<i>Myotis lucifugus</i>	S2S3
Mammals	Black-tailed Prairie Dog	<i>Cynomys ludovicianus</i>	S3
Mammals	Canada Lynx	<i>Lynx canadensis</i>	S3
Mammals	Columbia Plateau Pocket Mouse	<i>Perognathus parvus</i>	S3
Mammals	Fisher	<i>Pekania pennanti</i>	S3
Mammals	Fringed Myotis	<i>Myotis thysanodes</i>	S3
Mammals	Long-eared Myotis	<i>Myotis evotis</i>	S3
Mammals	Long-legged Myotis	<i>Myotis volans</i>	S3
Mammals	Merriam's Shrew	<i>Sorex merriami</i>	S3
Mammals	Pallid Bat	<i>Antrozous pallidus</i>	S3
Mammals	Preble's Shrew	<i>Sorex preblei</i>	S3
Mammals	Pygmy Rabbit	<i>Sylvilagus idahoensis</i>	S3
Mammals	Silver-haired Bat	<i>Lasionycteris noctivagans</i>	S3
Mammals	Swift Fox	<i>Vulpes velox</i>	S3
Mammals	Townsend's Big-eared Bat	<i>Corynorhinus townsendii</i>	S3
Mammals	Western Pygmy Shrew	<i>Sorex eximius</i>	S3
Mammals	Wolverine	<i>Gulo gulo</i>	S3
Mammals	Yuma Myotis	<i>Myotis yumanensis</i>	S3
Mammals	Eastern Red Bat	<i>Lasiurus borealis</i>	S3B
Mammals	Northern Hoary Bat	<i>Lasiurus cinereus</i>	S3B
Mammals	Hoary Marmot	<i>Marmota caligata</i>	S3S4
Mammals	Meadow Jumping Mouse	<i>Zapus hudsonius</i>	S3S4
Mammals	North American Porcupine	<i>Erethizon dorsatum</i>	S3S4
Mammals	Prairie Shrew	<i>Sorex haydeni</i>	S3S4
Mammals	North American Water Vole	<i>Microtus richardsoni</i>	S4
Mammals	Red-tailed Chipmunk	<i>Neotamias ruficaudus</i>	S4
Mammals	Sagebrush Vole	<i>Lemmiscus curtatus</i>	S4
Reptiles	Plains Hog-nosed Snake	<i>Heterodon nasicus</i>	S2
Reptiles	Smooth Greensnake	<i>Opheodrys vernalis</i>	S2
Reptiles	Western Milksnake	<i>Lampropeltis gentilis</i>	S2
Reptiles	Greater Short-horned Lizard	<i>Phrynosoma hernandesi</i>	S3
Reptiles	Northern Alligator Lizard	<i>Elgaria coerulea</i>	S3
Reptiles	Snapping Turtle	<i>Chelydra serpentina</i>	S3
Reptiles	Spiny Softshell	<i>Apalone spinifera</i>	S3
Reptiles	Western Skink	<i>Plestiodon skiltonianus</i>	S3
Reptiles	Northern Rubber Boa	<i>Charina bottae</i>	S4

Reptiles	Prairie Rattlesnake	Crotalus viridis	S4

3.4 Terrestrial Invertebrate SGCN List

We included 57 terrestrial invertebrate species as SGCN in the 2025 SWAP. Of these SGCN, 33 species had ranks that included S1 or S2 due to small population sizes, limited distribution, and/or affinity to specific environmental conditions coupled with direct or indirect threats. The terrestrial invertebrate SGCN list includes 1 ant, 1 arachnid, 9 bees, 2 beetles, 2 bugs, 11 butterflies, 1 fly, 5 grasshoppers, 5 millipedes, 15 mollusks, 1 moth, 3 skippers, and 1 springtail (Table 9).

Table 9. List of terrestrial invertebrate Species of Greatest Conservation Need (SGCN) in Montana’s 2025 State Wildlife Action Plan. Species are arranged alphabetically by group, then by state rank, and then alphabetically by common name.

Group	Common Name	Scientific Name	State Rank	G Rank
Ants	Light-headed Mound Ant	<i>Formica laeviceps</i>	SNR	G3
Arachnids	A Cave Obligate Harvestman	<i>Sclerobunus cavicolus</i>	S2	G1G2
Bees	Suckley's Cuckoo Bumble Bee	<i>Bombus suckleyi</i>	S1	G2G3
Bees	Western Bumble Bee	<i>Bombus occidentalis</i>	S2	G3
Bees	Yellow-banded Bumble Bee	<i>Bombus terricola</i>	S2	G3G4
Bees	American Bumble Bee	<i>Bombus pensylvanicus</i>	S3	G3G4
Bees	Golden-belted Bumble Bee	<i>Bombus kirbiellus</i>	S4	G3G5
Bees	A Leafcutter Bee	<i>Megachile dakotensis</i>	SNR	G2G3
Bees	A Leafcutter Bee	<i>Megachile nevadensis</i>	SNR	G3G4
Bees	Hurd’s Mason Bee	<i>Osmia austromaritima</i>	SNR	G2G4
Bees	Pasqueflower Mason Bee	<i>Osmia pulsatillae</i>	SNR	G2G3
Beetles	St. Anthony Dune Tiger Beetle	<i>Cicindela arenicola</i>	S1	G1G2
Beetles	Ghost Tiger Beetle	<i>Ellipsoptera lepida</i>	SU	G3
Bugs	Cooley’s Tingid	<i>Acalypta cooleyi</i>	SNR	G2
Bugs	Thick-antennaed Plant Bug	<i>Pronotocrepis clavicornis</i>	SNR	G2
Butterflies	Frigga Fritillary	<i>Boloria frigga</i>	S1S2	G5
Butterflies	Alberta Fritillary	<i>Boloria alberta</i>	S2	G3
Butterflies	Astarte Fritillary	<i>Boloria astarte</i>	S2	G5
Butterflies	Eyed Brown	<i>Lethe eurydice</i>	S2	G5
Butterflies	Gillette’s Checkerspot	<i>Euphydryas gillettii</i>	S2	G3
Butterflies	Labrador Sulphur	<i>Colias nastes</i>	S2	G5
Butterflies	Rockslide Checkerspot	<i>Chlosyne whitneyi</i>	S2	G4
Butterflies	Indra Swallowtail	<i>Papilio indra</i>	S2S3	G4?
Butterflies	Monarch	<i>Danaus plexippus</i>	S2S3	G4
Butterflies	Hops Azure	<i>Celastrina humulus</i>	SNR	G2G3

Butterflies	Regal Fritillary	<i>Argynnis idalia</i>	SU	G3?
Flies	Blue-black Ant Fly	<i>Microdon piperi</i>	SNR	G2G4
Grasshoppers	A Spur-throat Grasshopper	<i>Melanoplus lanthanus</i>	SNR	G1G3
Grasshoppers	A Spur-throat grasshopper	<i>Melanoplus missoulae</i>	SNR	G1
Grasshoppers	A Spur-throat Grasshopper	<i>Melanoplus picropidzae</i>	SNR	G1G3
Grasshoppers	Knowles' Spur-throat Grasshopper	<i>Melanoplus knowlesi</i>	SNR	G1G2
Grasshoppers	Rehn's Slow Grasshopper	<i>Argiacris rehni</i>	SNR	G2G3
Millipedes	A Millipede	<i>Austrotyla montani</i>	S1S3	G1G2
Millipedes	A Millipede	<i>Corypus cochlearis</i>	S1S3	G1G3
Millipedes	A Millipede	<i>Taiyutyla curvata</i>	S1S3	G1G3
Millipedes	A Millipede	<i>Orthogmus oculatus</i>	S1S3	G1G3
Millipedes	A Millipede	<i>Adrityla cucullata</i>	S1S3	GU
Mollusks	Carinate Mountainsnail	<i>Oreohelix elrodi</i>	S1	G2
Mollusks	Keeled Mountainsnail	<i>Oreohelix carinifera</i>	S1	G1
Mollusks	Lake Disc	<i>Discus brunsoni</i>	S1	G1
Mollusks	Pygmy Mountainsnail	<i>Oreohelix pygmaea</i>	S1	G2
Mollusks	Bitterroot Mountainsnail	<i>Oreohelix amariradix</i>	S1S2	G1G2
Mollusks	Skade's Jumping-slug	<i>Hemphillia skadei</i>	S1S2	G3?
Mollusks	Alpine Mountainsnail	<i>Oreohelix alpina</i>	S2	G2
Mollusks	Lyrate Mountainsnail	<i>Oreohelix haydeni</i>	S2	G2
Mollusks	Oblique Ambersnail	<i>Oxyloma nuttallianum</i>	S2	G2G4
Mollusks	Robust Lancetooth Snail	<i>Haplotrema vancouverense</i>	S2	G5
Mollusks	Sheathed Slug	<i>Zacoleus idahoensis</i>	S2	G3
Mollusks	Ninepipes Ambersnail	<i>Oxyloma missoula</i>	S3S4	G2G4
Mollusks	Rocky Mountain Axetail	<i>Securicauda hermani</i>	SNR	G1
Mollusks	Kingston Oregonian	<i>Cryptomastix sanburni</i>	SU	G3
Mollusks	Thinlip Tightcoil	<i>Pristiloma idahoense</i>	SU	G3
Moths	Corylus Dagger Moth	<i>Acronicta falcata</i>	SNR	G2G4
Skippers	Arogos Skipper	<i>Atrytone arogos</i>	S2	G2G3
Skippers	Ottoo Skipper	<i>Hesperia ottoe</i>	S2S3	G3
Skippers	Iowa Skipper	<i>Atrytone arogos iowa</i>	SNR	G2G3T2T3
Springtails	A Cave Obligate Springtail	<i>Oncopodura cruciata</i>	S2	G1G2

3.5 Aquatic Invertebrate SGCN List

In the 2025 SWAP, we identified 56 aquatic invertebrate species as SGCN, including 2 beetles, 13 caddisflies, 1 amphipod, 1 isopod, 2 damselflies, 3 dragonflies, 2 freshwater sponges, 14 mayflies, 7 mollusks, and 11 stoneflies (Table 10).

Table 10. List of aquatic invertebrate Species of Greatest Conservation Need (SGCN) in Montana’s 2025 State Wildlife Action Plan. Species are arranged alphabetically by group, then by state rank, and then alphabetically by common name.

Group	Common Name	Scientific Name	State Rank	Global Rank
Beetles	Brown’s Microcylloepus Riffle Beetle	<i>Microcylloepus browni</i>	S1	G1
Beetles	Warm Spring Zaitzevian Riffle Beetle	<i>Zaitzevia thermae</i>	S1	G1
Caddisflies	A Rhyacophilan Caddisfly	<i>Rhyacophila belona</i>	S1	G3G4
Caddisflies	A Rhyacophilan Caddisfly	<i>Rhyacophila ebria</i>	S1	G2G3
Caddisflies	A Rhyacophilan Caddisfly	<i>Rhyacophila glaciera</i>	S1	G3
Caddisflies	A Rhyacophilan Caddisfly	<i>Rhyacophila unimaculata</i>	S1	G2G3
Caddisflies	A Caddisfly	<i>Philocasca banksi</i>	S2	G1G3
Caddisflies	A Rhyacophilan Caddisfly	<i>Rhyacophila gemona</i>	S2	G3
Caddisflies	A Rhyacophilan Caddisfly	<i>Rhyacophila newelli</i>	S2	G1
Caddisflies	A Rhyacophilan Caddisfly	<i>Rhyacophila potteri</i>	S2	G3
Caddisflies	A Rhyacophilan Caddisfly	<i>Rhyacophila rickeri</i>	S2	G3G4
Caddisflies	Alexander's Free-living Caddisfly	<i>Rhyacophila alexanderi</i>	S2	G2
Caddisflies	An Arctoporan Caddisfly	<i>Arctopora salmon</i>	S2	G2G4
Caddisflies	Northern Rocky Mountains Refugium Caddisfly	<i>Goereilla baumanni</i>	S2	G2G3
Caddisflies	Northern Rocky Mountains Refugium Caddisfly	<i>Rossiana montana</i>	S2	G2
Crustaceans	A Cave Obligate Isopod	<i>Salmasellus steganothrix</i>	S1	G2
Crustaceans	Glacier Amphipod	<i>Stygobromus glacialis</i>	S1	G1
Damselflies	Subarctic Bluet	<i>Coenagrion interrogatum</i>	S2	G5
Damselflies	Prairie Bluet	<i>Coenagrion angulatum</i>	S2S3	G5
Dragonflies	Eastern Ringtail	<i>Erpetogomphus designatus</i>	S1	G5
Dragonflies	Western Pondhawk	<i>Erythemis collocata</i>	S1S2	G5
Dragonflies	Brimstone Clubtail	<i>Stylurus intricatus</i>	S2	G4
Freshwater Sponges	A Freshwater Sponge	<i>Ephydatia cooperensis</i>	S1	G1
Freshwater Sponges	A Freshwater Sponge	<i>Heteromeyenia baileyi</i>	S2	G5
Mayflies	A Mayfly	<i>Parameletus columbiae</i>	S1	G1G2
Mayflies	A Sand-dwelling Mayfly	<i>Anepeorus rusticus</i>	S1	G2
Mayflies	A Sand-dwelling Mayfly	<i>Lachlania saskatchewanensis</i>	S1	G4
Mayflies	A Mayfly	<i>Baetisca columbiana</i>	S2	G2G4
Mayflies	A Mayfly	<i>Cinygmula gartrelli</i>	S2	G2G3
Mayflies	A Mayfly	<i>Heptagenia whitingi</i>	S2	G2G3
Mayflies	A Mayfly	<i>Raptoheptagenia cruentata</i>	S2	G4
Mayflies	A Sand-dwelling Mayfly	<i>Anaetris eximia</i>	S2	G3
Mayflies	A Sand-dwelling Mayfly	<i>Homoeoneuria alleni</i>	S2	G4
Mayflies	A Sand-dwelling Mayfly	<i>Macdunnoa nipawinia</i>	S2	G3

Mayflies	Kootenay Flat-headed Mayfly	<i>Cinygmula kootenai</i>	S2	G1G3
Mayflies	Lolo Mayfly	<i>Caurinella idahoensis</i>	S2	G3
Mayflies	Neave's Sand Minnow Mayfly	<i>Ametropus neavei</i>	S2	G4
Mayflies	Pacific Flat-headed Mayfly	<i>Ironodes nitidus</i>	S2	G4
Mollusks	Bedford Springsnail	<i>Pyrgulopsis bedfordensis</i>	S1	G1
Mollusks	Blaine Pyrg	<i>Pyrgulopsis blainica</i>	S1	G1
Mollusks	Cloaked Physa	<i>Physa megalochlamys</i>	S1	G3G4
Mollusks	Rocky Mountain Capshell	<i>Acroloxus coloradensis</i>	S1	G3
Mollusks	Rocky Mountain Dusksnail	<i>Colligyrus greggi</i>	S1	G4
Mollusks	Shortface Lanx	<i>Fisherola nuttalli</i>	S1	G2
Mollusks	Western Pearlshell	<i>Margaritifera falcata</i>	S2	G3G4
Stoneflies	Salish Sallfly	<i>Suwallia salish</i>	S1	G1
Stoneflies	Meltwater Lednian Stonefly	<i>Lednia tumana</i>	S1	G1G2
Stoneflies	Western Glacier Stonefly	<i>Zapada glacier</i>	S1	G1
Stoneflies	Clearwater Roachfly	<i>Soliperla salish</i>	S2	G2
Stoneflies	Columbian Snowfly	<i>Utacapnia columbiana</i>	S2	G4
Stoneflies	Cordilleran Forestfly	<i>Zapada cordillera</i>	S2	G3
Stoneflies	Hooked Snowfly	<i>Isocapnia crinita</i>	S2	G5
Stoneflies	Lolo Sallfly	<i>Sweltsa durfeeii</i>	S2	G2
Stoneflies	Rocky Mountain Forestfly	<i>Soyedina potteri</i>	S2	G2
Stoneflies	Springs Stripetail	<i>Isoperla petersoni</i>	S2	G5
Stoneflies	Giant Needlefly	<i>Megaleuctra stigmata</i>	S2S3	G2G3

3.6 Plant SGCN List

For the 2025 SWAP, we included Plant SGCN identified in the Montana Native Plant Conservation Strategy and linked each species to their associated Habitat of Greatest Conservation Need (HGCN; Table 11). This SWAP provides a brief overview of plant SGCN in the state, but readers should consult the Montana Native Plant Conservation Strategy for comprehensive information on plant SGCN, identifying and addressing their threats and stressors, and recommended conservation actions that will help ensure the persistence of plant SGCN into the future.

List of Plant SGCN

We included 109 vascular plant species as SGCN in the 2025 SWAP. Of these species, 105 were identified as Species of Concern by MTNHP with a rank including S1, S2, or S3 due to small population sizes, limited distribution, and/or affinity to specific environmental conditions coupled with direct or indirect threats (Table 11). An additional 4 species that were included were common species with specific management concerns (Table 7). These

species are common on the landscape but observed by land managers from different agencies and/or tribal nations as in potential decline from various threats.

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Table 11. List of plant Species of Greatest Conservation Need (SGCN) in Montana’s 2025 State Wildlife Action Plan, including information on their distribution, ranks, threat scores, and habitats. Species are arranged alphabetically by group, then by state rank, and then alphabetically by common name. In the HGCN columns, “Other” indicates the Plant SGCN is associated with a habitat that is not classified as a HGCN.

Plant SGCN ^a Scientific Name Common Name	Global Rank ^b	State Rank ^c	Montana State Threat Score ^d	2025 Montana SWAP – Habitats of Greatest Conservation Need ^e		
				Montana Level 1	Montana Level 2	Montana Group
<i>Agastache cusickii</i> Cusick's Horsemint	G3G4	S2S3	High - Medium	Other	---	---
<i>Allium columbianum</i> Columbia Onion	G3	S1	Medium	Grassland	Lowland-Prairie Grassland	Rocky Mountain Low Elevation-Dry Grassland
<i>Allium parvum</i> Small Onion	G5	S2S3	Very High - High	Grassland Shrubland Forest and Woodland	Lowland-Prairie Grassland Sagebrush Shrubland Low Elevation-Xeric Forest and Woodland	Rocky Mountain Low Elevation-Dry Grassland Mountain Big Sagebrush Shrubland Ponderosa Pine Forest and Woodland
<i>Alnus rubra</i> Red Alder	G5	S2S3	---	Wetland and Riparian	Riparian Shrubland	---
<i>Ammannia robusta</i> Scarlet Ammannia	G5	S2	Medium	Wetland and Riparian Wetland and Riparian Open Water (Lake-Pond)	Riparian Shrubland Wet Meadow and Marsh ---	--- --- ---
<i>Anthoxanthum hirtum</i> Norhern Sweet Grass	G5	S3S4	---	Wetland and Riparian Wetland and Riparian Wetland and Riparian Wetland and Riparian	Peatland Riparian and Wetland Forest Riparian Shrubland Wet Meadow and Marsh	--- --- --- ---
<i>Astragalus barrii</i> Barr's Milkvetch	G3G4	S3	Medium - Low	Grassland	Lowland-Prairie Grassland	Great Plains Sand Prairie
<i>Astragalus ceramicus</i> variety <i>apus</i> Painted Milkvetch	G4T3	S1S2	Medium - Low	Grassland	Lowland-Prairie Grassland	Other
<i>Astragalus ceramicus</i> variety <i>filifolius</i> Painted Milkvetch	G4T4	S3	Medium - Low	Grassland	Lowland-Prairie Grassland	Great Plains Sand Prairie
<i>Astragalus convallarius</i> Lesser Rushy Milkvetch	G5	S3	Medium - Low	Grassland Forest and Woodland	Lowland-Prairie Grassland Low Elevation-Xeric Forest and Woodland	Rocky Mountain Low Elevation-Dry Grassland Ponderosa Pine Forest and Woodland

Astragalus oreganus Wind River Milkvetch	G4?	S2	Medium	Shrubland	Sagebrush Shrubland	Basin and Wyoming Big (Threetip) Sagebrush Shrubland
Athysanus pusillus Sandweed	G5	S1S2	High	Other	---	---
Boechea fecunda Sapphire Rockcress	G2	S2	Medium	Grassland Shrubland Shrubland	Lowland-Prairie Grassland Foothills-Montane Shrubland Sagebrush Shrubland	Rocky Mountain Low Elevation-Dry Grassland Mountain Mahogany Woodland and Shrubland Mountain Big Sagebrush Shrubland
Braya humilis Low Braya	G5	S2	Likely High	Wetland and Riparian	Peatland	---
Calochortus bruneauensis Bruneau Mariposa Lily	G5	S2	Low	Grassland Shrubland	Lowland-Prairie Grassland Sagebrush Shrubland	Rocky Mountain Low Elevation-Dry Grassland Basin and Wyoming Big (Threetip) Sagebrush Shrubland
Carex grvida Heavy Sedge	G5	S3	High - Medium	Wetland and Riparian Forest and Woodland	Riparian and Wetland Forest Deciduous Forest and Woodland	--- Great Plains Mesic Forest and Woodland
Carex idaho Idaho Sedge	G3	S3	High	Wetland and Riparian Wetland and Riparian	Peatland Wet Meadow and Marsh	---
Carex sychnocephala Many-headed Sedge	G5	S1S2	High - Medium	Wetland and Riparian	Wet Meadow and Marsh	---
Castilleja covilleana Coville Indian Paintbrush	G3G4	S3	Low	Forest and Woodland	Low Elevation-Xeric Forest and Woodland	Ponderosa Pine Forest and Woodland
Cirsium longistylum Long-styled Thistle	G2G3	S2S3	Medium	Forest and Woodland	Montane-Subalpine Forest and Woodland	Whitebark Pine-Subalpine Larch Forest and Woodland
Clarkia rhomboidea Diamond Clarkia	G5	S3	Low	Forest and Woodland	Low Elevation-Xeric Forest and Woodland	Ponderosa Pine Forest and Woodland
Cleome lutea Yellow Beeplant	G5	S1S2	---	Shrubland	Sagebrush Shrubland	Basin and Wyoming Big (Threetip) Sagebrush Shrubland
Cryptantha fendleri Fendler Cat's-eye	G5	S2	Medium	Grassland	Lowland-Prairie Grassland	Great Plains Sand Prairie
Cyperus schweinitzii Schweinitz's Flatsedge	G5	S2	Low	Grassland	Lowland-Prairie Grassland	Great Plains Sand Prairie
Cypripedium fasciculatum Clustered Lady's-slipper	G4	S3	Medium	Forest and Woodland	Montane-Subalpine Forest and Woodland	Cedar-Hemlock Forest
Cypripedium passerinum Sparrow's-egg Lady's-slipper	G5	S2S3	Low	Wetland and Riparian Wetland and Riparian	Peatland Riparian and Wetland Forest	---
Dichanthelium acuminatum Panic Grass	G5	S2S3	---	Wetland and Riparian	Wet Meadow and Marsh	---

<i>Dichanthelium oligosanthes</i> variety <i>scribnerianum</i> Scribner's Panic Grass	G5T5	S1S2	Low	Grassland Forest and Woodland Forest and Woodland	Lowland-Prairie Grassland Deciduous Forest and Woodland Low Elevation-Xeric Forest and Woodland	Great Plains Sand Prairie Great Plains Mesic Forest and Woodland Ponderosa Pine Forest and Woodland
<i>Draba densifolia</i> Dense-leaf Draba	G5	S2	Low	<i>Other</i>	<i>Other</i>	---
<i>Drosera anglica</i> English Sundew	G5	S3	Low	Wetland and Riparia	Peatland	---
<i>Drosera linearis</i> Slenderleaf Sundew	G4G5	S2	Likely Very High	Wetland and Riparian	Peatland	---
<i>Eleocharis bella</i> Delicate Spikerush	G5	S1	---	Wetland and Riparian	Wet Meadow and Marsh	---
<i>Eleocharis rostellata</i> Beaked Spikerush	G5	S3	Likely Low	Wetland and Riparian Wetland and Riparian Wetland and Riparian	Alkaline-Saline Wetlands Peatland Wet Meadow and Marsh	--- --- ---
<i>Elymus flavescens</i> Sand Wildrye	G3	S1S2	Low	Grassland	Lowland-Prairie Grassland	<i>Other</i>
<i>Epipactis gigantea</i> Giant Helleborine	G4	S2S3	Low	Wetland and Riparian Wetland and Riparian	Peatland Riparian and Wetland Forest	--- ---
<i>Erigeron leiomerus</i> Smooth Fleabane	G4	S2	Low	<i>Other</i>	---	---
<i>Erigeron linearis</i> Linear-leaf Fleabane	G5	S2	Low	Grassland Shrubland Shrubland	Lowland-Prairie Grassland Sagebrush Shrubland Sagebrush Shrubland	Rocky Mountain Low Elevation-Dry Grassland Basin and Wyoming Big (Threetip) Sagebrush Shrubland Mountain Big Sagebrush Shrubland
<i>Eriogonum salsuginosum</i> Smooth Buckwheat	G4?	S1S2	Likely Moderate	Shrubland	<i>Other</i>	---
<i>Eriogonum soliceps</i> Railroad Canyon Wild Buckwheat	G3	S3	Likely Low	Shrubland Shrubland	Sagebrush Shrubland Sagebrush Shrubland	Basin and Wyoming Big (Threetip) Sagebrush Shrubland Low-Black Sagebrush Shrubland
<i>Fraxinus pennsylvanica</i> Green Ash	G4	S5	Potentially High	Wetland and Riparian Forest and Woodland Forest and Woodland	Riparian and Wetland Forest Deciduous Forest and Woodland Deciduous Forest and Woodland	--- Aspen Forest and Woodland Great Plains Mesic Forest and Woodland
<i>Githopsis specularioides</i> Common Blue-cup	G5	S1S2	---	Grassland	<i>Other</i>	---
<i>Glossopetalon spinescens</i> Spiny Greasebush	G5	S1	---	<i>Other</i>	---	---

<i>Goodyera repens</i> Northern Rattlesnake-plantain	G5	S3	High - Low	Forest and Woodland	Montane-Subalpine Forest and Woodland	<i>Other-Not on HGCN List</i>
<i>Grayia spinosa</i> Spiny Hopsage	G5	S2	Likely Low	Shrubland Shrubland	Arid-Saline Shrubland Sagebrush Shrubland	Greasewood Shrubland Basin and Wyoming Big (Threetip) Sagebrush Shrubland
<i>Grindelia howellii</i> Howell's Gumweed	G3	S2S3	High - Medium	Grassland Wetland and Riparian	Lowland-Prairie Grassland Wet Meadow and Marsh	Rocky Mountain Low Elevation-Dry Grassland ---
<i>Heterocodon rariflorum</i> Western Pearl-flower	G5	S2	Medium - Low	<i>Grassland</i>	<i>Other</i>	---
<i>Howellia aquatilis</i> Water Howellia	G3	S3	High - Medium	Wetland and Riparian Wetland and Riparian Open Water (Lake-Pond)	Riparian and Wetland Forest Wet Meadow and Marsh ---	--- --- ---
<i>Idahoia scapigera</i> Scalepod	G5	S1S2	High - Medium	<i>Other</i>	---	---
<i>Ipomopsis congesta</i> <i>subspecies crebrifolia</i> Ballhead Ipomopsis	G5T3T4	S2S3	---	Shrubland Shrubland	Sagebrush Shrubland Sagebrush Shrubland	Basin and Wyoming Big (Threetip) Sagebrush Shrubland Mountain Big Sagebrush Shrubland
<i>Kochia americana</i> Red Sage	G5	S2	Likely Moderate	Shrubland Shrubland Wetland and Riparian	Arid-Saline Shrubland Sagebrush Shrubland Alkaline-Saline Wetland	Greasewood Shrubland Basin and Wyoming Big (Threetip) Sagebrush Shrubland ---
<i>Lagophylla ramosissima</i> Slender Hareleaf	G5	S1	Low	Grassland	Lowland-Prairie Grassland	Rocky Mountain Low Elevation-Dry Grassland
<i>Lemna valdiviana</i> Pale Duckweed	G5	S1	---	Open Water (Lake-Pond)	---	---
<i>Leptodactylon caespitosum</i> Matted Prickly-phlox	G4	S2S3	Low	Forest and Woodland	<i>Other</i>	---
<i>Lewisia columbiana</i> Columbia Lewisia	G4G5	S1S2	Medium - Low	<i>Other</i>	---	---
<i>Lilium columbianum</i> Columbia Lily	G5	S2	Moderate	Forest and Woodland	<i>Other</i>	---
<i>Liparis loeselii</i> Loesel's Twayblade	G5	S2	High	Wetland and Riparian	Peatland	---
<i>Lobelia kalmii</i> Kalm's Lobelia	G5	S3	---	Wetland and Riparian Wetland and Riparian	Peatland Wet Meadow and Marsh	--- ---

<i>Lomatium nuttallii</i> Nuttall Desert-parsley	G3	S2	High - Medium	Forest and Woodland	Low Elevation-Xeric Forest and Woodland	Ponderosa Pine Forest and Woodland
<i>Malacothrix torreyi</i> Desert Dandelion	G4	S1S2	---	Shrubland	Sagebrush Shrubland	Basin and Wyoming Big (Threetip) Sagebrush Shrubland
<i>Mentzelia pumila</i> Dwarf mentzelia	G4	S2S3	Likely Moderate	Shrubland	Sagebrush Shrubland	Basin and Wyoming Big (Threetip) Sagebrush Shrubland
<i>Mimulus breviplorus</i> Short-flowered Monkeyflower	G4	S1S2	Likely Moderate	Grassland	<i>Other</i>	---
<i>Mimulus nanus</i> Dwarf Purple Monkeyflower	G5	S2S3	High - Low	<i>Other</i>	---	---
<i>Mimulus primuloides</i> Primrose Monkeyflower	G4	S3	Low	Wetland and Riparian Wetland and Riparian	Peatland Wet Meadow and Marsh	--- ---
<i>Muhlenbergia andina</i> Foxtail Muhly	G4	S2S3	---	Wetland and Riparian	Wet Meadow and Marsh	---
<i>Nama densum</i> Nama	G5	S1S2	---	<i>Other</i>	---	---
<i>Nuttallanthus texanus</i> Blue Toadflax	G4G5	S1S2	High - Medium	Grassland Forest and Woodland	Lowland-Prairie Grassland Low Elevation-Xeric Forest and Woodland	Great Plains Sand Prairie Ponderosa Pine Forest and Woodland
<i>Oenothera pallida</i> subspecies <i>pallida</i> Pale Evening-primrose	G5T4	S1	Likely Very High	<i>Grassland</i>	<i>Other</i>	---
<i>Ophioglossum pusillum</i> Adder's Tongue	G4	S3	Likely Moderate	Wetland and Riparian Wetland and Riparian	Peatland Wet Meadow and Marsh	--- ---
<i>Oxytropis campestris</i> variety <i>columbiana</i> Columbia Locoweed	G5T2	S1	Very High	Wetland and Riparian	Riparian and Wetland Forest	---
<i>Pedicularis crenulata</i> Scallop-leaf Lousewort	G4	S1	High	Wetland and Riparian Wetland and Riparian	Riparian Shrubland Wet Meadow and Marsh	--- ---
<i>Penstemon angustifolius</i> Narrowleaf Penstemon	G5	S2S3	Likely High	Grassland	Lowland-Prairie Grassland	Great Plains Sand Prairie
<i>Penstemon lemhiensis</i> Lemhi Beardtongue	G3	S3	High - Medium	Grassland Shrubland	Lowland-Prairie Grassland Sagebrush Shrubland	Rocky Mountain Low Elevation-Dry Grassland Mountain Big Sagebrush Shrubland
<i>Penstemon payettensis</i> Payette Beardtongue	G4	S1	Very High	Grassland	Lowland-Prairie Grassland	Rocky Mountain Low Elevation-Dry Grassland
<i>Petasites frigidus</i> variety <i>frigidus</i> Arctic Sweet Coltsfoot	G5T5	S2	Medium	Wetland and Riparian	Riparian and Wetland Forest	---

<i>Phegopteris connectilis</i> Northern Beechfern	G5	S2S3	Medium - Low	Wetland and Riparian Forest and Woodland	Riparian and Wetland Forest Montane-Subalpine Forest and Woodland	--- Cedar-Hemlock Forest
<i>Phlox missoulensis</i> Missoula Phlox	G1	S1	Very High - High	Grassland	Lowland-Prairie Grassland	Rocky Mountain Low Elevation-Dry Grassland
<i>Physaria carinata</i> Keeled Bladderpod	G3G4TNR	S1S2	Medium	Grassland Shrubland Forest and Woodland	Lowland-Prairie Grassland Sagebrush Shrubland Low Elevation-Xeric Forest and Woodland	Rocky Mountain Low Elevation-Dry Grassland Basin and Wyoming Big (Threetip) Sagebrush Shrubland Ponderosa Pine Forest and Woodland
<i>Physaria didymocarpa</i> variety lanata Woolly Twinpod	G5T2	S2S3	---	Grassland Forest and Woodland	Lowland-Prairie Grassland Low Elevation-Xeric Forest and Woodland	Great Plains Dry Mixedgrass Prairie Ponderosa Pine Forest and Woodland
<i>Physaria douglasii</i> Douglas Bladderpod	G5	S1	Medium	Forest and Woodland	Low Elevation-Xeric Forest and Woodland	Ponderosa Pine Forest and Woodland
<i>Physaria humilis</i> Bitterroot Bladderpod	G2	S2	High - Medium	Other	---	---
<i>Physaria klausii</i> Divide Bladderpod	G3	S3	Low	Grassland	Lowland-Prairie Grassland	Rocky Mountain Low Elevation-Dry Grassland
<i>Physaria lesicii</i> Lesica's Bladderpod	G2	S2	High - Medium	Grassland Forest and Woodland	Other Other	--- ---
<i>Physaria pachyphylla</i> Thick-leaf Bladderpod	G2G3	S2S3	Low	Forest and Woodland	Other	---
<i>Pinus albicaulis</i> Whitebark Pine	G3G4	S3	High - Very High	Forest and Woodland	Montane-Subalpine Forest and Woodland	Whitebark Pine-Subalpine Larch Forest and Woodland
<i>Pinus monticola</i> Western White Pine	G4G5	S3S4	Likely High	Forest and Woodland	Montane-Subalpine Forest and Woodland	Cedar-Hemlock Forest
<i>Pleiocanthus spinosus</i> Spiny Skeletonweed	G4	S2S3	Likely Moderate	Grassland	Lowland-Prairie Grassland	Rocky Mountain Low Elevation-Dry Grassland
<i>Populus tremuloides</i> Quaking Aspen -- as a plant community --	G5	S5	Likely Moderate - High	Shrubland Wetland and Riparian Forest and Woodland	Other Riparian and Wetland Forest Deciduous Forest and Woodland	--- --- Aspen Forest and Woodland
<i>Primula alcalina</i> Alkali Primrose	G2	S2	Very High	Wetland and Riparian	Wet Meadow and Marsh	---
<i>Primula incana</i> Mealy Primrose	G5	S3	High	Wetland and Riparian Wetland and Riparian	Alkaline-Saline Wetlands Wet Meadow and Marsh	--- ---
<i>Prunus pumila</i> Sand Cherry	G5	S1S3	---	Grassland	Lowland-Prairie Grassland	Great Plains Sand Prairie
<i>Quercus macrocarpa</i> Bur Oak	G5	S2	High	Forest and Woodland Forest and Woodland	Deciduous Forest and Woodland	Great Plains Mesic Forest and Woodland Ponderosa Pine Forest and Woodland

					Low Elevation-Xeric Forest and Woodland	
<i>Ranunculus orthorhynchus</i> Straightbeak Buttercup	G5	S1S2	Low	Wetland and Riparian Wetland and Riparian	Riparian Shrubland Wet Meadow and Marsh	--- ---
<i>Rotala ramosior</i> Toothcup	G5	S1S2	Likely High	Wetland and Riparian Wetland and Riparian	Riparian Shrubland Wet Meadow and Marsh	--- ---
<i>Sandbergia perplexa</i> Puzzling Rockcress	G4	S2	High - Low	Grassland Shrubland Shrubland	Lowland-Prairie Grassland Foothills-Montane Shrubland Sagebrush Shrubland	Rocky Mountain Low Elevation-Dry Grassland Mountain Mahogany Woodland and Shrubland Mountain Big Sagebrush Shrubland
<i>Scheuchzeria palustris</i> Pod Grass	G5	S3	Medium - Low	Wetland and Riparian	Peatland	---
<i>Sidalcea oregana</i> Oregon Checker-mallow	G5	S2S3	High - Medium	Grassland Wetland and Riparian	<i>Other</i> Riparian Shrubland	--- ---
<i>Silene spaldingii</i> Spalding's Catchfly	G2	S2	Very High	Grassland Shrubland Forest and Woodland	Lowland-Prairie Grassland Foothills-Montane Shrubland Low Elevation-Xeric Forest and Woodland	Rocky Mountain Low Elevation-Dry Grassland Lowland-Montane Shrubland Ponderosa Pine Forest and Woodland
<i>Spiranthes diluvialis</i> Ute Ladies'-tresses	G2G3	S1S2	High	Wetland and Riparian	Alkaline-Saline Wetlands	---
<i>Tetradymia spinosa</i> Short-spine Horsebrush	G5	S2S3	Likely Low	Shrubland	Sagebrush Shrubland	Basin and Wyoming Big (Threetip) Sagebrush Shrubland
<i>Thalictrum alpinum</i> Alpine Meadowrue	G5	S2	High - Medium	Wetland and Riparian Wetland and Riparian Wetland and Riparian	Peatland Riparian Shrubland Wet Meadow and Marsh	--- --- ---
<i>Tonestus aberrans</i> Idaho Goldenweed	G3	S1S2	Likely High	<i>Other</i>	---	---
<i>Trichophorum alpinum</i> Hudson's Bay Bulrush	G5	S2	Low	Wetland and Riparian	Peatland	---
<i>Trichophorum cespitosum</i> Tufted Club-rush	G5	S2	Likely Moderate	Wetland and Riparian	Peatland	---
<i>Trifolium eriocephalum</i> Woolly-head Clover	G5	S2	Medium - Low	Grassland Forest and Woodland	Lowland-Prairie Grassland <i>Other</i>	Rocky Mountain Low Elevation-Dry Grassland ---
<i>Trifolium gymnocarpon</i> Hollyleaf Clover	G5	S2	Medium - Low	Grassland Forest and Woodland	Lowland-Prairie Grassland Low Elevation-Xeric Forest and Woodland	Rocky Mountain Low Elevation-Dry Grassland Ponderosa Pine Forest and Woodland
<i>Trifolium microcephalum</i> Woolly Clover	G5	S3	High - Medium	Wetland and Riparian Wetland and Riparian	Riparian and Wetland Forest Wet Meadow and Marsh	--- ---

<i>Utricularia intermedia</i> Flatleaf Bladderwort	G5	S2	---	Wetland and Riparian	Peatland	---
<i>Vaccinium myrtilloides</i> Velvetleaf Huckleberry	G5	S2	Medium - Low	Forest and Woodland	<i>Other</i>	---
<i>Viburnum lentago</i> Nannyberry	G5	S2S3	---	Wetland and Riparian Forest and Woodland	Riparian and Wetland Forest <i>Other</i>	--- ---

^a Scientific and common names used as the primary name in the MTNHP botany database (MTNHP 2024).

^b Global Rank as determined by NatureServe (2024). Refer to Box 4-1 and NatureServe Explorer: <https://explorer.natureserve.org/>

^c State Rank as determined by MTNHP (2024). Refer to Box 4-1 and MTNHP Montana Field Guide: <https://fieldguide.mt.gov/default.aspx>

^d Montana State Threat Score (MTNHP Threat Assessment 2021 or as updated).

^e Habitat of Greatest Conservation Need (HGCN) as defined by the Montana SWAP which uses the US National Vegetation Classification at three levels of scale.

3.7 Terrestrial Vertebrate SGCN and HGCN Associations

The critical importance of habitat to the conservation of species is evident throughout the SWAP, with the majority of threats and actions identified for SGCN being related to their habitat. It is therefore also critical to explicitly link SGCN in the SWAP to associated HGCN. This allows for a holistic approach to nongame conservation by considering the entire range of threats to a species, both those that directly affect the species and those that affect the environment it lives in. Linking SGCN and HGCN also draws clearer threads between conservation actions, whether they be species-specific or habitat-specific. Those working on habitat conservation on the landscape can better understand which species are most at-risk in those habitats, and then focus conservation efforts on habitats with the highest potential to conserve those species. Those working on single-species conservation or management can relate their species of interest to a wider range of conservation work that, while not focused on a single species or group, can still be highly beneficial for the simple reason that good habitat supports a greater abundance and diversity of the plants and animals that live there.

Most terrestrial vertebrate SGCN in the 2025 SWAP are associated with one or more HGCN. There are other habitats beyond those identified as HGCN in the SWAP that also support many SGCN, but those associations are not listed here. In order to link SGCN to HGCN, we only considered HGCN where the associated SGCN regularly breed or overwinter, or areas they travel through on migration routes. We then used the following information to assign SGCN to HGCN categories:

1. Incidental observations and structured survey results from various efforts across Montana via the MTNHP state-wide point observation database.
2. Review of literature that summarizes the breeding, overwintering, and/or migratory habitat requirements of each SGCN (Dobkin 1992, Hart et al. 1998, Hutto and Young 1999, Maxell 2000, Werner et al. 2004, Adams 2003, and Foresman 2012).
3. Evaluation of structural characteristics and distribution of each vegetation community associated with an HGCN relative to the species' range and habitat requirements.
4. Calculation of the percentage of observations associated with each HGCN relative to the percent of Montana covered by each HGCN to get a metric of the number of observations in the context of available habitat.

Species that breed in Montana were only evaluated for breeding habitat use. Species that only overwinter in Montana were only evaluated for overwintering habitat use. Species that only migrate through Montana were only evaluated for migratory habitat use. In general,

species are listed as associated with a HGCN if it contains structural characteristics known to be used by the species. However, species are not listed as associated with a vegetation community if we found no support in the literature for the species' use of structural characteristics of the community even if point observations were associated with it. Caspian Terns and Blue-gray Gnatcatchers were the only species without an associated HGCN.

Suggested Uses and Limitations

Species associations with HGCN should be used to generate potential lists of species that may occupy broader landscapes for the purposes of landscape-level planning. These potential lists of species should not be used in place of documented occurrences of species or predicted habitat suitability models (this information can be requested at: <https://mtnhp.mt.gov/requests/>), or systematic surveys for species and onsite evaluations of habitat by trained biologists. Users of this information should be aware that the land cover data used to generate species associations is based on satellite imagery from 2016 and was only intended to be used at broader landscape scales. Land-cover mapping accuracy is particularly problematic when the vegetation communities occur as small patches or where the land cover types have been altered over the past decade. Thus, caution should be taken when using the associations in assessments of smaller areas (e.g., evaluations of public land survey sections). Although a species may be associated with a particular HGCN within its known geographic range, portions of HGCN may occur outside of the species' known geographic range. Similarly, species are associated with a variety of HGCNs and these associations do not designate the relative importance of different HGCN.

Table 12. Forest and Woodland HGCN and associated SGCN.

Taxonomic Group	Species Name	Cedar - Hemlock Forest	Great Plains Mesic Forest and Woodland	Great Plains Ponderosa Pine Forest and Woodland	Rocky Mountain Aspen Forest and Woodland	Rocky Mountain Ponderosa Pine Forest and Woodland	Whitebark Pine - Subalpine Larch Forest and Woodland
Amphibian	Coeur d'Alene Salamander	•					
Amphibian	Idaho Giant Salamander	•					
Amphibian	Western Toad	•			•	•	•
Bird	Lewis's Woodpecker			•		•	
Bird	Black-backed Woodpecker	•		•		•	•
Bird	Boreal Chickadee	•					•
Bird	Brown Creeper	•				•	
Bird	Clark's Nutcracker					•	•
Bird	Evening Grosbeak	•			•	•	•
Bird	Golden Eagle		•	•	•	•	•
Bird	Northern Hawk Owl	•			•		•
Bird	Pacific Wren	•				•	•
Bird	Pileated Woodpecker	•				•	
Bird	Pinyon Jay			•		•	
Bird	White-tailed Ptarmigan						•
Bird	Alder Flycatcher				•		
Bird	Black-billed Cuckoo		•	•	•	•	
Bird	Brewer's Sparrow			•		•	
Bird	Ferruginous Hawk		•	•		•	

Bird	Flammulated Owl	•				•	
Bird	Green-tailed Towhee		•	•	•	•	
Bird	Loggerhead Shrike		•	•		•	
Bird	Red-headed Woodpecker		•	•			
Bird	Varied Thrush	•				•	•
Bird	Yellow-billed Cuckoo		•				
Bird	Eastern Screech-Owl		•	•		•	
Bird	Great Gray Owl	•			•		
Bird	Western Screech-Owl	•				•	•
Bird	Boreal Owl	•					
Bird	Chimney Swift		•	•			
Bird	Plumbeous Vireo		•	•		•	
Bird	Cassin's Finch	•		•	•	•	•
Bird	Dusky Grouse	•		•	•	•	•
Bird	Prairie Falcon		•	•	•	•	•
Bird	Cassin's Vireo	•				•	
Bird	Hammond's Flycatcher	•			•	•	
Bird	Red-naped Sapsucker	•	•	•	•	•	•
Bird	Upland Sandpiper			•			
Bird	Williamson's Sapsucker	•			•	•	
Mammal	Little Brown Myotis	•	•	•	•	•	
Mammal	Canada Lynx	•					
Mammal	Fisher	•			•		•
Mammal	Fringed Myotis	•	•	•	•	•	

Mammal	Long-eared Myotis	•	•	•	•	•	
Mammal	Long-legged Myotis	•	•	•	•	•	
Mammal	Merriam's Shrew			•		•	
Mammal	Pallid Bat		•				
Mammal	Preble's Shrew		•	•		•	•
Mammal	Silver-haired Bat	•	•	•	•	•	
Mammal	Townsend's Big-eared Bat	•	•	•	•	•	
Mammal	Western Pygmy Shrew	•			•		•
Mammal	Wolverine	•					•
Mammal	Yuma Myotis	•				•	
Mammal	Eastern Red Bat		•	•			
Mammal	Hoary Bat	•	•	•	•	•	•
Mammal	Hayden's Shrew		•	•			
Mammal	Meadow Jumping Mouse		•	•			
Mammal	North American Porcupine	•	•	•	•	•	•
Mammal	North American Water Vole	•					•
Mammal	Sagebrush Vole			•		•	
Reptile	Plains Hog-nosed Snake			•		•	
Reptile	Smooth Greensnake		•				
Reptile	Western Milksnake		•	•		•	
Reptile	Greater Short-horned Lizard			•		•	
Reptile	Northern Alligator Lizard	•				•	
Reptile	Western Skink	•				•	

Reptile	Northern Rubber Boa	.		.		.	
Reptile	Prairie Rattlesnake			.		.	

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Table 13. Grassland HGCN and associated SGCN.

Taxonomic Group	Species Name	Great Plains Dry Mixedgrass Prairie	Great Plains Mesic Mixedgrass Prairie	Great Plains Sand Prairie	Rocky Mountain Low Elevation - Dry Grassland
Bird	Greater Sage-Grouse	•	•		
Bird	Chestnut-collared Longspur	•	•	•	
Bird	Mountain Plover	•	•		
Bird	Golden Eagle	•	•	•	•
Bird	Baird's Sparrow	•	•	•	•
Bird	Bobolink	•	•		•
Bird	Burrowing Owl	•	•		
Bird	Ferruginous Hawk	•	•	•	•
Bird	Green-tailed Towhee				•
Bird	Loggerhead Shrike	•	•	•	•
Bird	Long-billed Curlew	•	•		•
Bird	Sprague's Pipit	•	•		
Bird	Thick-billed Longspur	•	•		
Bird	Western Screech-Owl				•
Bird	Dusky Grouse				•
Bird	Prairie Falcon	•	•	•	•
Bird	Grasshopper Sparrow	•	•	•	•
Bird	Lark Bunting	•	•	•	
Bird	Marbled Godwit	•	•		
Bird	Upland Sandpiper	•	•	•	•
Mammal	Black-footed Ferret	•	•	•	
Mammal	Little Brown Myotis	•	•	•	•
Mammal	Black-tailed Prairie Dog	•	•	•	
Mammal	Fringed Myotis				•
Mammal	Long-eared Myotis	•	•	•	•
Mammal	Long-legged Myotis				•

Mammal	Merriam's Shrew	•	•	•	•
Mammal	Pallid Bat	•	•	•	
Mammal	Preble's Shrew	•	•	•	•
Mammal	Silver-haired Bat	•	•	•	•
Mammal	Swift Fox	•	•		
Mammal	Townsend's Big-eared Bat				•
Mammal	Western Pygmy Shrew				•
Mammal	Yuma Myotis				•
Mammal	Eastern Red Bat	•	•		
Mammal	Hoary Bat	•	•		•
Mammal	Hayden's Shrew	•	•	•	•
Mammal	Meadow Jumping Mouse	•	•	•	•
Mammal	North American Porcupine	•	•		•
Mammal	Sagebrush Vole	•	•	•	
Reptile	Plains Hog-nosed Snake	•	•	•	
Reptile	Smooth Greensnake	•	•	•	
Reptile	Western Milksnake	•	•	•	•
Reptile	Greater Short-horned Lizard	•	•	•	•
Reptile	Western Skink				•
Reptile	Northern Rubber Boa				•
Reptile	Prairie Rattlesnake	•	•	•	•

Table 14. Shrubland HGCN and associated SGCN.

Taxonomic Group	Species Name	Basin and Wyoming Big (Threetip) Sagebrush Shrubland	Lowland - Montane Shrubland	Mountain Big Sagebrush Shrubland	Mountain Mahogany Woodland and Shrubland
Amphibian	Western Toad	•	•	•	
Bird	Greater Sage-Grouse	•		•	
Bird	Mountain Plover	•			
Bird	Clark's Nutcracker		•		•
Bird	Evening Grosbeak		•		
Bird	Golden Eagle	•	•	•	•
Bird	Northern Hawk Owl		•		
Bird	Pinyon Jay				•
Bird	Brewer's Sparrow	•		•	
Bird	Burrowing Owl	•		•	
Bird	Ferruginous Hawk	•	•	•	
Bird	Green-tailed Towhee	•	•	•	•
Bird	Loggerhead Shrike	•		•	•
Bird	Sage Thrasher	•		•	
Bird	Sagebrush Sparrow	•		•	
Bird	Varied Thrush		•		
Bird	Gray Flycatcher	•		•	•
Bird	Dusky Grouse	•	•	•	
Bird	Prairie Falcon	•	•	•	•
Bird	Cassin's Vireo		•		
Bird	Hammond's Flycatcher		•		
Bird	Lark Bunting	•		•	
Bird	Marbled Godwit	•			
Bird	Red-naped Sapsucker		•		•
Bird	Upland Sandpiper	•		•	

Mammal	Black-footed Ferret	•			
Mammal	White-tailed Prairie Dog	•			
Mammal	Little Brown Myotis	•	•	•	•
Mammal	Black-tailed Prairie Dog	•			
Mammal	Fringed Myotis	•	•	•	•
Mammal	Long-eared Myotis	•	•	•	•
Mammal	Long-legged Myotis	•	•	•	•
Mammal	Merriam's Shrew	•	•	•	•
Mammal	Pallid Bat	•			•
Mammal	Preble's Shrew	•	•	•	•
Mammal	Pygmy Rabbit	•		•	
Mammal	Silver-haired Bat	•	•	•	•
Mammal	Townsend's Big-eared Bat	•	•	•	•
Mammal	Western Pygmy Shrew		•		
Mammal	Yuma Myotis		•		•
Mammal	Eastern Red Bat	•			
Mammal	Hoary Bat	•	•	•	•
Mammal	Hayden's Shrew	•	•		
Mammal	Meadow Jumping Mouse	•			
Mammal	North American Porcupine	•	•	•	•
Mammal	Sagebrush Vole	•		•	
Reptile	Plains Hog-nosed Snake	•			
Reptile	Western Milksnake	•	•		•
Reptile	Greater Short-horned Lizard	•			
Reptile	Northern Alligator Lizard		•		
Reptile	Western Skink		•		
Reptile	Northern Rubber Boa		•		•
Reptile	Prairie Rattlesnake	•	•	•	•

Table 15. Riparian and Wetland HGCN and associated SGCN, part 1.

Taxonomic Group	Species Name	Arid West Freshwater Marsh and Wet Meadow	Greasewood Shrubland	Great Plains Floodplain Forest	Great Plains Freshwater Marsh	Great Plains Saline Marsh and Wet Meadow	Great Plains Wet Meadow, Marsh, and Shrub Swamp	Intermountain Alkaline - Saline Grassland and Meadow	Lowland - Montane Riparian Deciduous Forest
Amphibian	Western Toad	•			•	•	•		•
Amphibian	Northern Leopard Frog	•		•	•	•	•		
Bird	Whooping Crane	•		•	•	•	•		
Bird	Black Rosy-Finch								
Bird	Gray-crowned Rosy-Finch								
Bird	Greater Sage-Grouse		•	•				•	
Bird	Harlequin Duck								•
Bird	Least Tern			•					
Bird	Lewis's Woodpecker								•
Bird	Mountain Plover		•					•	
Bird	Piping Plover	•		•	•	•	•		
Bird	Solitary Sandpiper	•	•	•	•	•	•	•	•
Bird	Black-backed Woodpecker								•

Bird	Boreal Chickadee								•
Bird	Brown Creeper								•
Bird	Clark's Nutcracker								•
Bird	Evening Grosbeak								•
Bird	Golden Eagle		•	•				•	•
Bird	Great Blue Heron	•		•	•	•	•		•
Bird	Northern Hawk Owl								•
Bird	Pacific Wren								•
Bird	Pileated Woodpecker								•
Bird	Pinyon Jay			•					•
Bird	Trumpeter Swan	•			•	•	•		•
Bird	White-tailed Ptarmigan								
Bird	Alder Flycatcher			•					•
Bird	American Bittern	•	•	•	•	•	•	•	•
Bird	American White Pelican	•			•	•	•		
Bird	Baird's Sparrow	•		•	•	•	•		
Bird	Black Tern	•			•	•	•		
Bird	Black-billed Cuckoo			•					•

Bird	Black-crowned Night Heron	•		•	•	•	•		•
Bird	Black-necked Stilt	•	•		•	•	•	•	
Bird	Bobolink	•		•	•	•	•		
Bird	Burrowing Owl		•					•	
Bird	Clark's Grebe	•			•	•	•		
Bird	Common Loon	•			•	•	•		
Bird	Common Tern	•		•	•	•	•		•
Bird	Ferruginous Hawk		•	•		•	•	•	
Bird	Forster's Tern	•			•	•	•		
Bird	Franklin's Gull	•		•	•	•	•		
Bird	Green-tailed Towhee			•					•
Bird	Horned Grebe	•			•	•	•		
Bird	LeConte's Sparrow	•		•	•	•	•		
Bird	Loggerhead Shrike		•	•		•	•	•	
Bird	Nelson's Sparrow	•		•	•	•	•		
Bird	Red-headed Woodpecker			•					
Bird	Sedge Wren	•			•	•	•		
Bird	Varied Thrush								•

Bird	White-faced Ibis	•		•	•	•	•		•
Bird	Yellow Rail	•			•	•	•		
Bird	Yellow-billed Cuckoo			•					•
Bird	Eastern Screech-Owl			•					•
Bird	Great Gray Owl								•
Bird	Western Screech-Owl								•
Bird	Boreal Owl								
Bird	Chimney Swift			•					
Bird	Plumbeous Vireo			•					
Bird	Cassin's Finch								•
Bird	Dusky Grouse								•
Bird	Prairie Falcon		•	•				•	•
Bird	Cassin's Vireo								•
Bird	Grasshopper Sparrow			•					
Bird	Hammond's Flycatcher								•
Bird	Lark Bunting		•	•				•	
Bird	Marbled Godwit	•	•	•	•	•	•	•	
Bird	Red-naped Sapsucker			•					•
Bird	Upland Sandpiper	•	•	•	•	•	•	•	

Bird	Williamson's Sapsucker								•
Mammal	Northern Myotis			•					
Mammal	Northern Bog Lemming	•			•	•	•		•
Mammal	Little Brown Myotis	•	•	•	•	•	•	•	•
Mammal	Canada Lynx								•
Mammal	Fisher								•
Mammal	Fringed Myotis	•		•	•	•	•		•
Mammal	Long-eared Myotis	•	•	•	•	•	•	•	•
Mammal	Long-legged Myotis	•		•	•	•	•		•
Mammal	Merriam's Shrew		•	•				•	
Mammal	Pallid Bat			•					
Mammal	Preble's Shrew		•			•	•	•	
Mammal	Silver-haired Bat	•	•	•	•	•	•	•	•
Mammal	Townsend's Big-eared Bat	•		•	•	•	•		•
Mammal	Western Pygmy Shrew	•			•	•	•		•
Mammal	Wolverine								
Mammal	Yuma Myotis	•			•	•	•		•
Mammal	Eastern Red Bat	•		•	•	•	•		
Mammal	Hoary Bat	•	•	•	•	•	•	•	•

Mammal	Hayden's Shrew	•	•	•	•	•	•	•	
Mammal	Hoary Marmot								
Mammal	Meadow Jumping Mouse	•		•	•	•	•		
Mammal	North American Porcupine			•					•
Mammal	North American Water Vole								
Mammal	Sagebrush Vole		•	•				•	
Reptile	Plains Hog-nosed Snake	•	•	•	•	•	•	•	
Reptile	Smooth Greensnake	•		•	•	•	•		
Reptile	Western Milksnake		•	•				•	
Reptile	Greater Short-horned Lizard			•					
Reptile	Northern Alligator Lizard								•
Reptile	Snapping Turtle	•		•	•	•	•		
Reptile	Spiny Softshell			•					
Reptile	Western Skink								•

Reptile	Northern Rubber Boa			•					•
Reptile	Prairie Rattlesnake		•	•				•	

Table 15 continued. Riparian and Wetland HGCN and associated SGCN, part 2.

Taxonomic Group	Species Name	Lowland - Montane Riparian Shrubland	Montane Forested Wetland	Montane - Subalpine Riparian and Seep Shrubland	Montane - Subalpine Riparian Forest	Montane Wet Meadow and Marsh	Rocky Mountain Acidic Fen	Rocky Mountain Alkaline Fen	Alpine - Subalpine Herbaceous and Dwarf-Shrub Riparian and Wetland
Amphibian	Western Toad	•	•	•	•	•	•	•	•
Amphibian	Northern Leopard Frog								
Bird	Whooping Crane								
Bird	Black Rosy-Finch					•			•
Bird	Gray-crowned Rosy-Finch					•			•
Bird	Greater Sage-Grouse								
Bird	Harlequin Duck	•	•	•	•				
Bird	Least Tern								
Bird	Lewis's Woodpecker		•		•				
Bird	Mountain Plover								

Bird	Piping Plover								
Bird	Solitary Sandpiper	•	•	•	•	•	•	•	•
Bird	Black-backed Woodpecker		•		•				
Bird	Boreal Chickadee		•		•				
Bird	Brown Creeper		•		•				
Bird	Clark's Nutcracker	•	•	•	•	•	•	•	•
Bird	Evening Grosbeak	•	•	•	•				
Bird	Golden Eagle								•
Bird	Great Blue Heron	•	•	•	•	•	•	•	•
Bird	Northern Hawk Owl		•		•		•	•	
Bird	Pacific Wren		•		•				
Bird	Pileated Woodpecker		•		•				
Bird	Pinyon Jay	•	•		•				
Bird	Trumpeter Swan	•				•			•
Bird	White-tailed Ptarmigan								•
Bird	Alder Flycatcher	•	•	•	•		•	•	
Bird	American Bittern	•	•	•	•	•	•	•	•
Bird	American White Pelican								

Bird	Baird's Sparrow								
Bird	Black Tern								
Bird	Black-billed Cuckoo	•		•					
Bird	Black-crowned Night Heron		•	•	•	•			
Bird	Black-necked Stilt								
Bird	Bobolink					•			•
Bird	Burrowing Owl								
Bird	Clark's Grebe								
Bird	Common Loon								
Bird	Common Tern								
Bird	Ferruginous Hawk					•			•
Bird	Forster's Tern								
Bird	Franklin's Gull					•			•
Bird	Green-tailed Towhee	•	•	•	•	•			•
Bird	Horned Grebe								
Bird	LeConte's Sparrow					•	•	•	•
Bird	Loggerhead Shrike								
Bird	Nelson's Sparrow								

Bird	Red-headed Woodpecker								
Bird	Sedge Wren								
Bird	Varied Thrush		•	•	•		•	•	
Bird	White-faced Ibis					•			•
Bird	Yellow Rail								
Bird	Yellow-billed Cuckoo	•	•	•	•				
Bird	Eastern Screech-Owl	•	•	•	•				
Bird	Great Gray Owl	•	•		•	•	•	•	•
Bird	Western Screech-Owl	•	•		•	•			•
Bird	Boreal Owl		•	•	•	•			•
Bird	Chimney Swift		•		•				
Bird	Plumbeous Vireo	•							
Bird	Cassin's Finch		•		•				
Bird	Dusky Grouse	•	•	•	•	•			•
Bird	Prairie Falcon	•	•		•	•			•
Bird	Cassin's Vireo		•	•	•	•	•	•	•
Bird	Grasshopper Sparrow								
Bird	Hammond's Flycatcher	•	•	•	•				
Bird	Lark Bunting								
Bird	Marbled Godwit								

Bird	Red-naped Sapsucker	•	•	•	•				
Bird	Upland Sandpiper								
Bird	Williamson's Sapsucker	•	•	•	•				
Mammal	Northern Myotis								
Mammal	Northern Bog Lemming	•	•	•	•	•	•	•	•
Mammal	Little Brown Myotis	•	•	•	•	•	•	•	•
Mammal	Canada Lynx		•	•	•				
Mammal	Fisher	•	•	•	•		•	•	•
Mammal	Fringed Myotis	•	•	•	•	•			•
Mammal	Long-eared Myotis	•	•	•	•	•	•	•	•
Mammal	Long-legged Myotis	•	•	•	•	•			•
Mammal	Merriam's Shrew								
Mammal	Pallid Bat								
Mammal	Preble's Shrew								
Mammal	Silver-haired Bat	•	•	•	•	•	•	•	•
Mammal	Townsend's Big-eared Bat	•	•	•	•				
Mammal	Western Pygmy Shrew	•	•	•	•	•	•	•	•
Mammal	Wolverine		•	•	•	•			•
Mammal	Yuma Myotis			•		•			•

Mammal	Eastern Red Bat								
Mammal	Hoary Bat	•	•	•	•	•			•
Mammal	Hayden's Shrew								
Mammal	Hoary Marmot					•			•
Mammal	Meadow Jumping Mouse								
Mammal	North American Porcupine	•	•	•	•				
Mammal	North American Water Vole		•	•	•	•	•	•	•
Mammal	Sagebrush Vole								
Reptile	Plains Hog-nosed Snake								
Reptile	Smooth Greensnake								
Reptile	Western Milksnake								
Reptile	Greater Short-horned Lizard								
Reptile	Northern Alligator Lizard								
Reptile	Snapping Turtle								

Reptile	Spiny Softshell								
Reptile	Western Skink								
Reptile	Northern Rubber Boa	•							
Reptile	Prairie Rattlesnake	•							

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CHAPTER 4:

SPECIES OF GREATEST INFORMATION NEED

Element 1. Species

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

4.1 Introduction

Species of Greatest Information Need (SGIN) lack enough information about population status, trend, and/or threats to the species to determine their state status rank. SGIN are species that have the highest need for additional information because they lack baseline surveys, have outdated surveys, lack scientific information about important life history traits or habitat associations, and/or we have low confidence in the existing information about the species.

We emphasize that SGIN are not less important than SGCN; they are just lacking information largely due to difficulties in detecting or counting the species. For example, species that are cryptic and/or difficult to capture may require large amounts of time, funding, and person-power to obtain even basic data on current populations, much less evaluate those populations' trends over time. Our goal with identifying SGIN is to focus resources on gathering the most useful information with the greatest efficiency, resulting in an ability for the Species of Concern Committee to assign a state conservation status rank. As species are removed from the SGIN list, they may be added to the SGCN list if their conservation status rank places them within the criteria for inclusion as SGCN. Threats and conservation actions were not developed for SGIN species, in recognition of the need for evaluating their status in the state first.

Montana's 2025 State Wildlife Action Plan (SWAP) identifies 98 Species of Greatest Information Need (SGIN), including 12 birds, 11 fish, 14 mammals, 26 aquatic invertebrates, and 35 terrestrial invertebrates. These SGIN are considered SWAP species and are eligible for federal funding. We recognize the outstanding need to collect baseline data on all plants and invertebrates in the state. However, including all these species as Species of Greatest Information Need in the SWAP would be too long and cumbersome. We are including a small portion of plant and invertebrate species as SGIN in the SWAP based on feedback from species experts which we believe to be a key step towards expanding our knowledge about Montana's species and informing conservation needs and strategies.

4.2 Methods

The identification of SGIN stems from the same species status ranking process outlined for identifying SGCN in Chapter 3. However, the identification of SGIN necessarily acknowledges the lack of information for confidently assigning an S-rank to a species. Therefore, SGIN were selected almost entirely from species with no numerical S-rank, except for special circumstances (Table 16).

Table 16. Criteria used to identify Species of Greatest Information Need (SGIN) categories for vertebrates, terrestrial invertebrates, and aquatic invertebrates for the 2025 Montana State Wildlife Action Plan.

SGIN Category	Criteria
Vertebrate SGIN	1. State conservation status rank of SU. 2. State conservation status rank of S4 or S5 with either: a. Known declines in parts of the species' range outside of Montana and lacking information on whether the species is declining in Montana. b. Gaps in information for rarity (range extent, area of occupancy, or habitat associations), threats, or short-term trends that, if documented, would allow the conservation status of a species to be more adequately assigned.
Terrestrial Invertebrate SGIN	1. State conservation status rank of SNR or SU that were nominated by taxonomic experts.
Aquatic Invertebrate SGIN	1. State conservation status rank of SU that were nominated by taxonomic experts. 2. Global conservation status rank of G1, G2, G3 that were nominated by taxonomic experts.

4.3 Vertebrate SGIN List

We included 37 vertebrate species as SGIN in the 2025 SWAP. Of these SGIN, 17 were classified as SU and an additional 20 species were included that were ranked S4 or S5, but for which critical information for determining their status as SGCN is missing or there are documented declines in other areas. The Vertebrate SGIN list includes 12 birds, 11 fish, and 14 mammals (Table 17).

Table 17. List of vertebrate Species of Greatest Information Need (SGIN) included in the 2025 Montana State Wildlife Action Plan. Species are arranged alphabetically by group, then by state rank, and then alphabetically by common name.

Group	Common Name	Scientific Name	State Rank
Bird	Peregrine Falcon	<i>Falco peregrinus</i>	S4
Bird	Short-eared Owl	<i>Asio flammeus</i>	S4
Bird	Common Poorwill	<i>Phalaenoptilus nuttallii</i>	S4B
Bird	Olive-sided Flycatcher	<i>Contopus cooperi</i>	S4B
Bird	Rufous Hummingbird	<i>Selasphorus rufus</i>	S4B
Bird	Western Grebe	<i>Aechmophorus occidentalis</i>	S4B
Bird	Willet	<i>Tringa semipalmata</i>	S4B
Bird	Wilson's Phalarope	<i>Phalaropus tricolor</i>	S4B
Bird	American Kestrel	<i>Falco sparverius</i>	S5
Bird	Common Nighthawk	<i>Chordeiles minor</i>	S5B
Bird	Bewick's Wren	<i>Thryomanes bewickii</i>	SU
Bird	Northern Mockingbird	<i>Mimus polyglottos</i>	SUB
Fish	Burbot	<i>Lota lota</i>	S4
Fish	Creek Chub	<i>Semotilus atromaculatus</i>	S4
Fish	Plains Minnow	<i>Hybognathus placitus</i>	S4
Fish	Bigmouth Buffalo	<i>Ictiobus cyprinellus</i>	S4S5
Fish	Brassy Minnow	<i>Hybognathus hankinsoni</i>	S5
Fish	Sand Shiner	<i>Miniellus stramineus</i>	S5
Fish	Deepwater Sculpin	<i>Myoxocephalus thompsonii</i>	SU
Fish	Lake Whitefish	<i>Coregonus clupeaformis</i>	SU
Fish	Northern Pike	<i>Esox lucius</i>	SU
Fish	Spoonhead Sculpin	<i>Cottus ricei</i>	SU
Fish	Trout-perch	<i>Percopsis omiscomaycus</i>	SU
Mammal	California Myotis	<i>Myotis californicus</i>	S4
Mammal	Common Muskrat	<i>Ondatra zibethicus</i>	S4
Mammal	Spotted Bat	<i>Euderma maculatum</i>	S4
Mammal	Western Small-footed Myotis	<i>Myotis ciliolabrum</i>	S4
Mammal	Arctic Shrew	<i>Sorex arcticus</i>	SU
Mammal	Black-tailed Jackrabbit	<i>Lepus californicus</i>	SU

Mammal	Dwarf Shrew	<i>Sorex nanus</i>	SU
Mammal	Eastern Cottontail	<i>Sylvilagus floridanus</i>	SU
Mammal	Hispid Pocket Mouse	<i>Chaetodipus hispidus</i>	SU
Mammal	Idaho Pocket Gopher	<i>Thomomys idahoensis</i>	SU
Mammal	Northern Short-tailed Shrew	<i>Blarina brevicauda</i>	SU
Mammal	Uinta Ground Squirrel	<i>Urocitellus armatus</i>	SU
Mammal	Western Spotted Skunk	<i>Spilogale gracilis</i>	SU
Mammal	Wyoming Ground Squirrel	<i>Urocitellus elegans</i>	SU

4.4 Terrestrial Invertebrate SGIN List

We included 35 terrestrial invertebrate species as SGIN in the 2025 SWAP. The terrestrial invertebrate SGIN list includes 1 ant, 1 arachnid, 5 bees, 10 beetles, 6 butterflies, 1 cricket, 1 lacewing, 1 mantis, 8 moths, and 1 rock crawler (Table 18).

Table 18. List of terrestrial invertebrate Species of Greatest Information Need (SGIN) included in the 2025 Montana State Wildlife Action Plan. Species are arranged alphabetically by group, then by state rank, and then alphabetically by common name.

Group	Common Name	Scientific Name	State Rank	G Rank
Ant	A Velvet Ant	<i>Dasymutilla stevensi</i>	SNR	GNR
Arachnid	A Solifuge	<i>Eremobates ascopulatus</i>	SNR	GNR
Bee	A Leafcutter Bee	<i>Dianthidium singulare</i>	SNR	GNR
Bee	A Leafcutting Bee	<i>Dianthidium cressonii</i>	SNR	GNR
Bee	Buckell's Miner Bee	<i>Andrena buckelli</i>	SNR	GNR
Bee	Common Loosestrife Oil Bee	<i>Macropis nuda</i>	SNR	GNR
Bee	Prickly Pear Bee	<i>Macrotera opuntiae</i>	SNR	GNR
Beetle	A Bombardier Beetle	<i>Metrius explodens</i>	SNR	GNR
Beetle	A Click Beetle	<i>Athoplastus acutus</i>	SNR	GNR
Beetle	A Click Beetle	<i>Beckerus barri</i>	SNR	GNR
Beetle	Enigma Ladybeetle	<i>Allenius iviei</i>	SNR	GNR
Beetle	Granular-necked Firefly	<i>Photinus granulicollis</i>	SNR	GU
Beetle	Nine-spotted Lady Beetle	<i>Coccinella novemnotata</i>	SNR	G5
Beetle	Prairie Dung Beetle	<i>Canthon praticola</i>	SNR	G5
Beetle	Rainbow Scarab	<i>Phanaeus vindex</i>	SNR	GNR
Beetle	Rocky Mountain Firefly	<i>Photinus faculus</i>	SNR	GU
Beetle	Simple Dung Beetle	<i>Canthon simplex</i>	SNR	GNR
Butterfly	Clodius Parnassian	<i>Parnassius clodius</i>	SU	G5
Butterfly	Colorado Alpine	<i>Erebia callias</i>	SU	G4G5
Butterfly	Melissa Arctic	<i>Oeneis melissa</i>	SU	G5
Butterfly	Northern Marble	<i>Euchloe creusa</i>	SU	G5

Butterfly	Red-disked Alpine	<i>Erebia discoidalis</i>	SU	G5
Butterfly	White-veined Arctic	<i>Oeneis bore</i>	SU	G5
Cricket	Sagebrush Grig	<i>Cyphoderris strepitans</i>	SNR	GNR
Lacewing	Giant Lacewing	<i>Polystoechotes punctatus</i>	SU	GNR
Mantis	Skinner's Ground Mantis	<i>Litaneutria skinneri</i>	SNR	GNR
Moth	A Dart Moth	<i>Euxoa dodi</i>	SNR	GNR
Moth	A Dart Moth	<i>Euxoa inscripta</i>	SNR	GNR
Moth	A Geometrid Moth	<i>Chesiadodes montanaensis</i>	SNR	GNR
Moth	A Noctuid Moth	<i>Protophygia pryorensis</i>	SNR	GNR
Moth	A Noctuid Moth	<i>Protophygia alberta</i>	SNR	GNR
Moth	A Noctuid Moth	<i>Sympistis sesmu</i>	SNR	GNR
Moth	Cecropia Silkworm	<i>Hyalophora cecropia</i>	SNR	G5
Moth	Dune Cutworm Moth	<i>Euxoa aurulenta</i>	SNR	G5
Rock Crawler	Northern Rock Crawler	<i>Grylloblatta campodeiformis</i>	SU	GNR

4.5 Aquatic Invertebrate SGIN List

We included 26 aquatic invertebrate species as SGIN in the 2025 SWAP. Of these SGIN, all 26 were classified as SU, and 24 were ranked as G1, G2, or G3, and were nominated by taxa experts. The Aquatic Invertebrate SGIN list includes 9 caddisflies, 7 crustaceans, 5 mayflies, 3 mollusks, and 2 stoneflies (Table 19).

Table 19. List of aquatic invertebrate Species of Greatest Information Need (SGIN) for the 2025 Montana State Wildlife Action Plan. Species are arranged alphabetically by group, then by state rank, and then alphabetically by common name.

Group	Common Name	Scientific Name	State Rank	G Rank
Caddisflies	A Caddisfly	<i>Allomyia hector</i>	SU	G1G2
Caddisflies	A Caddisfly	<i>Apatania comosa</i>	SU	G2G3
Caddisflies	A Caddisfly	<i>Cryptochia furcata</i>	SU	G3G4
Caddisflies	A Caddisfly	<i>Glossosoma idaho</i>	SU	G2G3
Caddisflies	A Caddisfly	<i>Philocasca antennata</i>	SU	G1G3
Caddisflies	A Rhyacophilan Caddisfly	<i>Rhyacophila donaldi</i>	SU	G2G3
Caddisflies	A Rhyacophilan Caddisfly	<i>Rhyacophila ophrys</i>	SU	G1G3
Caddisflies	A Rhyacophilan Caddisfly	<i>Rhyacophila oreia</i>	SU	G2
Caddisflies	A Rhyacophilan Caddisfly	<i>Rhyacophila robusta</i>	SU	G2G3
Crustaceans	A Cave Obligate Amphipod	<i>Stygobromus montanensis</i>	SU	G1
Crustaceans	A Cave Obligate Amphipod	<i>Stygobromus obscurus</i>	SU	G1
Crustaceans	A Cave Obligate Amphipod	<i>Stygobromus puteanus</i>	SU	G1
Crustaceans	Worn Stygobromid	<i>Stygobromus tritus</i>	SU	G1
Crustaceans	Great Basin Tadpole Shrimp	<i>Lepidurus bilobatus</i>	SU	G2G3

Crustaceans	Hookleg Clam Shrimp	<i>Lynceus mucronatus</i>	SU	G3
Crustaceans	Ornate Fairy Shrimp	<i>Eubbranchipus ornatus</i>	SU	G3
Mayflies	A Mayfly	<i>Ameletus bellulus</i>	SU	G3
Mayflies	A Mayfly	<i>Cinygma dimicki</i>	SU	G3
Mayflies	A Mayfly	<i>Isaiaea rubrolaterale</i>	SU	G2
Mayflies	A Mayfly	<i>Leucrocota petersi</i>	SU	G2G3
Mayflies	A Mayfly	<i>Siphonurus autumnalis</i>	SU	G2G4
Mollusks	Flathead Pondsail	<i>Ladislavella elrodi</i>	SU	G1
Mollusks	Lake Amnicola	<i>Amnicola sp. 2</i>	SU	G1
Mollusks	Longmouth Pondsail	<i>Ladislavella elrodiana</i>	SU	G1
Stoneflies	Ice Snowfly	<i>Bolshecapnia spenceri</i>	SU	G3
Stoneflies	Sexton clade Forestfly	<i>Zapada Sexton clade</i>	SU	GNR

CHAPTER 5:

THREATS AND CONSERVATION ACTIONS

Element 3. Threats/Stressors

The problems that may adversely affect SGCN or their habitats, and priority research and surveys needed to identify factors that may assist in restoration and improved conservation of SGCN and their habitats

Element 4. Actions

The actions necessary to conserve SGCN and their habitats and the priorities for implementing such conservation actions

5.1 Introduction

In Chapters 2 and 3, we outlined Habitats of Greatest Conservation Need (HGCN) and Species of Greatest Conservation Need (SGCN) identified in the SWAP, setting the foundation for which species and habitats are highest priority for investments in conservation in Montana. But identifying species and habitats is only part of the larger picture of conservation, and the next step is to identify what threats make these species and habitats a high priority in the first place.

There is no use in identifying threats to HGCN and SGCN without pairing those threats with a plan for what we can do about them. We only identified a threat to a species or habitat if there were tangible conservation actions that could be taken to address that threat. Of course, almost always there were multiple actions that could address each threat, and similarly there were usually multiple threats that could be addressed by each action. As the SWAP technical teams and external experts compiled more than 6,000 threats and actions for the 2025 SWAP, the complexity of the interactions between threats and actions became apparent. One of the heaviest lifts in the process of revising the SWAP was organizing threats and actions, but the result is a comprehensive look at what is impacting our natural resources in Montana and what we can do about it.

This chapter covers a wide breadth of threats and actions for species and habitats in recognition that for most species and habitats, degradation and population declines are rarely the result of a single or small number of threats. Instead, many interacting threats come into play and which threats are most impactful changes across space and time. It is therefore important to outline the entire range of threats and actions so that FWP and its partners can then use more localized knowledge to identify which actions are most applicable to their geographic area or area of expertise and the specific threats that are most important in those contexts.

While we include a great many threats and actions in this SWAP, the format does not lend itself to fully capturing and communicating the entirety of the information compiled by the technical teams and external experts. The full detail of all the threats and actions identified as part of the SWAP revision will be included in a forthcoming SWAP dashboard. This dashboard will allow this complex web of interacting threats and actions to be databased, sorted, and queried by users looking for more in-depth information on a particular species or habitat. The SWAP dashboard, combined with the action-based focal area mapping (Chapter 6), will make the immense information we compiled about conservation threats and actions easier to visualize, understand, and act upon for FWP and its partners.

5.2 Identifying Threats and Conservation Actions for HGCN

For Montana's 2025 SWAP, threats and conservation actions were identified for all Habitats of Greatest Conservation Need (HGCN). As defined in Table 2, Elements 3 and 4, "threats" are problems for species and habitats, and "actions" are responses FWP and other partners can take to help reduce the adverse effects of those problems. Lists of threats and actions for each HGCN were assembled and reviewed by the habitat teams that worked to identify HGCN (see Chapter 2 for that process). Additionally, the SWAP habitat team hosted a partner engagement workshop at the Montana Chapter of The Wildlife Society (5 March 2025) that was attended by 37 people from 18 organizations. During this workshop, teams of partners, led by members of the habitat team, worked to brainstorm threats and actions for HGCN while considering the suite of SGCN those habitats support. Additional threats and actions were identified through expert experience and review of other State Wildlife Action plans and habitat management plans.

After lists of threats and actions were generated, they were categorized under the Conservation Measures Partnership Threats and Actions Classification System (Version 2.0, Salafsky et al. 2008, Appendix F). Because many threats and actions were shared across all HGCN, threats and actions are presented in a hierarchical structure, with threats and actions applicable to all HGCN presented first, and those applicable to specific HGCN presented within the HGCN habitat profiles. Threats and actions for HGCN can be considered threats and actions for the SGCN that use those habitats. In the SGCN threats and actions section, we outline any threats and actions that were specific to a particular SGCN and were not habitat related.

Through the process of compiling threats and actions for HGCN, the technical teams made decisions about grouping HGCN based on whether identified threats and actions were specific to certain types of HGCN or were widely applicable to all HGCN in a given category (Grassland, Shrubland, Forest and Woodland, Wetland and Riparian, River and Stream, Lake and Reservoir). In most cases, threats and actions were best communicated at the broadest level of HGCN classification (Tables 4 and 5). We provide more specific threats

and actions for some Forest and Woodland and Shrubland sub-categories, but for all other HGCN threats and actions are outlined at the broadest classification level.

5.3 Identifying Threats and Conservation Actions for SGCN

For Montana's 2025 SWAP, conservation actions and their corresponding threats were identified for all SGCN species. Lists of threats and actions for each species were then assembled and reviewed by a technical team consisting of two to five biologists, including a representative from FWP working with species experts from partner organizations. Overall, 140 people representing 37 partner organizations served on these species expert teams. The teams reviewed threats documented by the Montana Natural Heritage Program (MTNHP), as well as threats and actions listed in Montana's 2015 SWAP. They also identified additional threats and actions by drawing on scientific literature, conservation plans, and expert opinion. For species that are native in one part of the state and introduced in other parts of the state, the species teams were instructed to consider threats and actions for species only for the native portion of the population. For example, snapping turtles are native east of the Continental Divide in Montana but are introduced and problematic for other SGCN west of the Continental Divide. Therefore, threats and actions presented herein for snapping turtles apply only to the native portion of the species range.

Conservation actions and threats for SGCN were categorized according to the Conservation Measures Partnership Threats and Actions Classification System (Version 2.0; Salafsky et al. 2008, Appendix F), as recommended in the *Best Practices for State Wildlife Action Plans Voluntary Guidance to States for Revision and Implementation* developed by the Association of Fish and Wildlife Agencies (AFWA 2012). The intent of this classification system is to provide standard language for terms used by the conservation community (Appendix F). This classification system is also employed in MTNHP's species status assessments, and any new threats and actions identified through this SWAP revision will be reviewed for potential inclusion in species status rank revisions by MTNHP. All identified actions are linked to the threat(s) they address, allowing the same actions to be linked to multiple threats and vice-versa.

We employed a hierarchical approach to presenting threats and actions in the 2025 SWAP. A majority of threats and actions identified for SGCN pertain to habitat and are directly addressed in the threats and actions for HGCN. Threats actions for SGCN that are addressed in the threats and actions for the HGCN those SGCN are associated with have therefore been excluded from the SGCN threats and actions tables. (See Section 3.7 for associations between SGCN and HGCN). As such, the threats and actions presented for SGCN are constrained to those that are species-specific. Habitat-related actions may still be included where they require species-specific information to implement.

Additionally, we have excluded actions pertaining to research and monitoring (Conservation Measures Partnership Threats and Actions Classification System Action 8.0) from the HGCN and SGCN summaries because these actions are being summarized and considered separately as forthcoming “Research Needs.” For species with existing management plans (e.g., sage-grouse), a selection of key threats and actions have been included, and the species-specific management plans have been linked. In the forthcoming SWAP dashboard, habitat threats and actions that provide the foundation for species conservation will be linked to individual species accounts.

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5.4 HGCN Profiles with Threats and Conservation Actions

Actions for the conservation of Habitats of Greatest Conservation Need (HGCN) are provided below, along with their corresponding threats, organized by the Conservation Measures Partnership Threats and Actions classification systems (Version 2.0, Salafsky et al. 2008, Appendix F). Threats and actions that are relevant to all HGCN are provided first, followed by tables relevant to specific HGCN.

In addition to the actions provided in the tables, addressing any of the threats herein would generally be aided by:

1. Providing decision makers with data, analysis, and interpretation regarding threats to HGCN and outlining effective conservation actions to address those threats.
2. Highlighting successful HGCN restoration, maintenance, and enhancement projects through a wide variety of media outlets.
3. Investigating the need for, and then creating or updating, guidance documents that are useful for minimizing negative impacts to HGCN.
4. Working with schools, universities, and the general public to include education around HGCN and threats and actions related to HGCN in curriculums.

Threats and Actions Applicable to All HGCN

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Avoid or minimize the use of pesticides and herbicides. Use alternative methods for invasive plant control before moving on to herbicides (e.g., biocontrol, mechanical removal, organic agriculture). If pesticides and herbicides must be used, follow Best Management Practices (e.g. Integrated Pest Management (IPM) guidelines provided by EPA, Managed Pollinator Protection Plan developed by MT Department of Agriculture) and use experienced applicators to minimize risk to riparian vegetation and invertebrate prey base.	9.3 Agricultural & Forestry Effluents	Pesticide, herbicide, and fertilizer use, runoff and contamination.
		2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.
		7.3 Other Ecosystem Modifications	Incompatible vegetation management, including timber harvest, and/or lack of vegetation management.
		8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.
		8.2 Problematic Native Plants & Animals	Ungulate over-grazing and over-browsing.

		9.1 Household Sewage & Urban Waste Water	Urban and transportation runoff and contamination changes nutrient cycling.
		9.2 Industrial & Military Effluents	Commercial & Industrial Effluents.
		9.3 Agricultural & Forestry Effluents	Pesticide, herbicide, and fertilizer use, runoff and contamination.
	Create or maintain corridors of native vegetation around and through converted habitat to facilitate movement among and between HGCM (shrubby draws, riparian areas, densely forested corridors, fence lines, etc.).	1.1 Housing & Urban Areas	Development of residential areas, including subdivision of large tracts of land.
		1.2 Commercial & Industrial Areas	Commercial, and industrial development, including subdivision of large tracts of land.
		2.1 Annual & Perennial Non-Timber Crops	Intensive agricultural production, including habitat conversion for agriculture.
		2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.
		4.1 Roads & Railroads	Transportation corridor use, construction, maintenance, and expansion.
	In areas where restoration of HGCM is occurring or has occurred, re-establish native plants that are adapted to the local environment, with attention to potential successional stages needed to rebuild soils, gene flow from adjacent native plant communities, viability of native species under projected climatic change scenarios, and establishing native plant communities that may be best able to compete with invasive species in the long-term.	11.3 Changes in Temperature Regimes	Habitat alteration due to rapid changes in hydrological and temperature regimes (e.g., changes in plant phenology creating a mismatch between arrival/emergence of wildlife/pollinators and flowering, seed production, reduced total production of vegetation due to hot and dry conditions and/or shifts in the timing/type of precipitation).
		11.4 Changes in Precipitation & Hydrological Regimes	
		1.1 Housing & Urban Areas	Development of residential areas, including subdivision of large tracts of land.

	Manage and/or provide stewardship for remaining intact pieces of habitat within or near human development and other human land uses.	1.2 Commercial & Industrial Areas	Commercial, and industrial development, including subdivision of large tracts of land.
	Manage road density at or below current levels in and around HGCN. Locate transportation corridors away from HGCN if possible. If transportation corridors must pass through HGCN or already pass through, promote the use of BMPs to reduce pollutant runoff and minimize establishment and spread of invasive weeds. Reclaim and restore HGCN impacted by illegal roads and trails or formerly used roads, trails, parking areas, etc. that have been abandoned or taken out of legal use.	6.1 Recreational Activities	Recreational use of public lands including motorized and non-motorized use of waterways, trails, and roads and the management of those sites can impact HGCN.
		9.1 Household Sewage & Urban Waste Water	Urban and transportation runoff and contamination changes nutrient cycling.
	Remove encroaching conifer where it threatens HGCN (e.g., aspen stands, grasslands, cottonwood forests, Douglas-fir in foothill ponderosa pine forests).	8.2 Problematic Native Plants & Animals	Conifer encroachment and in-growth.
	Use an integrated weed management approach, catered to the specific invasive species and the specific landscape, to control or eliminate invasive plant species. Prioritize largescale weed treatments, such as those administered by county Weed Districts and through FWP's Wildlife Habitat Improvement Program, in areas where recovery of diverse and largely native vegetation is most likely to succeed.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.
	Use fencing and/or rest-rotation grazing to restore important patches of HGCN that are being negatively impacted by livestock or ungulate	2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.

	browsing or restored HGCN where heavy grazing/browsing could stall or diminish restoration outcomes.	8.2 Problematic Native Plants & Animals	Ungulate over-grazing and over-browsing.
1.2 Ecosystem & Natural Process (Re)Creation	Use prescribed fire and direct vegetation management (e.g., timber harvest) under adaptive management to restart or mimic natural disturbance regimes, primarily fire, where they have been lost/diminished or where they can no longer function (e.g., near human habitations) to maintain and restore HGCN. However, consider limited fire suppression around sites critical to the persistence of an SGCN population.	7.1 Fire & Fire Suppression	Altered fire regimes lead to unnatural fire frequency and severity; Fire suppression leads to lack of beneficial fire disturbance.
		2.1 Annual & Perennial Non-Timber Crops	Intensive agricultural production, including habitat conversion for agriculture.
		2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.
		7.3 Other Ecosystem Modifications	Incompatible vegetation management, including timber harvest, and/or lack of vegetation management.
		7.4 Removing / Reducing Human Maintenance	Reducing/removing human maintenance of HGCN that can degrade without human intervention.
		8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.
		8.2 Problematic Native Plants & Animals	Unnatural level and extent of native insect infestations.
			Ungulate over-grazing and over-browsing.
			Conifer encroachment and in-growth.

2. Species Management			
2.1 Species Stewardship	Manage game populations and/or implement grazing/browsing protection measures if over-grazing/browsing is negatively impacting HGCN.	8.2 Problematic Native Plants & Animals	Ungulate over-grazing and over-browsing.
2.2 Species Re-Introduction & Translocation	Where native plant and animal species important to the function of HGCN have been greatly reduced or extirpated, reintroduce species and/or work on restoration and land conservation projects that maintain or restore gene flow from nearby populations.	7.3 Other Ecosystem Modifications	Incompatible vegetation management, including timber harvest, and/or lack of vegetation management.
		8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.
		8.3 Introduced Genetic Material	Hybridization with native species.
		8.4 Pathogens & Microbes	Outbreaks of introduced diseases.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Develop and distribute outreach materials on the impacts of pesticides and herbicides on HGCN and ways landowners and land managers can reduce reliance on chemical applications (e.g., native predators, pheromones, biocontrol agents, regenerative agriculture, avoid insecticide coated seed, etc.).	8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.
		9.3 Agricultural & Forestry Effluents	Pesticide, herbicide, and fertilizer use, runoff and contamination.
	Highlight successful HGCN restoration, maintenance, and enhancement projects through a wide variety of media outlets.	2.1 Annual & Perennial Non-Timber Crops	Intensive agricultural production, including habitat conversion for agriculture.
		2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.

		7.3 Other Ecosystem Modifications	Incompatible vegetation management, including timber harvest, and/or lack of vegetation management.
	Increase outreach to off-highway vehicle (OHV) and watercraft users, as well as non-motorized recreationists, on how their activities can negatively impact HGCN (e.g., damage to soils, water, habitat, and spread of noxious weeds) to foster stewardship and advocacy for HGCN.	6.1 Recreational Activities	Recreational use of public lands including motorized and non-motorized use of waterways, trails, and roads and the management of those sites can impact HGCN.
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Strengthen and promote education and enforcement around state- and local-level laws that provide protection for HGCN (e.g., 310 law, firewood cutting restrictions, OHV use, etc.) and encourage reporting and remedy of violations. Pursue and promote volunteer efforts and community organizing to identify and report violations of laws and regulations to fill gaps in staffing at local, state, and federal enforcement agencies.	1.1 Housing & Urban Areas	Development of residential areas, including subdivision of large tracts of land.
		1.2 Commercial & Industrial Areas	Commercial, and industrial development, including subdivision of large tracts of land.
		3.1 Oil & Gas Drilling	Resource extraction (e.g. oil/gas drilling).
		3.2 Mining & Quarrying	Resource extraction (e.g. mining and quarrying).
		3.3 Renewable Energy	Resource extraction (e.g. Renewable energy).
		4.1 Roads & Railroads	Transportation corridor use, construction, maintenance, and expansion.
		6.1 Recreational Activities	Recreational use of public lands including motorized and non-motorized use of waterways, trails, and roads and the management of those sites can impact HGCN.

5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Collaborate with NGOs, user groups, and the general public to: Raise awareness for the value of HGCN; Minimize negative impacts of recreation HGCN; Implement restoration, maintenance, and enhancement projects for recreation infrastructure to minimize negative impacts to HGCN (e.g., establish agreements for road and trail maintenance, rehab opportunities, fence removal, weed management, etc.)	6.1 Recreational Activities	Recreational use of public lands including motorized and non-motorized use of waterways, trails, and roads and the management of those sites can impact HGCN.
	Promote certifications and labeling for products and services that are produced using methods meant to reduce negative impacts to HGCN.	2.1 Annual & Perennial Non-Timber Crops	Intensive agricultural production, including habitat conversion for agriculture.
		2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.
		7.3 Other Ecosystem Modifications	Incompatible vegetation management, including timber harvest, and/or lack of vegetation management.
	Promote the use of carbon credit programs to conserve HGCN and provide technical assistance for landowners and land managers to take advantage of these programs.	11.3 Changes in Temperature Regimes	Habitat alteration due to rapid changes in hydrological and temperature regimes (e.g., changes in plant phenology creating a mismatch between arrival/emergence of wildlife/pollinators and flowering, seed production, reduced total production of vegetation due to hot and dry conditions and/or shifts in the timing/type of precipitation).
		11.4 Changes in Precipitation & Hydrological Regimes	

	Suggest and implement seasonal and/or site/time-specific closures or restrictions on recreational areas and activities to minimize disturbance to critical breeding areas within HGCN during sensitive time periods.	6.1 Recreational Activities	Recreational use of public lands including motorized and non-motorized use of waterways, trails, and roads and the management of those sites can impact HGCN.
5.3 Market-Based Incentives	Work with agricultural producers on alternative or additional sources of income from things like guided birding tours, wildlife viewing areas, or hunting/fishing (Block Management Program or outfitters) where exceptional HGCN exist on agricultural lands.	1.1 Housing & Urban Areas	Development of residential areas, including subdivision of large tracts of land.
		1.2 Commercial & Industrial Areas	Commercial, and industrial development, including subdivision of large tracts of land.
		2.1 Annual & Perennial Non-Timber Crops	Intensive agricultural production, including habitat conversion for agriculture.
		2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.
5.4 Direct Economic Incentives	Develop and promote landowner incentives to keep large blocks of land intact and provide technical assistance to landowners for accessing resources to take advantage of these incentives.	1.1 Housing & Urban Areas	Development of residential areas, including subdivision of large tracts of land.
		1.2 Commercial & Industrial Areas	Commercial, and industrial development, including subdivision of large tracts of land.
		2.1 Annual & Perennial Non-Timber Crops	Intensive agricultural production, including habitat conversion for agriculture.

5.5 Non-Monetary Values	Provide recognition for landowners and land managers for conserving and restoring HGCN.	2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.
		6.3 Work & Other Activities	Construction, maintenance, and expansion of fences.
		7.3 Other Ecosystem Modifications	Incompatible vegetation management, including timber harvest, and/or lack of vegetation management.
		7.4 Removing / Reducing Human Maintenance	Reducing/removing human maintenance of HGCN that can degrade without human intervention.
		8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.
		8.2 Problematic Native Plants & Animals	Unnatural level and extent of native insect infestations.
			Ungulate over-grazing and over-browsing.
		Conifer encroachment and in-growth.	
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.2 Easements & Resource Rights	Develop a funding program for habitat protection (conservation easements, land acquisitions, and habitat leases) and habitat restoration, centered on nongame wildlife habitat or HGCN, that allows for alternative forms of public access for landowners to participate (e.g., non-hunting access).	1.1 Housing & Urban Areas	Development of residential areas, including subdivision of large tracts of land.
		1.2 Commercial & Industrial Areas	Commercial, and industrial development, including subdivision of large tracts of land.
		2.1 Annual & Perennial Non-Timber Crops	Intensive agricultural production, including habitat conversion for agriculture.
		3.1 Oil & Gas Drilling	Resource extraction (e.g. oil/gas drilling).

		3.2 Mining & Quarrying	Resource extraction (e.g. mining and quarrying).
		3.3 Renewable Energy	Resource extraction (e.g. renewable energy).
	Use programs like Habitat Montana, Future Fisheries Improvement Program, State Wildlife Grants, Wildlife Habitat Improvement Program, Upland Game Bird Enhancement Program, and other state and federal funding sources to support opportunities to conserve high-priority HGCN through fee-title acquisitions, conservation easements, and habitat leases by FWP and partners (e.g., land trusts, NGOs, conservation-minded private landowners). Prioritize locations that are adjacent to current conservation investments and are likely to remain as HGCN under future climate scenarios to create contiguous, protected habitats that provides linkages across large landscapes and that are resilient and/or adaptable to current and future threats and provide for a mosaic of habitat successional stages.	1.1 Housing & Urban Areas	Development of residential areas, including subdivision of large tracts of land.
		1.2 Commercial & Industrial Areas	Commercial, and industrial development, including subdivision of large tracts of land.
		11.3 Changes in Temperature Regimes	Habitat alteration due to rapid changes in hydrological and temperature regimes (e.g., changes in plant phenology creating a mismatch between arrival/emergence of wildlife/pollinators and flowering, seed production, reduced total production of vegetation due to hot and dry conditions and/or shifts in the timing/type of precipitation).
		11.4 Changes in Precipitation & Hydrological Regimes	
6.4 Conservation Planning	Actively engage with land-use planning efforts put forth by city and county governments and public land management agencies that have the potential to impact HGCN (e.g., subdivision reviews, Forest Plan revisions, city and county zoning efforts, etc.).	1.1 Housing & Urban Areas	Development of residential areas, including subdivision of large tracts of land.
		1.2 Commercial & Industrial Areas	Commercial, and industrial development, including subdivision of large tracts of land.
		3.1 Oil & Gas Drilling	Resource extraction (e.g. oil/gas drilling).
		3.2 Mining & Quarrying	Resource extraction (e.g. mining and quarrying).
		3.3 Renewable Energy	Resource extraction (e.g. renewable energy).

		6.1 Recreational Activities	Recreational use of public lands including motorized and non-motorized use of waterways, trails, and roads and the management of those sites can impact HGCN.
		7.1 Fire & Fire Suppression	Altered fire regimes lead to unnatural fire frequency and severity; Fire suppression leads to lack of beneficial fire disturbance.
	Actively engage with remediation, reclamation, and restoration planning and implementation efforts regarding Superfund sites and other former resource extraction sites.	3.2 Mining & Quarrying	Resource extraction (e.g. mining and quarrying).
		9.2 Industrial & Military Effluents	Commercial & Industrial Effluents.
	Provide mapping of HGCN to landowners or land managers where chemical damage is likely to occur so applicators can avoid or modify activities to prevent degradation of habitats.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.
		9.3 Agricultural & Forestry Effluents	Pesticide, herbicide, and fertilizer use, runoff and contamination.
6.5 Site Infrastructure	Maintain public access roads and trails into and through public land and use signage and other forms of outreach to minimize damage from illegal use.	6.1 Recreational Activities	Recreational use of public lands including motorized and non-motorized use of waterways, trails, and roads and the management of those sites can impact HGCN.
	Make existing transportation corridors more permeable to SGCN using crossing structures, strategic fencing, road/rail relocation projects, slower speed limits, signage, culvert upgrades, planting of native vegetation in right-of-ways, and removing invasive plants in right-of-ways.	4.1 Roads & Railroads	Transportation corridor use, construction, maintenance, and expansion.
		4.2 Utility & Service Lines	Powerline and utility construction, maintenance, and expansion.
		8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.

		9.1 Household Sewage & Urban Waste Water	Urban and transportation runoff and contamination changes nutrient cycling.
	Use on-site signage in HGCN with high value for SGCN but where human presence is high or increasing to notify the public that they are in an area with exceptional wildlife habitat.	6.1 Recreational Activities	Recreational use of public lands including motorized and non-motorized use of waterways, trails, and roads and the management of those sites can impact HGCN.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Promote, strengthen and propose laws and policies that support the restoration, maintenance, and enhancement of HGCN at the local, state, and federal level.	2.1 Annual & Perennial Non-Timber Crops	Intensive agricultural production, including habitat conversion for agriculture.
		2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.
		3.1 Oil & Gas Drilling	Resource extraction (e.g. oil/gas drilling).
		3.2 Mining & Quarrying	Resource extraction (e.g. mining and quarrying).
		3.3 Renewable Energy	Resource extraction (e.g. renewable energy).
		7.1 Fire & Fire Suppression	Altered fire regimes lead to unnatural fire frequency and severity; Fire suppression leads to lack of beneficial fire disturbance.
		7.3 Other Ecosystem Modifications	Incompatible vegetation management, including timber harvest, and/or lack of vegetation management.
		7.4 Removing / Reducing Human Maintenance	Reducing/removing human maintenance of HGCN that can degrade without human intervention.

		8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCM by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.
		8.2 Problematic Native Plants & Animals	Ungulate over-grazing and over-browsing.
			Conifer encroachment and in-growth.
		8.3 Introduced Genetic Material	Hybridization with native species.
		8.4 Pathogens & Microbes	Outbreaks of introduced diseases.
		11.3 Changes in Temperature Regimes	Habitat alteration due to rapid changes in hydrological and temperature regimes (e.g., changes in plant phenology creating a mismatch between arrival/emergence of wildlife/pollinators and flowering, seed production, reduced total production of vegetation due to hot and dry conditions and/or shifts in the timing/type of precipitation).
	Work to limit the use of pesticides that rely on neonicotinoids.	9.3 Agricultural & Forestry Effluents	Pesticide, herbicide, and fertilizer use, runoff and contamination.
9. Education & Training			
9.2 Training & Individual Capacity Development	Promote principles of regenerative agriculture and develop workshops, outreach materials, funding programs, and technical assistance (e.g., additional staff) to help landowners implement regenerative agriculture practices.	2.1 Annual & Perennial Non-Timber Crops	Intensive agricultural production, including habitat conversion for agriculture.
		8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCM by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.
		9.3 Agricultural & Forestry Effluents	Pesticide, herbicide, and fertilizer use, runoff and contamination.

	11.3 Changes in Temperature Regimes	Habitat alteration due to rapid changes in hydrological and temperature regimes (e.g., changes in plant phenology creating a mismatch between arrival/emergence of wildlife/pollinators and flowering, seed production, reduced total production of vegetation due to hot and dry conditions and/or shifts in the timing/type of precipitation).
	11.4 Changes in Precipitation & Hydrological Regimes	
Provide and attend trainings/workshops for landowners and agencies on proper use of prescribed fire in HGCN.	7.1 Fire & Fire Suppression	Altered fire regimes lead to unnatural fire frequency and severity; Fire suppression leads to lack of beneficial fire disturbance.
	7.3 Other Ecosystem Modifications	Incompatible vegetation management, including timber harvest, and/or lack of vegetation management.
	8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.
	8.2 Problematic Native Plants & Animals	Conifer encroachment and in-growth.
Provide trainings on agriculture, mining, logging, and other industries in Montana that can impact HGCN for agency and NGO biologists and land managers. Include training on strategies and techniques that conserve and protect HGCN such as regenerative agriculture, sustainable forestry, and mine reclamation.	1.2 Commercial & Industrial Areas	Commercial, and industrial development, including subdivision of large tracts of land.
	3.1 Oil & Gas Drilling	Resource extraction (e.g., oil/gas drilling).
	3.2 Mining & Quarrying	Resource extraction (e.g., mining and quarrying).
	3.3 Renewable Energy	Resource extraction (e.g., renewable energy).
	5.3 Logging & Wood Harvesting	Commercial or large-scale timber harvest can negatively impact forest HGCN.

	Pursue opportunities for creating new programs and positions to conserve and protect HGCN (e.g., energy development biologists, public comment coordinators, nongame habitat biologists, vegetation monitoring programs,co-op biologist positions, etc.).	7.3 Other Ecosystem Modifications	Incompatible vegetation management, including timber harvest, and/or lack of vegetation management.
		7.4 Removing / Reducing Human Maintenance	Reducing/removing human maintenance of HGCN that can degrade without human intervention.
		8.2 Problematic Native Plants & Animals	Conifer encroachment and in-growth. Ungulate over-grazing and over-browsing.
	Where agency workforce gaps exist or more capacity is needed, pursue opportunities for cross-agency cooperation and/or create volunteer workforces to assist with conservation action for HGCN.	7.3 Other Ecosystem Modifications	Incompatible vegetation management, including timber harvest, and/or lack of vegetation management.
		7.4 Removing / Reducing Human Maintenance	Reducing/removing human maintenance of HGCN that can degrade without human intervention.
		8.2 Problematic Native Plants & Animals	Conifer encroachment and in-growth. Ungulate over-grazing and over-browsing.
10. Institutional Development			
10.3 Alliance & Partnership Development	Actively partner with private landowners, conservation groups, NGOs, state and federal government agencies, local governments, tribal nations, land trusts, conservation districts, economic and urban development groups, social scientists, agriculture and grazing associations, and other interested parties to: Listen to concerns around HGCN conservation; Develop and maintain effective coordination within and amongst these stakeholders; Ensure planning efforts, and any actions that result from those efforts, consider HGCN; Develop projects to restore, maintain, and/or enhance HGCN;	1.1 Housing & Urban Areas	Development of residential areas, including subdivision of large tracts of land.
		1.2 Commercial & Industrial Areas	Commercial, and industrial development, including subdivision of large tracts of land.
		2.1 Annual & Perennial Non-Timber Crops	Intensive agricultural production, including habitat conversion for agriculture.
		2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.
		6.1 Recreational Activities	Recreational use of public lands including motorized and non-motorized use of

Promote HGCN conservation while maintaining private land management objectives. Encourage biologist with expertise in HGCN conservation participate.		waterways, trails, and roads and the management of those sites can impact HGCN.
	7.1 Fire & Fire Suppression	Altered fire regimes lead to unnatural fire frequency and severity; Fire suppression leads to lack of beneficial fire disturbance.
	7.3 Other Ecosystem Modifications	Incompatible vegetation management, including timber harvest, and/or lack of vegetation management.
Develop Memorandums of Understanding between state and federal agencies to coordinate prescribed burning policies, practices, and projects across jurisdictions.	7.1 Fire & Fire Suppression	Altered fire regimes lead to unnatural fire frequency and severity; Fire suppression leads to lack of beneficial fire disturbance.
	7.3 Other Ecosystem Modifications	Incompatible vegetation management, including timber harvest, and/or lack of vegetation management.
	8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.

Grasslands

The grasslands of Montana are some of the state's most impressive and productive habitats. West of the Continental Divide, grasslands form an undulating swath of habitat separating broad river floodplains at the valley floor from higher-elevation, forested habitats in the mountains. East of the Continental Divide is Montana's portion of the Great Plains, an immense grassland and sagebrush ecosystem that covers roughly 60 percent of the state. Other grasslands cover alpine plateaus or are splattered across largely forested habitats as meadows. Overall, grasslands cover 28% of the land area in Montana (2017 Montana Land Cover Layers) and support 48 terrestrial vertebrate SGCN species. Many of these species, such as the thick-billed longspur and Sprague's pipet, are facing some of the most dramatic declines of any species on Montana's SGCN list. Grasslands in Montana are central to the state's farming and ranching operations, are highly valued for wildlife viewing and hunting, and are considered some of the last best places for many North American grassland wildlife species.

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Implement regenerative grazing practices that mimic natural grazing disturbance regimes and maintain or enhance soil health.	7.4 Removing / Reducing Human Maintenance	Reducing/removing human maintenance of HGCN that can degrade without human intervention.
	Protect old shelterbelts and nesting bushes from cattle grazing and rubbing. If new shelterbelts are needed avoid planting them within grassland habitat. Provide guidelines for native plants or alternatives use in shelterbelts or human structures to prevent establishment of invasive species inadvertently or intentionally.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.
		8.2 Problematic Native Plants & Animals	Conifer encroachment and in-growth.
1.2 Ecosystem & Natural Process (Re)Creation	Implement regenerative grazing practices that mimic natural grazing disturbance regimes and maintain or enhance soil health.	2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.

B. Behavioral Change/ Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Increase educational efforts on the benefits of burrowing mammals to grassland habitats and ways landowners and land managers can control or live with these species in ways that minimize impacts to HGCN.	5.1 Hunting & Collecting Terrestrial Animals	Excessive removal of prairie dogs, ground squirrels, and gophers reduces soil aeration, water infiltration, and seed dispersal and reduces prey base for some SGCN.
		6.1 Recreational Activities	Recreational use of public lands including motorized and non-motorized use of waterways, trails, and roads and the management of those sites can impact HGCN.
		9.3 Agricultural & Forestry Effluents	Pesticide, herbicide, and fertilizer use, runoff and contamination.
	Use outreach efforts to highlight the potential negative impacts of feral pigs and horses on hunting, agriculture, and recreation, and what people can do to help (e.g., report sightings, volunteer removals, advocacy for policies and laws, etc.).	8.1 Invasive Non-Native/Alien Plants & Animals	Feral pigs and horses degrade grassland HGCN through trampling and over-grazing.
5. Livelihood Economic & Moral Incentives			
5.4 Direct Economic Incentives	Develop and promote the use of grass banking programs.	2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Develop programs and policies to remove feral pigs and horses that are degrading grassland habitats.	8.1 Invasive Non-Native/Alien Plants & Animals	Feral pigs and horses degrade grassland HGCN through trampling and over-grazing.
	Install new utility lines underground, develop a weed control plan approved by the local weed district. Consider increasing minimum allowable subdivision parcel sizes through local regulations to 640 acres or greater.	4.2 Utility & Service Lines	Powerline and utility construction, maintenance, and expansion.

9. Education & Training			
9.2 Training & Individual Capacity Development	Develop and implement outreach materials and trainings to landowners and county weed departments on invasive annual grass management.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.
		9.3 Agricultural & Forestry Effluents	Pesticide, herbicide, and fertilizer use, runoff and contamination.
	Develop fire management plans that can be used on private lands, easements/leases, and public owned land that will benefit grassland bird habitat. Develop prioritization and risk management tools. Pursue outreach opportunities around the benefits of fire in fire-adapted grassland HGCN.	7.1 Fire & Fire Suppression	Altered fire regimes lead to unnatural fire frequency and severity; Fire suppression leads to lack of beneficial fire disturbance.
	Increase awareness, expertise, and use of virtual fencing technologies for rangeland management.	6.3 Work & Other Activities	Construction, maintenance, and expansion of fences.
	Provide training and technical/financial assistance to agricultural producers for farming crops that use less water than current practices.	11.3 Changes in Temperature Regimes	Habitat alteration due to rapid changes in hydrological and temperature regimes (e.g., changes in plant phenology creating a mismatch between arrival/emergence of wildlife/pollinators and flowering, seed production, reduced total production of vegetation due to hot and dry conditions and/or shifts in the timing/type of precipitation).
		11.4 Changes in Precipitation & Hydrological Regimes	
	Provide training and technical/financial assistance to agricultural producers to take advantage of state and federal programs to improve rangelands (e.g., NRCS Farm Bill programs).	2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.
	Pursue outreach opportunities in agricultural communities about the benefits of CRP lands and provide technical assistance with applications.	2.1 Annual & Perennial Non-Timber Crops	Intensive agricultural production, including habitat conversion for agriculture.

Shrublands

The shrublands of Montana include a wide variety of habitats ranging from willow and alder thickets in the avalanche chutes of the Bitterroot Mountains to vast “sagebrush seas” overlooking the Missouri River Breaks. Combine all these varieties of shrub-dominated habitats, which cover 17% of the state, and there are 53 terrestrial vertebrate SGCN that depend on them. Whether it is a shin-high cinquefoil or a 30-foot-high maple, shrubs fill the layer between the ground and the trees (if there are trees) with structure for nesting and evading predators and abundant food in the form of nutritious buds, delectable berries, and hordes of insects. Shrublands in Montana are often intermixed with grasslands, and similarly important to the state’s ranching operations. These are also great habitats for wildlife-viewing and hunting, as it is a little bit easier to get close to wildlife when there are some plants to hide behind.

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Early and aggressive management of introduced invasive grasses in intact shrublands. Treatment of burned areas with range of annual grasses with herbicide after fires to prevent catastrophic spread.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.
	Focus site management methods (e.g. prescribed fire, mechanical removal) in areas where woody expansion is in its initial stages	8.2 Problematic Native Plants & Animals	Conifer encroachment and in-growth.
	Identify sites with severe perennial grass infestations/monocultures and use restoration practices to eliminate or reduce the invasive grasses and replace them with native species. Implement management practices that will maintain	8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.

	native species over time. Evaluate treated sites to determine effectiveness of non-native perennial grass control methods.		
1.2 Ecosystem & Natural Process (Re)Creation	Implement regenerative grazing practices that mimic natural grazing disturbance regimes and maintain or enhance soil health.	2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.
B. Behavioral Change/ Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Increase educational efforts on the benefits of burrowing mammals to shrubland habitats and ways landowners and land managers can control or live with these species in ways that minimize impacts to HGCN.	5.1 Hunting & Collecting Terrestrial Animals	Excessive removal of prairie dogs, ground squirrels, and gophers reduces soil aeration, water infiltration, and seed dispersal and reduces prey base for some SGCN.
		6.1 Recreational Activities	Recreational use of public lands including motorized and non-motorized use of waterways, trails, and roads and the management of those sites can impact HGCN.
		9.3 Agricultural & Forestry Effluents	Pesticide, herbicide, and fertilizer use, runoff and contamination.
	Use outreach efforts to highlight the potential negative impacts of feral pigs and horses on hunting, agriculture, and recreation, and what people can do to help (e.g., report sightings, volunteer removals, advocacy for policies and laws, etc.).	8.1 Invasive Non-Native/Alien Plants & Animals	Feral pigs and horses degrade grassland HGCN through trampling and over-grazing.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Encourage development in incremental stages to stagger disturbance (federal leases range from 3-10 years); design schedules that include long-term strategies to localize disturbance and recovery within established zones over a staggered time frame.	3.1 Oil & Gas Drilling	Resource extraction (e.g. oil/gas drilling).

5.4 Direct Economic Incentives	Develop and promote the use of grass banking programs.	2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Develop funding programs to move overhead lines underground when possible, especially for private landowners with lines running through important shrubland HGCN.	4.2 Utility & Service Lines	Powerline and utility construction, maintenance, and expansion.
	Develop programs and policies to remove feral pigs and horses that are degrading grassland habitats.	8.1 Invasive Non-Native/Alien Plants & Animals	Feral pigs and horses degrade grassland HGCN through trampling and over-grazing.
	Identify areas in shrubland HGCN with high likelihood of high-severity fire and plan/implement appropriate management activities to reduce risk or have appropriate suppression resources available when fires in these areas do start.	7.1 Fire & Fire Suppression	Altered fire regimes lead to unnatural fire frequency and severity; Fire suppression leads to lack of beneficial fire disturbance.
9. Education & Training			
9.2 Training & Individual Capacity Development	Develop and implement outreach materials and trainings to landowners and county weed departments on invasive annual grass management.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasion of HGCN by noxious weeds, invasive shrubs, perennial grasses, invertebrates & vertebrates.
		9.3 Agricultural & Forestry Effluents	Pesticide, herbicide, and fertilizer use, runoff and contamination.

Develop educational programs and outreach opportunities around the benefits of fire in fire-adapted shrubland HGCN.	7.1 Fire & Fire Suppression	Altered fire regimes lead to unnatural fire frequency and severity; Fire suppression leads to lack of beneficial fire disturbance.
Increase awareness, expertise, and use of virtual fencing technologies for rangeland management.	6.3 Work & Other Activities	Construction, maintenance, and expansion of fences.
Outreach to agricultural communities about the benefits of CRP lands and technical assistance with applications. Provide training and technical/financial assistance to agricultural producers to take advantage of state and federal programs to improve rangelands (e.g., NRCS Farm Bill programs).	2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.
Provide training and technical/financial assistance to agricultural producers for farming crops that use less water than current practices.	11.3 Changes in Temperature Regimes	Habitat alteration due to rapid changes in hydrological and temperature regimes (e.g., changes in plant phenology creating a mismatch between arrival/emergence of wildlife/pollinators and flowering, seed production, reduced total production of vegetation due to hot and dry conditions and/or shifts in the timing/type of precipitation).
	11.4 Changes in Precipitation & Hydrological Regimes	
Provide training and technical/financial assistance to agricultural producers to take advantage of state and federal programs to improve rangelands (e.g., NRCS Farm Bill programs).	2.3 Livestock Farming & Ranching	Grazing practices that are not reflective of the natural grazing regimes for which native plant communities are adapted.

Sagebrush Shrublands (Basin and Wyoming Big Sagebrush and Mountain Big Sagebrush)

Action Classification	Action	Threat Classification	Threat
C. Enabling Conditions Actions			
6. Awareness Raising			
6.2 Easements & Resource Rights	Implement conservation programs (e.g., habitat leases) that limit the use of fire as a management tool in sagebrush HGCN where it is inappropriate.	7.1 Fire & Fire Suppression	Increased use of prescribed burning in sagebrush shrublands where is inappropriate due to longer historical burn intervals of 150+ years.
6.4 Conservation Planning	Engage in public and private land-use planning efforts to ensure prescribed fire is no implemented in inappropriate HGCN.		
C. Enabling Conditions Actions			
9. Education & Training			
9.2 Training & Individual Capacity Development	Attend and implement trainings for fire managers, private landowners, and land managers about historic fire intervals in sagebrush stands for different species and subspecies of sagebrush in the state, and where prescribed fire may or may not be an appropriate management tool.	7.1 Fire & Fire Suppression	Increased use of prescribed burning in sagebrush shrublands where is inappropriate due to longer historical burn intervals of 150+ years.

Forest and Woodland

Forests and woodlands are areas where trees are an important part of the overall vegetation community, and they cover 9% of Montana's landscape. This includes the sprawling conifer forests of western Montana's mountain ranges and the wooded draws and ponderosa pine savannahs of eastern Montana's open landscapes. Forests and woodlands are some of Montana's most iconic habitats and support important parts of Montana's economy such as timber harvest and outdoor recreation. Forests and woodlands bring vertical structure to the landscape, providing key resources to wildlife in form of safe nesting and resting sites, shade, and a whole lot of buds, berries, and insects for SGCN to eat. Overall, 68 terrestrial vertebrate SGCN depend on Montana's forests and woodlands.

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Implement forest management practices (e.g., thinning, prescribed burning, etc.) to maintain diverse stand structure including patches of mature and old-growth forest. Retain snags, deformed trees, and downed woody debris, especially larger sizes, during vegetation management.	7.3 Other Ecosystem Modifications	Vegetation management including timber harvest in HGCN can cause conversion to other forest types, remove important forest structure (e.g., mature and old-growth, ponderosa-pine savannah, etc.), remove key habitat elements (e.g., large-diameter trees, snags, downed woody debris, etc.), and/or cause disturbance to SGCN during sensitive time periods.
	In sites likely to be irreversibly altered due to climatic conditions, manage stand densities and use regeneration or planting to favor native, disturbance-resilient species (i.e., fire-adapted species and drought-tolerant species).	11.3 Changes in Temperature Regimes	Habitat alteration due to rapid changes in hydrological and temperature regimes (e.g., changes in plant phenology creating a mismatch between arrival/emergence of wildlife/pollinators and flowering, seed production, reduced total production of vegetation due to hot and dry conditions and/or shifts in the timing/type of precipitation).
		11.4 Changes in Precipitation & Hydrological Regimes	

	Use thinning, prescribed fire, and pheromones to control outbreaks of bark beetles and other tree parasites where they have the potential to cause mass tree mortalities.	8.2 Problematic Native Plants & Animals	Outbreaks of pine beetles and other tree parasites, exacerbated by fire suppression, warmer winters, and historic logging practices cause mass mortality events outside the normal range of variation for the forest.
1.2 Ecosystem & Natural Process (Re)Creation	Maintain and promote natural processes that sustain and recruit injured, dying, dead, and downed trees in forested areas (e.g., insects and disease, low-severity fires, etc.).	1.1 Housing & Urban Areas	Encroachment of development into HGCN degrades habitat through landowners removing injured, dying, dead, and downed trees and/or understory and midstory vegetation.
		1.2 Commercial & Industrial Areas	
		1.3 Tourism & Recreation	
2. Species Management			
2.1 Species Stewardship	Restore, maintain, and enhance beaver populations in areas of their historical range to conserve high-value forest habitats for SGCN and to build landscapes that are more resilient to fires, floods, and droughts.	7.1 Fire & Fire Suppression	Altered fire regimes lead to unnatural fire frequency and severity; Fire suppression leads to lack of beneficial fire disturbance
		11.3 Changes in Temperature Regimes	Habitat alteration due to rapid changes in hydrological and temperature regimes (e.g., changes in plant phenology creating a mismatch between arrival/emergence of wildlife/pollinators and flowering, seed production, reduced total production of vegetation due to hot and dry conditions and/or shifts in the timing/type of precipitation).
		11.4 Changes in Precipitation & Hydrological Regimes	
B. Behavioral Change/ Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Collaborate with DNRC Service Foresters to design outreach and education campaigns targeted towards landowners and land managers describing BMPs in HGCN that increase wildfire resilience, promote biodiversity, encourage old-growth development, and prevent wind throw.	7.3 Other Ecosystem Modifications	Vegetation management including timber harvest in HGCN can cause conversion to other forest types, remove important forest structure (e.g., mature and old-growth, ponderosa-pine savannah, etc.), remove key habitat elements (e.g., large-diameter trees, snags, downed woody debris, etc.), and/or cause disturbance to SGCN during sensitive time periods.

	Develop materials and outreach strategies/opportunities for landowners and land managers in and around HGCN focused on general forest ecology, with an emphasis on fire safety and important habitat elements for SGCN, and how landowners and land managers can be good stewards of the portion of the forest they manage while remaining fire safe.	7.1 Fire & Fire Suppression	Altered fire regimes lead to unnatural fire frequency and severity; Fire suppression leads to lack of beneficial fire disturbance.
	Use a wide variety of media outlets to highlight the importance of active forest management for restoring, maintaining, and enhancing HGCN.	7.3 Other Ecosystem Modifications	Vegetation management including timber harvest in HGCN can cause conversion to other forest types, remove important forest structure (e.g., mature and old-growth, ponderosa-pine savannah, etc.), remove key habitat elements (e.g., large-diameter trees, snags, downed woody debris, etc.), and/or cause disturbance to SGCN during sensitive time periods.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Develop a climate-resilience forest management prescription that can be implemented by landowners and land managers to address threats posed by predicted changing temperature and precipitation regimes.	11.3 Changes in Temperature Regimes	Habitat alteration due to rapid changes in hydrological and temperature regimes (e.g., changes in plant phenology creating a mismatch between arrival/emergence of wildlife/pollinators and flowering, seed production, reduced total production of vegetation due to hot and dry conditions and/or shifts in the timing/type of precipitation).
		11.4 Changes in Precipitation & Hydrological Regimes	
	Explore and develop alternative forest products industries in Montana to make traditionally low-value forests economically attractive for timber managers (e.g., wood pulp, biochar, materials for restoration projects).	7.3 Other Ecosystem Modifications	Vegetation management including timber harvest in HGCN can cause conversion to other forest types, remove important forest structure (e.g., mature and old-growth, ponderosa-pine savannah, etc.), remove key habitat elements (e.g., large-diameter trees, snags, downed woody debris, etc.), and/or

			cause disturbance to SGCN during sensitive time periods.
	Investigate various types of logging efforts related to fuels management near developed areas to determine what practices are least harmful to SGCN and develop recommendations to land managers.	1.1 Housing & Urban Areas 1.2 Commercial & Industrial Areas 1.3 Tourism & Recreation	Encroachment of development into HGCN degrades habitat through landowners removing injured, dying, dead, and downed trees and/or understory and midstory vegetation.
	Promote the use of agroforestry and silvopasture systems to diversify income streams and incentivize agricultural producers to maintain forested areas in and around croplands and rangelands. Include agroforestry/silvopasture in wildlife-related trainings, workshops, and curriculums.	7.3 Other Ecosystem Modifications	Vegetation management including timber harvest in HGCN can cause conversion to other forest types, remove important forest structure (e.g., mature and old-growth, ponderosa-pine savannah, etc.), remove key habitat elements (e.g., large-diameter trees, snags, downed woody debris, etc.), and/or cause disturbance to SGCN during sensitive time periods.
	Use winter logging whenever possible to limit impacts to soils, vegetation, and the reproductive season for most SGCN in Montana.	7.3 Other Ecosystem Modifications	Vegetation management including timber harvest in HGCN can cause conversion to other forest types, remove important forest structure (e.g., mature and old-growth, ponderosa-pine savannah, etc.), remove key habitat elements (e.g., large-diameter trees, snags, downed woody debris, etc.), and/or cause disturbance to SGCN during sensitive time periods.
5.3 Market-Based Incentives	Explore opportunities to include HGCN in Sustainable Forestry Initiative (SFI) and Forest Stewardship Council (FSC) certifications.	7.4 Removing / Reducing Human Maintenance	Diminishing wood products industry leads to less desire and capacity to conduct HGCN restoration and enhancement work. Forest management projects on public lands that can benefit HGCN are delayed or halted due to litigation.
5.4 Direct Economic Incentives	Develop and promote the use of forest banking programs.	7.3 Other Ecosystem Modifications	Vegetation management including timber harvest in HGCN can cause conversion to other forest types, remove important forest structure (e.g., mature and old-growth, ponderosa-pine savannah, etc.), remove key habitat elements (e.g., large-diameter

			trees, snags, downed woody debris, etc.), and/or cause disturbance to SGCN during sensitive time periods.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Create HGCN conservation and enhancement guidelines for timber harvest operations and/or update existing guidelines to include HGCN such as: Biodiversity Guide for Montana Forest and Woodlot Owners (MSU Extension Forestry, 2011), Riparian Forest Wildlife: Guideline for Landowners and Loggers (MSU Extension Forestry 1997), and Voluntary Wildlife Guidelines for Streamside Management Zones (DNRC 1995).	7.3 Other Ecosystem Modifications	Vegetation management including timber harvest in HGCN can cause conversion to other forest types, remove important forest structure (e.g., mature and old-growth, ponderosa-pine savannah, etc.), remove key habitat elements (e.g., large-diameter trees, snags, downed woody debris, etc.), and/or cause disturbance to SGCN during sensitive time periods.
	Develop guidance document that provides common terms used in forest management and common terms used in describing biological needs of forest-dependent SGCN species targeted towards making it easier for biologists and foresters to speak the same language when discussing vegetation management.	7.4 Removing / Reducing Human Maintenance	Diminishing wood products industry leads to less desire and capacity to conduct HGCN restoration and enhancement work. Forest management projects on public lands that can benefit HGCN are delayed or halted due to litigation.
9. Education & Training			
9.2 Training & Individual Capacity Development	Attend or host workshops and trainings to share ecological knowledge, approaches, and success stories related to building climate resilient forested HGCN.	11.3 Changes in Temperature Regimes	Habitat alteration due to rapid changes in hydrological and temperature regimes (e.g., changes in plant phenology creating a mismatch between arrival/emergence of wildlife/pollinators and flowering, seed production, reduced total production of vegetation due to hot and dry conditions and/or shifts in the timing/type of precipitation).
		11.4 Changes in Precipitation & Hydrological Regimes	

Develop outreach materials and strategies for landowners and managers about the role native tree parasites have in forest ecology and how they can get out of control and how to protect their forests from outbreaks of tree parasites.	8.2 Problematic Native Plants & Animals	Outbreaks of pine beetles and other tree parasites, exacerbated by fire suppression, warmer winters, and historic logging practices cause mass mortality events outside the normal range of variation for the forest.
Provide training and technical/financial assistance to landowners with forested areas on their property to take advantage of state and federal programs to improve forest health and wildfire resiliency (e.g., USFS and DNRC programs).	7.1 Fire & Fire Suppression	Altered fire regimes lead to unnatural fire frequency and severity; Fire suppression leads to lack of beneficial fire disturbance.
Work with developers and livestock producers to manage the removal of snags and downed woody debris from HGCN.	1.1 Housing & Urban Areas	Encroachment of development into HGCN degrades habitat through landowners removing injured, dying, dead, and downed trees and/or understory and midstory vegetation.
	1.2 Commercial & Industrial Areas	
	1.3 Tourism & Recreation	
Encourage landowners and land managers to address conifer encroachment and maintain restored conditions using prescribed fire or continued thinning. Provide technical assistance and funding for restoration and maintenance projects. Support forest products industry as a partner to remove conifer encroachment and help offset the cost of treatments for landowners.	8.2 Problematic Native Plants & Animals	Conifer encroachment and in-growth.

Rocky Mountain Aspen Forest and Woodland

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Avoid removing aspen stems during timber harvest operations, except when conducting coppice treatments for regeneration.	5.3 Logging & Wood Harvesting	Herbicide use for site preparation and aspen being undesirable vegetation related to commercial timber production degrades or removes aspen stands in forested areas.
	Develop off-site watering infrastructure for livestock to help minimize the need for livestock to use any available water sources that may be located within or near deciduous forests.	7.2 Dams & Water Management / Use	Hydrologic regime changes due to human development and water use levels and timing stresses native vegetation, causes native vegetation community shifts, and/or favors non-native and invasive plants.
	Use coppicing, conifer removal, ground disturbance, and/or prescribed fire to promote aspen regeneration followed by grazing deferment, browse protection, or other protective measures if needed.	7.1 Fire & Fire Suppression	Laws and policies deter the use of prescribed fire for HGCN maintenance, enhancement, and restoration.
		7.3 Other Ecosystem Modifications	Incompatible vegetation management, including timber harvest, and/or lack of vegetation management.
2. Species Management			
2.1 Species Stewardship	Look for opportunities for establishing and/or facilitating habitat on new sites based on changing hydrologic regimes.	7.2 Dams & Water Management / Use	Hydrologic regime changes due to human development and water use levels and timing stresses native vegetation, causes native vegetation community shifts, and/or favors non-native and invasive plants.
B. Behavioral Change/ Threat Reduction			
3. Awareness Raising			

3.1 Outreach & Communications	Use media and partner with other organizations to tell story of sudden aspen decline and conifer encroachment into aspen stands, how they can be/are being managed, and highlight success stories.	11.4 Changes in Precipitation & Hydrological Regimes	Prolonged drought and water stress are contributing factors to sudden aspen decline (SAD).
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Discourage production forestry approaches that favor commercial species at the expense of aspen.	5.3 Logging & Wood Harvesting	Herbicide use for site preparation and aspen being undesirable vegetation related to commercial timber production degrades or removes aspen stands in forested areas.
	Implement alternative low water-use crop production and improve efficiency of water use.	7.2 Dams & Water Management / Use	Hydrologic regime changes due to human development and water use levels and timing stresses native vegetation, causes native vegetation community shifts, and/or favors non-native and invasive plants.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Incorporate detailed guidelines for aspen maintenance and enhancement in FWP's Fish and Wildlife Recommendations for Subdivision Development and other guidance documents. Create aspen enhancement guidelines for prescribed burn plans.	1.1 Housing & Urban Areas	Development of residential areas, including subdivision of large tracts of land.
9. Education & Training			
9.2 Training & Individual Capacity Development	Encourage landowners and land managers to incorporate aspen enhancement into management plans, timber harvest prescriptions, burn plans, and fire management decisions.	7.4 Removing / Reducing Human Maintenance	Removal of human maintenance and disturbance causes lack of recruitment and loss of aspen to disease and succession.

Cedar - Hemlock Forest

Action Classification	Action	Threat Classification	Threat
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Focus conservation actions and habitat improvement projects on sites with cool, moist microclimates such as north-facing slopes and valley bottoms that are likely to support healthy cedar-hemlock forests even under changing temperature and precipitation regimes.	11.3 Changes in Temperature Regimes	Shift in species composition near edge of warm/dry range.

Great Plains Mesic Forest and Woodland

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Develop off-site watering infrastructure for livestock to help minimize the need for livestock to use any available water sources that may be located within upland woody draws or deciduous forests.	7.2 Dams & Water Management / Use	Hydrologic regime changes due to human development and water use levels and timing stresses native vegetation, causes native vegetation community shifts, and/or favors non-native and invasive plants.
	Fence recruiting cottonwoods to reduce impact of herbivory.	8.2 Problematic Native Plants & Animals	Ungulate over-grazing and over-browsing.
	Identify and establish replacement tree species for green ash killed by emerald ash borer and American elm killed by Dutch elm disease.	8.1 Invasive Non-Native/Alien Plants & Animals	Feral hogs directly destroy habitat or help spread invasive plants. Emerald ash borer could result in significant loss of green ash. Dutch elm disease could result in significant loss of American elm.
2. Species Management			
2.3 Ex-Situ Conservation	Support gene conservation efforts of green ash and American elm for potential future reintroduction.	8.1 Invasive Non-Native/Alien Plants & Animals	Feral hogs directly destroy habitat or help spread invasive plants. Emerald ash borer could result in significant loss of green ash. Dutch elm disease could result in significant loss of American elm.
B. Behavioral Change/ Threat Reduction			
5. Awareness Raising			
5.2 Better Products & Management Practices	Implement alternative low water-use crop production and improve efficiency of water use.	7.2 Dams & Water Management / Use	Hydrologic regime changes due to human development and water use levels and timing stresses native vegetation, causes native vegetation community shifts, and/or favors non-native and invasive plants.
C. Enabling Conditions Actions			

6. Conservation Designation & Planning			
6.4 Conservation Planning	Develop programs and policies to aggressively remove feral hogs from Montana.	8.1 Invasive Non-Native/Alien Plants & Animals	Feral hogs directly destroy habitat or help spread invasive plants. Emerald ash borer could result in significant loss of green ash. Dutch elm disease could result in significant loss of American elm.
	Focus conservation actions and habitat improvement projects on sites that are likely to support healthy Great Plains mesic forests even under changing temperature and precipitation regimes.	11.3 Changes in Temperature Regimes	Shift in species composition near edge of warm/dry range.
	Look for opportunities for establishing and/or facilitating habitat on new sites based on changing hydrologic regimes.	11.3 Changes in Temperature Regimes	Shift in species composition near edge of warm/dry range.
		7.2 Dams & Water Management / Use	Hydrologic regime changes due to human development and water use levels and timing stresses native vegetation, causes native vegetation community shifts, and/or favors non-native and invasive plants.

Great Plains Ponderosa Pine and Rocky Mountain Ponderosa Pine Forest and Woodland

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Strategically use prescribed fire, timber harvest, and/or livestock grazing to maintain healthy grass/forb/shrub plant communities in ponderosa pine forests. Doing nothing may also be the best strategy in some areas that just need time to undergo succession.	7.3 Other Ecosystem Modifications	Homogenization and/or oversimplification of stand structure within and around developments due to incompatible silvicultural techniques (e.g., evenly spaced trees) or because of a lack of management leading to uncharacteristically dense forests.
	Treat ponderosa pine stands to reduce or remove Douglas-fir to mimic historical effects of fire.	7.1 Fire & Fire Suppression	Laws and policies deter the use of prescribed fire for HGCN maintenance, enhancement, and restoration.

Whitebark – Subalpine Larch Forest and Woodland

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Implement forest management practices that create openings within 10 km of WBP stands (e.g., through cutting or prescribed burns) that may then be used for seed-caching by Clark’s nutcrackers.	7.3 Other Ecosystem Modifications	Insufficient or lack of timber harvest targeting other conifer species (e.g., lodgepole, subalpine fir, ponderosa pine) adjacent to WBP stands can result in encroachment of these species into WBP stands and/or allow mountain pine beetle to reach epidemic levels, causing a decline in WBP individuals and/or decline in cone production due to stress and competition for resources. This could cause a decline in Clark’s nutcracker populations, leading to further negative impacts on maintenance and recovery of WBP stands.
	Implement forest management practices that seek to harvest subalpine fir adjacent to or within WBP stands to prevent encroachment.	8.2 Problematic Native Plants & Animals	Encroachment of subalpine fir into Whitebark Pine stands. Mountain Pine Beetle also threatens Whitebark Pine.
	Implement forestry practices that thin lodgepole pine and ponderosa pine stands adjacent to WBP stands to reduce the impacts of summer droughts and minimize the spread of mountain pine beetle. If ponderosa pine has sufficient moisture, it is better able to resist MPB.		
2. Species Management			

2.1 Species Stewardship	Use nursery-raised, blister rust-resistant WBP stock for transplants into suitable habitat.	8.1 Invasive Non-Native/Alien Plants & Animals	Loss of WBP due to blister rust.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Work with the U.S. Forest Service to develop BMPs that allow for prescribed fire as a tool, where appropriate, to maintain healthy WBP stands.	7.1 Fire & Fire Suppression	Altered fire regimes lead to unnatural fire frequency and severity; Fire suppression leads to lack of beneficial fire disturbance
10. Institutional Development			
10.3 Alliance & Partnership Development	Translate White Bark Pine research to agencies and committees within the Forest Service, grizzly bear conservation, forest health, and WBP conservation to help them review and revise their WBP management plans.	7.3 Other Ecosystem Modifications	Species-driven habitat management strategies are in conflict with one another.

Riparian and Wetland

Riparian areas and wetlands cover a relatively small percentage of the land in Montana, but they are the biodiversity powerhouses of the state. The abundance of water in these habitats facilitates vigorous plant growth that occurs throughout the growing season. This leads to immense primary production (i.e., the base of the food web), which leads to a large number of SGCN that are dependent on riparian areas and wetlands. Despite largely existing as small patches and stringers in the larger Montana landscape, riparian areas and wetlands support 103 terrestrial vertebrate SGCN species. It is vital to consider that a great many SGCN, as well as all of the state's game and furbearer animals, are also dependent on water resources to survive. So, even though they may not spend their whole lives in this habitat, these other species will certainly need patches of riparian or wetland habitat in their home ranges to survive in the mostly arid environments of Montana.

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Adapt irrigation and watering practices to be specific to the watershed/basin in which they are located and the needs of HGCN/SGCN in that area. Protect natural springs and seeps.	7.2 Dams & Water Management / Use	Lack of floodplain connection across large swaths of streams and rivers from historical land-use practices (e.g., dams and bank hardening, resource extraction, fire suppression, stream channel manipulation, loss of beavers) diminishes important habitats and habitat features that are created, maintained, and enhanced through periodic flooding disturbance and results in drying out of floodplains which may cause shifts to upland vegetation types and allow fires to burn at high intensity in valley bottoms and through riparian areas.

Avoid/minimize bank hardening to only situations where it is needed to protect infrastructure. If bank hardening is needed, use naturalized bank stabilization whenever possible and re-vegetate waterbody-adjacent slopes with native riparian vegetation. Remove and rehab hardened banks where bank hardening is no longer necessary to protect infrastructure.		
Conduct hand-thinning operations in floodplain areas that have shifted to dense conifer forests to avoid future high-intensity wildfires in valley bottoms.	7.4 Removing / Reducing Human Maintenance	Lack of vegetation management and/or natural disturbance regimes: (1) Allows for conifer encroachment which can outcompete riparian plants and increase the risk of uncharacteristically severe wildfire; (2) Leads to homogenous stand structure which does not provide the range of conditions needed for cover, reproductive sites, and productive foraging areas for SGCN.
Do not create new dams or pits to artificially impound water in grasslands. Where possible, decommission and reclaim old dams or reservoirs and replace livestock water sources with wells and tanks.	7.2 Dams & Water Management / Use	Lack of floodplain connection across large swaths of streams and rivers from historical land-use practices (e.g., dams and bank hardening, resource extraction, fire suppression, stream channel manipulation, loss of beavers) diminishes important habitats and habitat features that are created, maintained, and enhanced through periodic flooding disturbance and results in drying out of floodplains which may cause shifts to upland vegetation types and allow fires to burn at high intensity in valley bottoms and through riparian areas.
Retain canopy cover, streamside vegetative complexity, and coarse woody debris in the stream channel and	11.3 Changes in Temperature Regimes	Hot climatic conditions contribute to eutrophication of waterbodies.

1.2 Ecosystem & Natural Process (Re)Creation	in streamside habitats to create/maintain moist microsites to reduce thermal stress from increased water temperatures. Reference riparian refugia work (Szcodronski et al. 2024) to identify locations with particular climate implications for SGCN.	11.4 Changes in Precipitation & Hydrological Regimes	Changes in runoff patterns, which may be flashier spring floods, less severe flooding, or extreme flood events, can lead to less water available within stream systems to maintain important floodplain processes and function or cause more damaging flood flows over shorter time periods than historical conditions which causes degradation of floodplains and exacerbates drought.
	Construct, repair, and replace passage barriers to reduce or prohibit non-native species movement into areas where they currently do not occur. Remove passage barriers where inappropriate.	7.3 Other Ecosystem Modifications	Loss of movement barriers allows non-native fish and other species to become established and spread in new areas.
	Use materials from conifer removal projects in or near floodplains and riparian areas to introduce woody material to stream channels and mimic/promote beaver activity (e.g., low-tech, process-based restoration).	7.1 Fire & Fire Suppression	Alteration of natural fire regimes along and adjacent to, and in the headwaters of, floodplains, riparian areas, and wetlands can: (1) Cause fires to burn at high intensity through HGCN; (2) Cause habitat degradation through impaired water quality via increased sedimentation; (3) Change runoff levels and timing; (4) Increase water temperatures and UV radiation.
		8.2 Problematic Native Plants & Animals	Conifer encroachment and in-growth.
2. Species Management			
2.1 Species Stewardship	Restore, maintain, and enhance beaver populations and habitats in areas of their historical range to increase natural water storage, reduce the severity of floods and wildfires, and maintain natural stream processes that create, enhance, and maintain habitat for SGCN.	5.1 Hunting & Collecting Terrestrial Animals	Loss of beavers from vast areas of their former range has reduced high-quality habitat for SGCN and maintained/perpetuated degradation in stream and river systems leading to loss or greatly diminished floodplain processes.
		7.1 Fire & Fire Suppression	Alteration of natural fire regimes along and adjacent to, and in the headwaters of, floodplains, riparian areas, and wetlands can: (1) Cause fires to burn at high intensity through HGCN; (2) Cause habitat degradation through impaired water quality via increased sedimentation; (3) Change runoff levels and timing; (4) Increase water temperatures and UV radiation.

		7.2 Dams & Water Management / Use	Lack of floodplain connection across large swaths of streams and rivers from historical land-use practices (e.g., dams and bank hardening, resource extraction, fire suppression, stream channel manipulation, loss of beavers) diminishes important habitats and habitat features that are created, maintained, and enhanced through periodic flooding disturbance and results in drying out of floodplains which may cause shifts to upland vegetation types and allow fires to burn at high intensity in valley bottoms and through riparian areas.
2.2 Species Re-Introduction & Translocation		1.1 Housing & Urban Areas	Human development and land uses near waterbodies leads to greater conflicts with beavers, potentially removing an important keystone species and ecosystem engineer from HGCN where its activities can be beneficial and/or reducing tolerance for beavers on the landscape amongst landowners and land managers.
		1.2 Commercial & Industrial Areas	
		5.1 Hunting & Collecting Terrestrial Animals	Loss of beavers from vast areas of their former range has reduced high-quality habitat for SGCN and maintained/perpetuated degradation in stream and river systems leading to loss or greatly diminished floodplain processes.
		7.1 Fire & Fire Suppression	Alteration of natural fire regimes along and adjacent to, and in the headwaters of, floodplains, riparian areas, and wetlands can: (1) Cause fires to burn at high intensity through HGCN; (2) Cause habitat degradation through impaired water quality via increased sedimentation; (3) Change runoff levels and timing; (4) Increase water temperatures and UV radiation.
B. Behavioral Change/ Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Implement education and outreach campaigns about the importance of	1.1 Housing & Urban Areas	Human development and land uses near waterbodies leads to greater conflicts with beavers, potentially removing an

	beavers to ecosystem services and natural stream processes and techniques for mitigating beaver-human conflicts catered to agricultural communities, water users, road crews, fire-prone communities, local watershed groups, irrigation districts, conservation districts, and local governments.	1.2 Commercial & Industrial Areas	important keystone species and ecosystem engineer from HGCN where its activities can be beneficial and/or reducing tolerance for beavers on the landscape amongst landowners and land managers.
		5.1 Hunting & Collecting Terrestrial Animals	Loss of beavers from vast areas of their former range has reduced high-quality habitat for SGCN and maintained/perpetuated degradation in stream and river systems leading to loss or greatly diminished floodplain processes.
		7.1 Fire & Fire Suppression	Alteration of natural fire regimes along and adjacent to, and in the headwaters of, floodplains, riparian areas, and wetlands can: (1) Cause fires to burn at high intensity through HGCN; (2) Cause habitat degradation through impaired water quality via increased sedimentation; (3) Change runoff levels and timing; (4) Increase water temperatures and UV radiation.
	Implement education and outreach campaigns in agricultural communities about the importance of healthy floodplains, riparian areas, and wetlands for providing ecosystem services and maintaining natural stream processes that result in more water available on the landscape.	7.2 Dams & Water Management / Use	Lack of floodplain connection across large swaths of streams and rivers from historical land-use practices (e.g., dams and bank hardening, resource extraction, fire suppression, stream channel manipulation, loss of beavers) diminishes important habitats and habitat features that are created, maintained, and enhanced through periodic flooding disturbance and results in drying out of floodplains which may cause shifts to upland vegetation types and allow fires to burn at high intensity in valley bottoms and through riparian areas.
4. Livelihood Economic & Moral Incentives			
4.3 Non-Criminal Legal Action	Increase enforcement of local, state, and federal laws around the protection and conservation of floodplains, riparian areas, and wetlands to address the culture of ignoring these laws or treating fines as fees for illegal activities (e.g., streamside vegetation removal, unpermitted bank hardening and	6.1 Recreational Activities	Driving vehicles around in floodplains and wetlands and wakes created by motorized watercraft degrade wetland vegetation.
		7.2 Dams & Water	Lack of floodplain connection across large swaths of streams and rivers from historical land-use practices (e.g., dams and

	bridge/culvert construction, driving vehicles around in floodplains and wetlands, etc.). This may require strengthening of state and federal laws around floodplains, riparian areas, and wetlands reduce protections for these HGCN to facilitate holding violators accountable.	Management / Use	bank hardening, resource extraction, fire suppression, stream channel manipulation, loss of beavers) diminishes important habitats and habitat features that are created, maintained, and enhanced through periodic flooding disturbance and results in drying out of floodplains which may cause shifts to upland vegetation types and allow fires to burn at high intensity in valley bottoms and through riparian areas.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Advocate for water-use management and dam operations to improve instream flows, prevent dewatering, mimic natural hydrologic regimes, and improve and maintain natural stream/river form and function. Work with dam operators to minimize water level fluctuations during important SGCN nesting seasons and avoid water level lowering ahead of or during heat waves.	7.2 Dams & Water Management / Use	Irrigation and/or hydropower dams result in partial or full passage barriers for aquatic and semi-aquatic SGCN.
	Develop dynamic watering strategies that allow for water conservation during periods of low water and provide for groundwater recharge during periods of high water.	7.2 Dams & Water Management / Use	Manipulation of water flow magnitude and timing due to dams and irrigation infrastructure can: (1) Result in fragmentation of linear riparian habitats; (2) Cause unnatural water fluctuations in reservoirs and in streams/rivers below reservoirs; (3) Cause a lack of beneficial flooding disturbance in streams/rivers below dams; (4) Cause low water levels in reservoirs that can allow access to sensitive nesting areas by predators; (5) Result in low waters that increase water temperatures with associated negative impacts (e.g., heat stress, harmful algae blooms); (6) Cause a mismatch with timing of life history events for aquatic SGCN; (7) Result in loss of beavers due to conflict prevention.
	Do not stock fish in currently fishless waterbodies. Use piscicides to remove non-native fish from lakes and streams	7.3 Other Ecosystem Modifications	Loss of movement barriers allows non-native fish and other species to become established and spread in new areas.

and restore fishless conditions or native fish assemblages.	8.2 Problematic Native Plants & Animals	Introduction and/or spread of native fish into areas that were formerly fishless introduces a novel predator to the system and creates competition for food resources with SGCN.
Follow guidance in Montana's Aquatic Invasive Species Management Plan.	7.3 Other Ecosystem Modifications	Loss of movement barriers allows non-native fish and other species to become established and spread in new areas.
Implement both lethal and non-lethal beaver conflict mitigation measures and programs to address conflicts with aquatic SGCN conservation and to increase tolerance for beavers on the landscape.	1.1 Housing & Urban Areas	Human development and land uses near waterbodies leads to greater conflicts with beavers, potentially removing an important keystone species and ecosystem engineer from HGCN where its activities can be beneficial and/or reducing tolerance for beavers on the landscape amongst landowners and land managers.
	1.2 Commercial & Industrial Areas	
Implement both lethal and non-lethal beaver conflict mitigation measures and programs to address conflicts with aquatic SGCN conservation and to increase tolerance for beavers on the landscape.	5.1 Hunting & Collecting Terrestrial Animals	Loss of beavers from vast areas of their former range has reduced high-quality habitat for SGCN and maintained/perpetuated degradation in stream and river systems leading to loss or greatly diminished floodplain processes.
	7.1 Fire & Fire Suppression	Alteration of natural fire regimes along and adjacent to, and in the headwaters of, floodplains, riparian areas, and wetlands can: (1) Cause fires to burn at high intensity through HGCN; (2) Cause habitat degradation through impaired water quality via increased sedimentation; (3) Change runoff levels and timing; (4) Increase water temperatures and UV radiation.
Maintain adequate vegetated buffers between human development, agricultural areas, logging projects and waterbodies to maintain the most critical habitats, help capture runoff of nutrients and pollutants, provide visual and auditory screening for SGCN, and minimize noise and light pollution. Use native plants in buffers when possible to maintain natural characteristics of riparian communities.	7.2 Dams & Water Management / Use	Lack of floodplain connection across large swaths of streams and rivers from historical land-use practices (e.g., dams and bank hardening, resource extraction, fire suppression, stream channel manipulation, loss of beavers) diminishes important habitats and habitat features that are created, maintained, and enhanced through periodic flooding disturbance and results in drying out of floodplains which may cause shifts to upland vegetation types and allow fires to burn at high intensity in valley bottoms and through riparian areas.

	Minimize or avoid the use of culverts for stream crossings in favor of bridges or large culverts that accommodate full stream width and marginal habitats with low stream velocities to facilitate movement for SGCN unless a culvert is an important movement barrier for non-native or problematic native species. Remove dams and barriers where appropriate to restore connectivity, except where the barrier provides necessary protection of an SGCN.	7.2 Dams & Water Management / Use	Irrigation and/or hydropower dams result in partial or full passage barriers for aquatic and semi-aquatic SGCN.
	Minimize use of agricultural fertilizers especially on fields adjacent to floodplains, riparian areas, and wetlands.	9.3 Agricultural & Forestry Effluents	Excess nutrients contribute to eutrophication of waterbodies.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.2 Easements & Resource Rights	Continue and increase efforts to maintain adequate stream flows via instream flow protections and water leases. Reference riparian refugia work (Szcodronski et al. 2024) to identify locations with particular climate implications for SGCN.	11.4 Changes in Precipitation & Hydrological Regimes	Reduced snowpack, diminished stream flows, higher temperatures, and changes in the timing and intensity of runoff can: (1) Cause streams to shift from perennial to intermittent flow; (2) Cause habitat fragmentation from loss of surface flow connectivity; (2) Allow access to sensitive breeding areas by predators; (3) Result in loss or reduction of food resources for SGCN; (4) Increase water temperatures; (5) Contribute to the concentration of saline in wetlands; (6) Create a mismatch between the timing of flow and the timing of the SGCN life history patterns (e.g., reproduction).
	Develop a state-level funding program specific to terrestrial habitats and species in floodplains, riparian areas, and wetlands so that relatively small-acreage conservation projects are not	7.2 Dams & Water Management / Use	Lack of floodplain connection across large swaths of streams and rivers from historical land-use practices (e.g., dams and bank hardening, resource extraction, fire suppression, stream channel manipulation, loss of beavers) diminishes important habitats and habitat features that are created, maintained, and

	constantly overshadowed by larger-acreage and more game-focused upland conservation projects. Remove the requirement for public hunting access to use state funds and instead focus on wildlife viewing access.		enhanced through periodic flooding disturbance and results in drying out of floodplains which may cause shifts to upland vegetation types and allow fires to burn at high intensity in valley bottoms and through riparian areas.
	Pursue channel migration easements on large rivers to allow for natural channel migration to maintain and restore critical floodplain processes for natural establishment of riparian plants and important floodplain features for SGCN (e.g., backwaters, floodplain pools, beaver-modified habitats, etc.).	7.2 Dams & Water Management / Use	Manipulation of water flow magnitude and timing due to dams and irrigation infrastructure can: (1) Result in fragmentation of linear riparian habitats; (2) Cause unnatural water fluctuations in reservoirs and in streams/rivers below reservoirs; (3) Cause a lack of beneficial flooding disturbance in streams/rivers below dams; (4) Cause low water levels in reservoirs that can allow access to sensitive nesting areas by predators; (5) Result in low waters that increase water temperatures with associated negative impacts (e.g., heat stress, harmful algae blooms); (6) Cause a mismatch with timing of life history events for aquatic SGCN; (7) Result in loss of beavers due to conflict prevention.
	Secure instream water rights or leases to maintain flows during low-water periods. Re-establish or improve flows in intermittent reaches of streams where intermittency is an unnatural condition.		
6.4 Conservation Planning	Conduct channel migration mapping on all major river and streams in Montana to improve land-use planning efforts that can benefit HGCN.	7.2 Dams & Water Management / Use	
	Develop and implement grazing management plans that meet or exceed riparian health objectives and exclude grazers from unlimited riparian access.	2.3 Livestock Farming & Ranching	Livestock grazing within riparian areas damages vegetation and degrades banks.
6.5 Site Infrastructure	Install and/or maintain kiosks at campgrounds, fishing access sites, and other important recreation sites associated with lakes to increase awareness of the dangers of AIS, releasing unwanted pets, and illegal but	8.1 Invasive Non-Native/Alien Plants & Animals	Introduced pasture grasses, invasive weeds, and invasive shrubs diminish or halt important natural processes that create and maintain floodplain and riparian habitats and/or outcompete native vegetation and cause changes to stream channel morphology, all of which can remove or degrade HGCN.

	purposeful introductions on non-native species.		
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Work to expand the scope of streamside protection laws to include a buffer along stream and river channels in recognition of channel migration and the importance of riparian and wetland vegetation that is not directly adjacent to the waterbody.	7.2 Dams & Water Management / Use	Bank stabilization to protect human infrastructure severs floodplain connectivity, reduces woody debris inputs into waterbodies, diminishes public access to waterbodies, facilitates increased development in and near floodplains, and perpetuates bank hardening downstream.
		9.1 Household Sewage & Urban Waste Water	Urban and transportation runoff and contamination changes nutrient cycling.
		9.2 Industrial & Military Effluents	Commercial and industrial effluents.
7.2 Policies & Guidelines	Establish no-wake lakes and river sections where there is community support and a conservation need or establish no-wake zones in portions of lakes and rivers with exceptional value to SGCN.	6.1 Recreational Activities	Driving vehicles around in floodplains and wetlands and wakes created by motorized watercraft degrade wetland vegetation.
9. Education & Training			
9.2 Training & Individual Capacity Development	Assist landowners and partners in developing bank stabilization alternatives that support floodplain connectivity (e.g., removal of rip rap, waterbody setbacks for development, naturalized stream bank stabilization).	7.2 Dams & Water Management / Use	Bank stabilization to protect human infrastructure severs floodplain connectivity, reduces woody debris inputs into waterbodies, diminishes public access to waterbodies, facilitates increased development in and near floodplains, and perpetuates bank hardening downstream.
	Develop materials and pursue outreach opportunities with agricultural communities about the negative impacts of encroaching on HGCN, with a specific emphasis on the connected nature of	7.2 Dams & Water Management / Use	Lack of floodplain connection across large swaths of streams and rivers from historical land-use practices (e.g., dams and bank hardening, resource extraction, fire suppression, stream channel manipulation, loss of beavers) diminishes important habitats and habitat features that are created, maintained, and

	streams and rivers and how actions taken on one property can perpetuate impacts up and downstream (e.g., bank hardening).		enhanced through periodic flooding disturbance and results in drying out of floodplains which may cause shifts to upland vegetation types and allow fires to burn at high intensity in valley bottoms and through riparian areas.
	Implement projects, provide technical/financial assistance, and conduct outreach around making ditches, buffers, and/or diversions more efficient and keep nutrients or chemicals out of streams. Fire retardant should be avoided in or adjacent to wetlands and riparian zones.	9.1 Household Sewage & Urban Waste Water 9.3 Agricultural & Forestry Effluents	Excess nutrients contribute to eutrophication of waterbodies.
10. Institutional Development			
10.1 Internal Organizational Management & Administration	Maintain funding and support for agency and non-profit internship and technician positions that conduct outreach with landowners and recreationists around waterbodies (e.g., FWP Loon Ranger internship, river ambassador programs, etc.).	6.1 Recreational Activities	Driving vehicles around in floodplains and wetlands and wakes created by motorized watercraft degrade wetland vegetation.
10.4 Financing Conservation	Maintain funding and support for FWP's AIS program, including a robust network of AIS check stations positioned strategically throughout the state.	7.3 Other Ecosystem Modifications	Loss of movement barriers allows non-native fish and other species to become established and spread in new areas.

Rivers and Streams

Montana is covered in a network of stream and river drainages that can take the form of everything from a small, crystal-clear seep or spring with barely a trickle of water to a giant muddy river more than 1/4-mile across. These streams and rivers are the lifeblood of Montana's ecosystems, transporting water from snowmelt and rain through sagebrush, grassland, and forested landscapes. In their healthiest form, these waterbodies form "river-wetland corridor" where channel migration and periodic flooding form broad riparian areas and wetland complexes used by the largest number of terrestrial SGCN of any HGCN in the state. Within the streams and rivers themselves swim some of Montana's most impressive animal populations: the fish and the aquatic invertebrates those fish rely on as the base of their food web. Montana is second to none in the U. S. for fisheries resources, and the allure of the state's streams and rivers brings in people from around the world. Alongside anglers are floaters, wildlife watchers, and hunters, who all escape to Montana's flowing waters to find abundant wildlife, cool temperatures, and some of the most beautiful and iconic scenery in the entire state. Streams and rivers make up a small percentage of the landscape in Montana, yet these habitats support well over 100 SGCN in both the aquatic and terrestrial realms.

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Avoid/minimize bank hardening to only situations where it is needed to protect infrastructure. If bank hardening is needed, use naturalized bank stabilization whenever possible and re-vegetate waterbody-adjacent slopes with native riparian vegetation. Remove and rehab hardened banks where bank hardening is no longer necessary to protect infrastructure.	7.2 Dams & Water Management / Use	Bank stabilization to protect human infrastructure severs floodplain connectivity, reduces woody debris inputs into waterbodies, diminishes public access to waterbodies, facilitates increased development in and near floodplains, and perpetuates bank hardening downstream.

	Upgrade irrigation diversions to include fish screens when necessary.	7.2 Dams & Water Management / Use	Irrigation and/or hydropower dams result in partial or full passage barriers for aquatic SGCN.
	Construct, repair, and replace passage barriers to reduce or prohibit non-native species movement into areas where they currently do not occur.	6.1 Recreational Activities	Introduction of Aquatic Invasive Species via recreational activities (watercraft, waders, etc.).
		7.3 Other Ecosystem Modifications	Loss of movement barriers allows non-native fish and other species to become established and spread in new areas.
	Conduct hand-thinning operations in floodplain areas that have shifted to dense conifer forests to avoid future high-intensity wildfires in valley bottoms.	7.4 Removing / Reducing Human Maintenance	Reducing/removing human maintenance of HGCN that can degrade without human intervention.
	Retain canopy cover, streamside vegetative complexity, and coarse woody debris in the stream channel and in streamside habitats to create/maintain moist microsites to reduce thermal stress from increased water temperatures.	11.3 Changes in Temperature Regimes	Hot climatic conditions contribute to increased plant and algae growth and longer growing season length may make some emergent and submergent plant species and algal blooms problematic for aquatic and semi-aquatic species through direct mortalities, changes to prey base, reduced water clarity, or reduced swimming ability/efficiency.
1.2 Ecosystem & Natural Process (Re)Creation	Strategically evaluate and act on opportunities to improve passage for SGCN and restore connectivity (e.g., to lake systems, between main rivers and tributaries) by identifying and removing movement barriers, improving native fish corridors, restoring habitat, and/or by installing fish passage structures.	7.2 Dams & Water Management / Use	Undersized culverts, perched culverts, and other waterbody obstructions interrupt connectivity for aquatic SGCN.
			Irrigation and/or hydropower dams result in partial or full passage barriers for aquatic SGCN.
2. Species Management			
2.1 Species Stewardship	Restore, maintain, and enhance beaver populations and habitats in areas of their historical range to increase natural water storage, reduce the severity of floods and wildfires, and maintain natural stream	1.1 Housing & Urban Areas	Human development and land uses near waterbodies leads to greater conflicts with beavers, potentially removing an important keystone species and ecosystem engineer from HGCN where its activities can be beneficial and/or reducing tolerance for beavers on the landscape amongst landowners and land managers.
		1.2 Commercial & Industrial Areas	

	processes that create, enhance, and maintain habitat for SGCN.	5.1 Hunting & Collecting Terrestrial Animals	Loss of beavers from vast areas of their former range has reduced high-quality habitat for SGCN and maintained/perpetuated degradation in stream and river systems leading to loss or greatly diminished floodplain processes.
B. Behavioral Change/ Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Implement education and outreach campaigns about the importance of beavers to ecosystem services and natural stream processes and techniques for mitigating beaver-human conflicts catered to agricultural communities, water users, road crews, fire-prone communities, local watershed groups, irrigation districts, conservation districts, and local governments.	1.1 Housing & Urban Areas	Human development and land uses near waterbodies leads to greater conflicts with beavers, potentially removing an important keystone species and ecosystem engineer from HGCN where its activities can be beneficial and/or reducing tolerance for beavers on the landscape amongst landowners and land managers.
		1.2 Commercial & Industrial Areas	
		5.1 Hunting & Collecting Terrestrial Animals	Loss of beavers from vast areas of their former range has reduced high-quality habitat for SGCN and maintained/perpetuated degradation in stream and river systems leading to loss or greatly diminished floodplain processes.
		7.1 Fire & Fire Suppression	Alteration of natural fire regimes along and adjacent to rivers and streams can lead to uncharacteristically severe fires that can: (1) Cause habitat degradation through impaired water quality via increased sedimentation; (2) Change runoff levels and timing; (3) Increase water temperatures and UV radiation.
	Implement education and outreach campaigns in agricultural communities about the importance of healthy floodplains, riparian areas, and wetlands for providing ecosystem services and maintaining natural stream processes that result in more water available on the landscape.	7.2 Dams & Water Management / Use	Lack of floodplain connection across large swaths of streams and rivers from historical land-use practices (e.g., dams and bank hardening, resource extraction, fire suppression, stream channel manipulation, loss of beavers) diminishes important habitats and habitat features that are created, maintained, and enhanced through periodic flooding disturbance and results in drying out of floodplains which may cause shifts to upland

			vegetation types and allow fires to burn at high intensity in valley bottoms and through riparian areas.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Increase enforcement of local, state, and federal laws around the protection and conservation of floodplains, riparian areas, and wetlands to address the culture of ignoring these laws or treating fines as fees for illegal activities (e.g., streamside vegetation removal, unpermitted bank hardening and bridge/culvert construction, driving vehicles around in floodplains and wetlands, etc.). This may require strengthening of state and federal laws around floodplains, riparian areas, and wetlands reduce protections for these HGCN to facilitate holding violators accountable.	6.1 Recreational Activities	Driving vehicles around in floodplains and wetlands and wakes created by motorized watercraft degrade vegetation.
		7.2 Dams & Water Management / Use	Bank stabilization to protect human infrastructure severs floodplain connectivity, reduces woody debris inputs into waterbodies, diminishes public access to waterbodies, facilitates increased development in and near floodplains, and perpetuates bank hardening downstream.
5. Livelihood Economic & Moral Incentives			

5.2 Better Products & Management Practices	Advocate for water-use management and dam operations to improve instream flows, prevent dewatering, mimic natural hydrologic regimes, and improve and maintain natural stream/river form and function. Work with dam operators to minimize water level fluctuations during important SGCN nesting seasons and avoid water level lowering ahead of or during heat waves.	7.2 Dams & Water Management / Use	Manipulation of water flow magnitude and timing due to dams and irrigation infrastructure can: (1) Result in fragmentation of linear riparian habitats; (2) Cause unnatural water fluctuations in reservoirs and in streams/rivers below reservoirs; (3) Cause a lack of beneficial flooding disturbance in streams/rivers below dams; (4) Cause low water levels in reservoirs that can allow access to sensitive nesting areas by predators; (5) Result in low waters that increase water temperatures with associated negative impacts (e.g., heat stress, harmful algae blooms); (6) Cause a mismatch with timing of life history events for aquatic SGCN; (7) Result in loss of beavers due to conflict prevention; (8) Fish and other aquatic species can become entrained in irrigation diversions.
	Do not stock fish in currently fishless waterbodies. Use piscicides to remove non-native fish from lakes and streams and restore fishless conditions or native fish assemblages.	7.3 Other Ecosystem Modifications	Loss of movement barriers allows non-native fish and other species to become established and spread in new areas.
		8.2 Problematic Native Plants & Animals	Introduction and/or spread of native fish into areas that were formerly fishless introduces a novel predator to the system and creates competition for food resources with SGCN.
	Follow guidance in Montana's Aquatic Invasive Species Management Plan.	6.1 Recreational Activities	Introduction of Aquatic Invasive Species via recreational activities (watercraft, waders, etc.).

Follow the Statewide Fisheries Management Plan and/or individual waterbody management plans, where applicable.	7.2 Dams & Water Management / Use	Manipulation of water flow magnitude and timing due to dams and irrigation infrastructure can: (1) Result in fragmentation of linear riparian habitats; (2) Cause unnatural water fluctuations in reservoirs and in streams/rivers below reservoirs; (3) Cause a lack of beneficial flooding disturbance in streams/rivers below dams; (4) Cause low water levels in reservoirs that can allow access to sensitive nesting areas by predators; (5) Result in low waters that increase water temperatures with associated negative impacts (e.g., heat stress, harmful algae blooms); (6) Cause a mismatch with timing of life history events for aquatic SGCN; (7) Result in loss of beavers due to conflict prevention; (8) Fish and other aquatic species can become entrained in irrigation diversions.
Implement both lethal and non-lethal beaver conflict mitigation measures and programs to address conflicts with aquatic SGCN conservation and to increase tolerance for beavers on the landscape.	1.1 Housing & Urban Areas	Human development and land uses near waterbodies leads to greater conflicts with beavers, potentially removing an important keystone species and ecosystem engineer from HGCN where its activities can be beneficial and/or reducing tolerance for beavers on the landscape amongst landowners and land managers.
	1.2 Commercial & Industrial Areas	
	5.1 Hunting & Collecting Terrestrial Animals	Loss of beavers from vast areas of their former range has reduced high-quality habitat for SGCN and maintained/perpetuated degradation in stream and river systems leading to loss or greatly diminished floodplain processes.
	7.1 Fire & Fire Suppression	Alteration of natural fire regimes along and adjacent to rivers and streams can lead to uncharacteristically severe fires that can: (1) Cause habitat degradation through impaired water quality via increased sedimentation; (2) Change runoff levels and timing; (3) Increase water temperatures and UV radiation.

	8.2 Problematic Native Plants & Animals	Beaver damming activity can create partial or full passage barriers for aquatic SGCN, silt in important spawning gravels, raise water temperatures, or cause aquatic community shifts (e.g., favoring non-native fish species).
Maintain adequate vegetated buffers between human development, agricultural areas, logging projects and waterbodies to maintain the most critical habitats, help capture runoff of nutrients and pollutants, provide visual and auditory screening for SGCN, and minimize noise and light pollution. Use native plants in buffers when possible to maintain natural characteristics of riparian communities.	7.2 Dams & Water Management / Use	Bank stabilization to protect human infrastructure severs floodplain connectivity, reduces woody debris inputs into waterbodies, diminishes public access to waterbodies, facilitates increased development in and near floodplains, and perpetuates bank hardening downstream.
Minimize or avoid the use of culverts for stream crossings in favor of bridges or large culverts that accommodate full stream width and marginal habitats with low stream velocities to facilitate movement for SGCN unless a culvert is an important movement barrier for non-native or problematic native species. Remove dams and barriers where appropriate to restore connectivity, except where the barrier provides necessary protection of an SGCN.		Undersized culverts, perched culverts, and other waterbody obstructions interrupt connectivity for aquatic SGCN.
Minimize use of agricultural fertilizers especially on fields adjacent to floodplains, riparian areas, and wetlands.	9.3 Agricultural & Forestry Effluents	Excess nutrients contribute to eutrophication of waterbodies. Point source pollution (e.g., industrial effluents) and nonpoint source pollution (e.g., agricultural and urban runoff) contribute pollutants and excess nutrients to waterbodies, with cascading negative impacts to aquatic SGCN and their food base. Relatively new and emerging contaminants negatively impact SGCN or their food base (e.g., PFAS chemicals, 6PPD-Q, selenium).

C. Enabling Conditions Actions

6. Conservation Designation & Planning

6.2 Easements & Resource Rights	Continue and increase efforts to maintain adequate stream flows via instream flow protections and water leases.	11.4 Changes in Precipitation & Hydrological Regimes	Changes in runoff patterns, which may be flashier spring floods, less severe flooding, or extreme flood events, can lead to less water available within stream systems to maintain important floodplain processes and function or cause more damaging flood flows over shorter time periods than historical conditions which causes degradation of floodplains and exacerbates drought.
	Pursue channel migration easements on large rivers to allow for natural channel migration to maintain and restore critical floodplain processes for natural establishment of riparian plants and important floodplain features for SGCN (e.g., backwaters, floodplain pools, beaver-modified habitats, etc.).	7.2 Dams & Water Management / Use	Lack of floodplain connection across large swaths of streams and rivers from historical land-use practices (e.g., dams and bank hardening, resource extraction, fire suppression, stream channel manipulation, loss of beavers) diminishes important habitats and habitat features that are created, maintained, and enhanced through periodic flooding disturbance and results in drying out of floodplains which may cause shifts to upland vegetation types and allow fires to burn at high intensity in valley bottoms and through riparian areas.
	Secure instream water rights or leases to maintain flows during low-water periods. Re-establish or improve flows in intermittent reaches of streams where intermittency is an unnatural condition.	7.2 Dams & Water Management / Use	Manipulation of water flow magnitude and timing due to dams and irrigation infrastructure can: (1) Result in fragmentation of linear riparian habitats; (2) Cause unnatural water fluctuations in reservoirs and in streams/rivers below reservoirs; (3) Cause a lack of beneficial flooding disturbance in streams/rivers below dams; (4) Cause low water levels in reservoirs that can allow access to sensitive nesting areas by predators; (5) Result in low waters that increase water temperatures with associated negative impacts (e.g., heat stress, harmful algae blooms); (6) Cause a mismatch with timing of life history events for aquatic SGCN; (7) Result in loss of beavers due to conflict prevention; (8) Fish and other

			aquatic species can become entrained in irrigation diversions.
6.4 Conservation Planning	Conduct channel migration mapping on all major river and streams in Montana to improve land-use planning efforts that can benefit HGCN.	7.2 Dams & Water Management / Use	Lack of floodplain connection across large swaths of streams and rivers from historical land-use practices (e.g., dams and bank hardening, resource extraction, fire suppression, stream channel manipulation, loss of beavers) diminishes important habitats and habitat features that are created, maintained, and enhanced through periodic flooding disturbance and results in drying out of floodplains which may cause shifts to upland vegetation types and allow fires to burn at high intensity in valley bottoms and through riparian areas.
	Develop and implement grazing management plans that meet or exceed riparian health objectives and exclude grazers from unlimited riparian access.	2.3 Livestock Farming & Ranching	Livestock grazing within riparian areas damages vegetation and degrades banks.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Advocate for aquatic connectivity during Federal Energy Regulatory Commission relicensing.	7.2 Dams & Water Management / Use	Lack of floodplain connection across large swaths of streams and rivers from historical land-use practices (e.g., dams and bank hardening, resource extraction, fire suppression, stream channel manipulation, loss of beavers) diminishes important habitats and habitat features that are created, maintained, and enhanced through periodic flooding disturbance and results in drying out of floodplains which may cause shifts to upland vegetation types and allow fires to burn at high intensity in valley bottoms and through riparian areas.
	Work to expand the scope of streamside protection laws to include a buffer along stream and river channels in recognition of channel migration and the importance of riparian and wetland vegetation that is not directly adjacent to the waterbody.		Bank stabilization to protect human infrastructure severs floodplain connectivity, reduces woody debris inputs into waterbodies, diminishes public access to waterbodies, facilitates increased development in and near floodplains, and perpetuates bank hardening downstream.

	Work to expand the scope of streamside protection laws to include a buffer along stream and river channels in recognition of channel migration and the importance of riparian and wetland vegetation that is not directly adjacent to the waterbody.	9.1 Household Sewage & Urban Waste Water 9.3 Agricultural & Forestry Effluents	Excess nutrients contribute to eutrophication of waterbodies. Point source pollution (e.g., industrial effluents) and nonpoint source pollution (e.g., agricultural and urban runoff) contribute pollutants and excess nutrients to waterbodies, with cascading negative impacts to aquatic SGCN and their food base. Relatively new and emerging contaminants negatively impact SGCN or their food base (e.g., PFAS chemicals, 6PPD-Q, selenium).
7.2 Policies & Guidelines	Establish no-wake lakes and river sections where there is community support and a conservation need or establish no-wake zones in portions of lakes and rivers with exceptional value to SGCN.	6.1 Recreational Activities	Driving vehicles around in floodplains and wetlands and wakes created by motorized watercraft degrade vegetation.
	Provide decision makers and regulatory agencies with data related to pollution, water quality, and tissue concentrations in SGCN and other native species to help develop water quality standards that are protective of all species and their habitats.	7.1 Fire & Fire Suppression	Firefighting efforts lead to damage to floodplains, riparian areas, and wetlands due to road-building, fire line construction, and introduction of pollutants from heavy equipment and fire retardants.
		9.1 Household Sewage & Urban Waste Water	Excess nutrients contribute to eutrophication of waterbodies. Point source pollution (e.g., industrial effluents) and nonpoint source pollution (e.g., agricultural and urban runoff) contribute pollutants and excess nutrients to waterbodies, with cascading negative impacts to aquatic SGCN and their food base. Relatively new and emerging contaminants negatively impact SGCN or their food base (e.g., PFAS chemicals, 6PPD-Q, selenium).
		9.2 Industrial & Miliary Effluents 9.3 Agricultural & Forestry Effluents	
9. Education & Training			

9.2 Training & Individual Capacity Development	Assist landowners and partners in developing bank stabilization alternatives that support floodplain connectivity (e.g., removal of rip rap, waterbody setbacks for development, naturalized stream bank stabilization).	7.2 Dams & Water Management / Use	Bank stabilization to protect human infrastructure severs floodplain connectivity, reduces woody debris inputs into waterbodies, diminishes public access to waterbodies, facilitates increased development in and near floodplains, and perpetuates bank hardening downstream.
	Develop materials and pursue outreach opportunities with agricultural communities about the negative impacts of encroaching on HGCN, with a specific emphasis on the connected nature of streams and rivers and how actions taken on one property can perpetuate impacts up and downstream (e.g., bank hardening).		
	Implement projects, provide technical/financial assistance, and conduct outreach around making ditches, buffers, and/or diversions more efficient and keep nutrients or chemicals out of streams. Fire retardant should be avoided in or adjacent to wetlands and riparian zones.	9.1 Household Sewage & Urban Waste Water 9.3 Agricultural & Forestry Effluents	Excess nutrients contribute to eutrophication of waterbodies.
10. Institutional Development			
10.1 Internal Organizational Management & Administration	Maintain funding and support for agency and non-profit internship and technician positions that conduct outreach with landowners and recreationists around waterbodies (e.g., FWP Loon Ranger internship, river ambassador programs, etc.).	6.1 Recreational Activities	Driving vehicles around in floodplains and wetlands and wakes created by motorized watercraft degrade vegetation.
			Introduction of Aquatic Invasive Species via recreational activities (watercraft, waders, etc.)

Lakes and Reservoirs

Lakes and reservoirs in Montana are central to the state's fishing and boating economies but are also critical for storing water and managing it to benefit agriculture and municipalities. The creation of reservoirs for water management has also created some of the most sought-after fishing destinations in the United States. Places like Canyon Ferry Lake, Fort Peck Reservoir, and Nelson Reservoir are renowned fishing destinations but also boast immense wetland areas and a rich aquatic food web that provide resources for many terrestrial SGCN. These areas are important for animals that forage and breed in Montana but are also critical stopover points for continent-scale migrations of shorebirds, waterfowl, and other water-loving birds. Some lesser-known species are also dependent on still waterbodies such as bats that need still water to drink and find abundant insects to eat. Overall, Montana is still an arid state, and lakes and reservoirs make up a small percentage of the landscape. Even with this small representation, over 100 terrestrial or aquatic SGCN are dependent on lakes and reservoirs at some point in their life cycle.

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Construct, repair, and replace passage barriers to reduce or prohibit non-native species movement into areas where they currently do not occur.	6.1 Recreational Activities	Introduction of Aquatic Invasive Species via recreational activities (watercraft, waders, etc.).
	Upgrade irrigation diversions to include fish screens when necessary.	7.2 Dams & Water Management / Use	Manipulation of water flow magnitude and timing due to dams and irrigation infrastructure can: (1) Result in fragmentation of linear riparian habitats; (2) Cause unnatural water fluctuations in reservoirs and in streams/rivers below reservoirs; (3) Cause a lack of beneficial flooding disturbance in streams/rivers below dams; (4) Cause low water levels in reservoirs that can allow access to sensitive nesting areas by predators; (5) Result in low waters that increase water temperatures

			with associated negative impacts (e.g., heat stress, harmful algae blooms); (6) Cause a mismatch with timing of life history events for aquatic SGCN; (7) Result in loss of beavers due to conflict prevention; (8) Fish and other aquatic species can become entrained in irrigation diversions.
	Avoid/minimize bank hardening to only situations where it is needed to protect infrastructure. If bank hardening is needed, use naturalized bank stabilization whenever possible and re-vegetate waterbody-adjacent slopes with native riparian vegetation. Remove and rehab hardened banks where bank hardening is no longer necessary to protect infrastructure.	7.2 Dams & Water Management / Use	Bank stabilization to protect human infrastructure severs floodplain connectivity, reduces woody debris inputs into waterbodies, diminishes public access to waterbodies, facilitates increased development in and near floodplains, and perpetuates bank hardening downstream.
	Conduct hand-thinning operations in floodplain areas that have shifted to dense conifer forests to avoid future high-intensity wildfires in valley bottoms.	8.2 Problematic Native Plants & Animals	Conifer encroachment and in-growth.
	Retain canopy cover, streamside vegetative complexity, and coarse woody debris in the stream channel and in streamside habitats to create/maintain moist microsites to reduce thermal stress from increased water temperatures.	11.3 Changes in Temperature Regimes	Hot climatic conditions contribute to eutrophication of waterbodies. Increased plant and algae growth and longer growing season length may make some emergent and submergent plant species and algal blooms problematic for aquatic and semi-aquatic species through direct mortalities, changes to prey base, reduced water clarity, or reduced swimming ability/efficiency.
1.2 Ecosystem & Natural Process (Re)Creation	Strategically evaluate and act on opportunities to improve passage for SGCN and restore connectivity (e.g., to lake systems, between main rivers and tributaries) by identifying and removing movement barriers, improving native fish	7.2 Dams & Water Management / Use	Manipulation of water flow magnitude and timing due to dams and irrigation infrastructure can: (1) Result in fragmentation of linear riparian habitats; (2) Cause unnatural water fluctuations in reservoirs and in streams/rivers below reservoirs; (3) Cause a lack of beneficial flooding disturbance in streams/rivers below dams; (4) Cause low water levels in reservoirs that can

	corridors, restoring habitat, and/or by installing fish passage structures.		allow access to sensitive nesting areas by predators; (5) Result in low waters that increase water temperatures with associated negative impacts (e.g., heat stress, harmful algae blooms); (6) Cause a mismatch with timing of life history events for aquatic SGCN; (7) Result in loss of beavers due to conflict prevention; (8) Fish and other aquatic species can become entrained in irrigation diversions.
2. Species Management			
2.1 Species Stewardship	Restore, maintain, and enhance beaver populations and habitats in areas of their historical range to increase natural water storage, reduce the severity of floods and wildfires, and maintain natural processes that create, enhance, and maintain habitat for SGCN.	1.1 Housing & Urban Areas	Human development and land uses near waterbodies leads to greater conflicts with beavers, potentially removing an important keystone species and ecosystem engineer from HGCN where its activities can be beneficial and/or reducing tolerance for beavers on the landscape amongst landowners and land managers.
		1.2 Commercial & Industrial Areas	
		5.1 Hunting & Collecting Terrestrial Animals	Loss of beavers from vast areas of their former range has reduced high-quality habitat for SGCN and maintained/perpetuated degradation in stream and river systems leading to loss or greatly diminished floodplain processes.
B. Behavioral Change/ Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Implement education and outreach campaigns about the importance of beavers to ecosystem services and natural stream processes and techniques for mitigating beaver-human conflicts catered to agricultural communities, water users, road crews, fire-prone communities, local watershed groups, irrigation districts,	1.1 Housing & Urban Areas	Human development and land uses near waterbodies leads to greater conflicts with beavers, potentially removing an important keystone species and ecosystem engineer from HGCN where its activities can be beneficial and/or reducing tolerance for beavers on the landscape amongst landowners and land managers.
		1.2 Commercial & Industrial Areas	
		5.1 Hunting & Collecting Terrestrial Animals	Loss of beavers from vast areas of their former range has reduced high-quality habitat for SGCN and maintained/perpetuated degradation in stream and river

	conservation districts, and local governments.		systems leading to loss or greatly diminished floodplain processes.
		7.1 Fire & Fire Suppression	Alteration of natural fire regimes along and adjacent to rivers and streams can lead to uncharacteristically severe fires that can: (1) Cause habitat degradation through impaired water quality via increased sedimentation; (2) Change runoff levels and timing; (3) Increase water temperatures and UV radiation.
	Implement education and outreach campaigns in agricultural communities about the importance of healthy floodplains, riparian areas, and wetlands for providing ecosystem services and maintaining natural stream processes that result in more water available on the landscape.	7.2 Dams & Water Management / Use	Manipulation of water flow magnitude and timing due to dams and irrigation infrastructure can: (1) Result in fragmentation of linear riparian habitats; (2) Cause unnatural water fluctuations in reservoirs and in streams/rivers below reservoirs; (3) Cause a lack of beneficial flooding disturbance in streams/rivers below dams; (4) Cause low water levels in reservoirs that can allow access to sensitive nesting areas by predators; (5) Result in low waters that increase water temperatures with associated negative impacts (e.g., heat stress, harmful algae blooms); (6) Cause a mismatch with timing of life history events for aquatic SGCN; (7) Result in loss of beavers due to conflict prevention; (8) Fish and other aquatic species can become entrained in irrigation diversions.
5. Livelihood Economic & Moral Incentives			

5.2 Better Products & Management Practices	Advocate for water-use management and dam operations to improve instream flows, prevent dewatering, mimic natural hydrologic regimes, and improve and maintain natural stream/river form and function. Work with dam operators to minimize water level fluctuations during important SGCN nesting seasons and avoid water level lowering ahead of or during heat waves.	7.2 Dams & Water Management / Use	Manipulation of water flow magnitude and timing due to dams and irrigation infrastructure can: (1) Result in fragmentation of linear riparian habitats; (2) Cause unnatural water fluctuations in reservoirs and in streams/ivers below reservoirs; (3) Cause a lack of beneficial flooding disturbance in streams/ivers below dams; (4) Cause low water levels in reservoirs that can allow access to sensitive nesting areas by predators; (5) Result in low waters that increase water temperatures with associated negative impacts (e.g., heat stress, harmful algae blooms); (6) Cause a mismatch with timing of life history events for aquatic SGCN; (7) Result in loss of beavers due to conflict prevention; (8) Fish and other aquatic species can become entrained in irrigation diversions.
	Do not stock fish in currently fishless waterbodies. Use piscicides to remove non-native fish from lakes and streams and restore fishless conditions or native fish assemblages.	7.3 Other Ecosystem Modifications	Loss of movement barriers allows non-native fish and other species to become established and spread in new areas.
		8.2 Problematic Native Plants & Animals	Introduction and/or spread of native fish into areas that were formerly fishless introduces a novel predator to the system and creates competition for food resources with SGCN.
	Follow guidance in Montana's Aquatic Invasive Species Management Plan.	6.1 Recreational Activities	Introduction of Aquatic Invasive Species via recreational activities (watercraft, waders, etc.).
	Follow the Statewide Fisheries Management Plan and/or individual waterbody management plans, where applicable.	7.2 Dams & Water Management / Use	Manipulation of water flow magnitude and timing due to dams and irrigation infrastructure can: (1) Result in fragmentation of linear riparian habitats; (2) Cause unnatural water fluctuations in reservoirs and in streams/ivers below reservoirs; (3) Cause a lack of beneficial flooding disturbance in streams/ivers below dams; (4) Cause low water levels in reservoirs that can allow access to sensitive nesting areas by predators; (5) Result in low waters that increase water temperatures

			with associated negative impacts (e.g., heat stress, harmful algae blooms); (6) Cause a mismatch with timing of life history events for aquatic SGCN; (7) Result in loss of beavers due to conflict prevention; (8) Fish and other aquatic species can become entrained in irrigation diversions.
Implement both lethal and non-lethal beaver conflict mitigation measures and programs to address conflicts with aquatic SGCN conservation and to increase tolerance for beavers on the landscape.	1.1 Housing & Urban Areas	1.2 Commercial & Industrial Areas	Human development and land uses near waterbodies leads to greater conflicts with beavers, potentially removing an important keystone species and ecosystem engineer from HGCN where its activities can be beneficial and/or reducing tolerance for beavers on the landscape amongst landowners and land managers.
	5.1 Hunting & Collecting Terrestrial Animals		
	7.1 Fire & Fire Suppression		Loss of beavers from vast areas of their former range has reduced high-quality habitat for SGCN and maintained/perpetuated degradation in stream and river systems leading to loss or greatly diminished floodplain processes.
			Alteration of natural fire regimes along and adjacent to rivers and streams can lead to uncharacteristically severe fires that can: (1) Cause habitat degradation through impaired water quality via increased sedimentation; (2) Change runoff levels and timing; (3) Increase water temperatures and UV radiation.
Minimize or avoid the use of culverts for stream crossings in favor of bridges or large culverts that accommodate full stream width and marginal habitats with low stream velocities to facilitate movement for SGCN unless a culvert is an important movement barrier for non-native or problematic native species. Remove dams and barriers where appropriate to restore connectivity, except where the	7.2 Dams & Water Management / Use		Manipulation of water flow magnitude and timing due to dams and irrigation infrastructure can: (1) Result in fragmentation of linear riparian habitats; (2) Cause unnatural water fluctuations in reservoirs and in streams/rivers below reservoirs; (3) Cause a lack of beneficial flooding disturbance in streams/rivers below dams; (4) Cause low water levels in reservoirs that can allow access to sensitive nesting areas by predators; (5) Result in low waters that increase water temperatures with associated negative impacts (e.g., heat stress, harmful algae blooms); (6) Cause a mismatch with timing

	barrier provides necessary protection of an SGCN.		of life history events for aquatic SGCN; (7) Result in loss of beavers due to conflict prevention; (8) Fish and other aquatic species can become entrained in irrigation diversions.
	Minimize use of agricultural fertilizers especially on fields adjacent to floodplains, riparian areas, and wetlands.	9.3 Agricultural & Forestry Effluents	Excess nutrients contribute to eutrophication of waterbodies. Point source pollution (e.g., industrial effluents) and nonpoint source pollution (e.g., agricultural and urban runoff) contribute pollutants and excess nutrients to waterbodies, with cascading negative impacts to aquatic SGCN and their food base. Relatively new and emerging contaminants negatively impact SGCN or their food base (e.g., PFAS chemicals, 6PPD-Q, selenium).
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.2 Easements & Resource Rights	Continue and increase efforts to maintain adequate water levels via instream flow protections and water leases.	11.4 Changes in Precipitation & Hydrological Regimes	Reduced snowpack, diminished stream flows, higher temperatures, and changes in the timing and intensity of runoff can: (1) Cause streams to shift from perennial to intermittent flow; (2) Cause habitat fragmentation from loss of surface flow connectivity; (2) Allow access to sensitive breeding areas by predators; (3) Result in loss or reduction of food resources for SGCN; (4) Increase water temperatures; (5) Contribute to the concentration of saline in wetlands; (6) Create a mismatch between the timing of flow and the timing of the SGCN life history patterns (e.g., reproduction); (6) contribute to eutrophication of waterbodies. Changes in runoff patterns and rain-on-snow events, which may be flashier spring floods, less severe flooding, or extreme flood events, can lead to less water available within stream systems to maintain important floodplain processes and function or cause more damaging flood flows over shorter time periods than historical conditions

			which causes degradation of floodplains and exacerbates drought.
	Secure instream water rights or leases to maintain flows during low-water periods. Re-establish or improve flows in intermittent reaches of streams where intermittency is an unnatural condition.	7.2 Dams & Water Management / Use	Manipulation of water flow magnitude and timing due to dams and irrigation infrastructure can: (1) Result in fragmentation of linear riparian habitats; (2) Cause unnatural water fluctuations in reservoirs and in streams/rivers below reservoirs; (3) Cause a lack of beneficial flooding disturbance in streams/rivers below dams; (4) Cause low water levels in reservoirs that can allow access to sensitive nesting areas by predators; (5) Result in low waters that increase water temperatures with associated negative impacts (e.g., heat stress, harmful algae blooms); (6) Cause a mismatch with timing of life history events for aquatic SGCN; (7) Result in loss of beavers due to conflict prevention; (8) Fish and other aquatic species can become entrained in irrigation diversions.
6.4 Conservation Planning	Develop and implement grazing management plans that meet or exceed riparian health objectives and exclude grazers from unlimited riparian access.	2.3 Livestock Farming & Ranching	Livestock grazing within riparian areas damages vegetation and degrades banks.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Advocate for aquatic connectivity during Federal Energy Regulatory Commission relicensing.	7.2 Dams & Water Management / Use	Manipulation of water flow magnitude and timing due to dams and irrigation infrastructure can: (1) Result in fragmentation of linear riparian habitats; (2) Cause unnatural water fluctuations in reservoirs and in streams/rivers below reservoirs; (3) Cause a lack of beneficial flooding disturbance in streams/rivers below dams; (4) Cause low water levels in reservoirs that can allow access to sensitive nesting areas by predators; (5) Result in low waters that increase water temperatures with associated negative impacts (e.g., heat stress, harmful algae blooms); (6) Cause a mismatch with timing

			of life history events for aquatic SGCN; (7) Result in loss of beavers due to conflict prevention; (8) Fish and other aquatic species can become entrained in irrigation diversions.
	Work to expand the scope of streamside protection laws to include a buffer along stream and river channels in recognition of channel migration and the importance of riparian and wetland vegetation that is not directly adjacent to the waterbody.	7.2 Dams & Water Management / Use	Bank stabilization to protect human infrastructure severs floodplain connectivity, reduces woody debris inputs into waterbodies, diminishes public access to waterbodies, facilitates increased development in and near floodplains, and perpetuates bank hardening downstream.
		9.3 Agricultural & Forestry Effluents	Excess nutrients contribute to eutrophication of waterbodies. Point source pollution (e.g., industrial effluents) and nonpoint source pollution (e.g., agricultural and urban runoff) contribute pollutants and excess nutrients to waterbodies, with cascading negative impacts to aquatic SGCN and their food base. Relatively new and emerging contaminants negatively impact SGCN or their food base (e.g., PFAS chemicals, 6PPD-Q, selenium).
7.2 Policies & Guidelines	Establish no-wake lakes and river sections where there is community support and a conservation need or establish no-wake zones in portions of lakes and rivers with exceptional value to SGCN.	6.1 Recreational Activities	Driving vehicles around in floodplains and wetlands and wakes created by motorized watercraft degrade vegetation.
		7.1 Fire & Fire Suppression	Firefighting efforts lead to damage to floodplains, riparian areas, and wetlands due to road-building, fire line construction, and introduction of pollutants from heavy equipment and fire retardants.
	Provide decision makers and regulatory agencies with data related to pollution, water quality, and tissue concentrations in SGCN and other native species to help develop water quality standards that are protective of all species and their habitats.	9.1 Household Sewage & Urban Waste Water	Excess nutrients contribute to eutrophication of waterbodies. Point source pollution (e.g., industrial effluents) and nonpoint source pollution (e.g., agricultural and urban runoff) contribute pollutants and excess nutrients to waterbodies, with cascading negative impacts to aquatic SGCN and their food base. Relatively new and emerging contaminants negatively impact SGCN or their food base (e.g., PFAS chemicals, 6PPD-Q, selenium).
		9.2 Industrial & Military Effluents	
		9.3 Agricultural & Forestry Effluents	

9. Education & Training			
9.2 Training & Individual Capacity Development	Develop materials and pursue outreach opportunities with agricultural communities about the negative impacts of encroaching on HGCN, with a specific emphasis on the connected nature of streams and rivers and how actions taken on one property can perpetuate impacts up and downstream (e.g., bank hardening).	7.2 Dams & Water Management / Use	Bank stabilization to protect human infrastructure severs floodplain connectivity, reduces woody debris inputs into waterbodies, diminishes public access to waterbodies, facilitates increased development in and near floodplains, and perpetuates bank hardening downstream.
	Implement projects, provide technical/financial assistance, and conduct outreach around making ditches, buffers, and/or diversions more efficient and keep nutrients or chemicals out of streams. Fire retardant should be avoided in or adjacent to wetlands and riparian zones.	9.1 Household Sewage & Urban Waste Water 9.3 Agricultural & Forestry Effluents	Excess nutrients contribute to eutrophication of waterbodies.
10. Institutional Development			
10.1 Internal Organizational Management & Administration	Maintain funding and support for agency and non-profit internship and technician positions that conduct outreach with landowners and recreationists around waterbodies (e.g., FWP Loon Ranger internship, river ambassador programs, etc.).	6.1 Recreational Activities	Driving vehicles around in floodplains and wetlands and wakes created by motorized watercraft degrade vegetation.
			Introduction of Aquatic Invasive Species via recreational activities (watercraft, waders, etc.).

5.5 Vertebrate SGCN Profiles with Threats and Conservation Actions

Actions for the conservation of vertebrate Species of Greatest Conservation Need (SGCN) are provided below, along with their corresponding threats, organized by the Conservation Measures Partnership Threats and Actions classification systems (Version 2.0, Salafsky et al. 2008, Appendix F).

Coeur d'Alene Salamander Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Conduct pre-construction surveys where gravel or hard rock operations are to occur to ensure that sites do not support salamanders or their habitat.	3.2 Mining & Quarrying	Removal of bedrock and talus for hard rock operations and road building could destroy subterranean habitats and cause direct mortality. Pollutants from mining tailings, including sediment, entering drainages and groundwater may impact populations or directly kill individuals.
1.1 Site/Area Stewardship	Implement and promote measures to prevent the spread of Amphibian Chytrid Fungus and the introduction of Bsal.	8.4 Pathogens & Microbes	Amphibian Chytrid Fungus and Bsal (Batrachochytrium salamandrivorans) may impact populations or directly kill individuals.
1.1 Site/Area Stewardship	Refrain from conducting prescribed burns during active movement seasons in known salamander range.	7.1 Fire & Fire Suppression	Wildfires and prescribed fires alter and/or fragment habitat, which can result in increased erosion and sedimentation that could destroy subterranean refugia, lead to individual or sub-population mortalities, and impede movement between sites. Commonly used fire retardants may be toxic to salamanders.
1.1 Site/Area Stewardship	Work with landowners and land management agencies to maintain current hydrology in and around known and predicted sites.	7.2 Dams & Water Management / Use	Resource extraction or development activities can alter the hydrology of known or predicted salamander habitat. Reduction in water flows could impact prey source for this species.

1.2 Ecosystem & Natural Process (Re)Creation	Prohibit timber extraction in areas that serve as refugia that limit hydrological and thermal stress on this species.	5.3 Logging & Wood Harvesting	Logging and wood harvesting operations can result in direct mortality, reduce canopy cover and soil moisture, inhibiting movement, and cause soil compaction or slumping, which can alter groundwater flow and spring runoff, increasing the likelihood of sediment loads entering streams and interstitial spaces adjacent to waterways.
1.2 Ecosystem & Natural Process (Re)Creation	Where possible, enact appropriate seasonal road closures to mitigate mortality and impediments to movement. Avoid or minimize road construction upstream within 328 feet (100 m) of known salamander occurrences. Ensure that roads are at least 100 feet (30 m) from waterways.	4.1 Roads & Railroads	Road cuts are more susceptible to landslide events that can destroy salamander habitat. Construction/maintenance of roads (including ditches and rip-rapping along waterways) can destroy or bisect salamander habitat and impede movement. Chemicals applied to road surfaces for maintenance, such as de-icers, herbicides, and for dust control can have lethal and sublethal effects on salamanders.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate the pet trade industry as to species on the Lacey Act to prevent accidental introduction of Bsal. Promote campaigns that educate recreational users on how to mitigate the spread of Amphibian Chytrid Fungus.	8.4 Pathogens & Microbes	Amphibian Chytrid Fungus and Bsal (Batrachochytrium salamandrivorans) may impact populations or directly kill individuals.
3.1 Outreach & Communications	Undertake a public education program to encourage people to enjoy and value native amphibians in the wild.	5.1 Hunting & Collecting Terrestrial Animals	Collection of individuals for pet trade or as personal pets.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Regulate the collection and harvest of rare species through permits to prevent population declines.	5.1 Hunting & Collecting Terrestrial Animals	Collection of individuals for pet trade or as personal pets.

Idaho Giant Salamander Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Avoid or minimize road construction around streams. Place or relocate roads > 200 m from streams and streamside habitats. Where roads already run along streams, use construction and maintenance best management practices to reduce sediment runoff where vegetated buffers are lacking. Maintain road crossings (culverts) that may provide movement barriers to predators or disease vectors (e.g., fish).	4.1 Roads & Railroads	Road infrastructure and maintenance along streams and headwaters can cause water quality issues, habitat degradation and fragmentation, and direct mortalities.
1.1 Site/Area Stewardship	Implement and promote measures to prevent the spread of Amphibian Chytrid Fungus and other potentially dangerous pathogens.	8.4 Pathogens & Microbes	Amphibian Chytrid Fungus may impact populations or directly kill individuals. Bsal (Batrachochytrium salamandrivorans) could potentially cause widespread mortality or morbidity, but mostly affects newts and lungless salamanders, as fungus thrives in cool temperatures.
1.1 Site/Area Stewardship	Locate recreation sites away from stream channels and floodplains. Rehabilitate pioneered campsites and access points that affect stream channels or streamside habitats, and make these sites inaccessible using gates, boulders, strategic tree felling, etc.	1.3 Tourism & Recreation	Recreation sites along streams can affect water quality through increased sediments or pollutants (e.g., trash, human waste, pet waste, vehicle runoff) that may be toxic to salamanders and/or their food base, can increase direct mortalities from vehicles, increase risk of disease introduction, and increase habitat disturbance, including the introduction of invasive plant and animal species.

1.2 Ecosystem & Natural Process (Re)Creation	Discontinue stocking or use piscicides to remove fish in naturally fishless lakes in headwaters stream drainages to prevent unnatural expansion of fish from upper ends of drainages and to increase opportunities for connectivity with populations of Idaho Giant Salamanders in Idaho.	8.1 Invasive Non-Native/Alien Plants & Animals	Fish congregations at culvert outflows can increase predation. Non-native fish and fish introduced to naturally fishless areas may compete for food resources. Use of piscicides for removal of non-native fish can be toxic to this species. Introduction and spread of <i>Didymosphenia geminata</i> (“rock snot”) can degrade water quality, reduce prey, and impact reproduction sites.
2. Species Management			
2.2 Species Re-Introduction & Translocation	Conduct fisheries restoration projects (e.g., rotenone and re-stocking) in unoccupied but potentially suitable streams to restore native fish populations in streams with invasive species.	8.1 Invasive Non-Native/Alien Plants & Animals	Fish congregations at culvert outflows can increase predation. Non-native fish and fish introduced to naturally fishless areas may compete for food resources. Use of piscicides for removal of non-native fish can be toxic to this species. Introduction and spread of <i>Didymosphenia geminata</i> (“rock snot”) can degrade water quality, reduce prey, and impact reproduction sites.
2.2 Species Re-Introduction & Translocation	Translocate individuals from remaining occupied stream drainages into areas where severe wildfires caused local extirpation (once conditions become suitable again) and into unoccupied drainages modeled as suitable habitat.	7.1 Fire & Fire Suppression	Fires can cause landslides and extirpations. Prescribed fire in spring/fall when conditions facilitate terrestrial movement may cause mortalities. Fire suppression can lead to homogenous stand structure unsuitable for cover, reproduction, and foraging, more severe fires that can increase sediments, stream temperatures, and UV radiation, remove habitat features, change runoff levels, and result in dense/immature growth with high water demands that deplete water in micro-habitats.
2.3 Ex-Situ Conservation	During severe fires, remove individuals and keep them in captivity, then re-introduce them once rehabilitation efforts are complete.	7.1 Fire & Fire Suppression	Fires can cause landslides and extirpations. Prescribed fire in spring/fall when conditions facilitate terrestrial movement may cause mortalities. Fire suppression can lead to homogenous stand structure unsuitable for cover, reproduction, and foraging, more severe fires that can increase sediments, stream temperatures, and UV radiation, remove habitat features, change runoff levels, and result in

			dense/immature growth with high water demands that deplete water in micro-habitats.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct educational campaigns about the dangers of releasing non-native species into waterways in Montana.	8.1 Invasive Non-Native/Alien Plants & Animals	Fish congregations at culvert outflows can increase predation. Non-native fish and fish introduced to naturally fishless areas may compete for food resources. Use of piscicides for removal of non-native fish can be toxic to this species. Introduction and spread of <i>Didymosphenia geminata</i> ("rock snot") can degrade water quality, reduce prey, and impact reproduction sites.
3.1 Outreach & Communications	Develop and implement education campaigns about streamside management zones and associated regulations affecting recreationists and wood harvesters.	5.3 Logging & Wood Harvesting	Timber harvest can cause loss of old-growth trees and of large woody debris in stream habitats, increase stream temperatures and sediment runoff, lead to shorter or more severe flow events that can cause excessive woody debris inputs, and lower base flow conditions that can lead to desiccation or thermal stress. Homogenous stand structure is less suitable for cover, reproduction, and foraging.
3.1 Outreach & Communications	Develop and implement education campaigns about streamside management zones and associated regulations affecting recreationists and wood harvesters. Use on-site signage to notify the public that they are in an area with exceptional aquatic wildlife resources.	1.3 Tourism & Recreation	Recreation sites along streams can affect water quality through increased sediments or pollutants (e.g., trash, human waste, pet waste, vehicle runoff) that may be toxic to salamanders and/or their food base, can increase direct mortalities from vehicles, increase risk of disease introduction, and increase habitat disturbance, including the introduction of invasive plant and animal species.
3.1 Outreach & Communications	Develop and implement public education campaigns designed to minimize the temptation to touch and handle amphibians.	5.4 Fishing & Harvesting Aquatic Resources	Curiosity by visitors to occupied sites can lead to handling of individuals which could introduce diseases or toxins. Rare species endemic to small areas may be vulnerable to and targeted for the pet trade.
3.1 Outreach & Communications	Develop and promote messaging about the dangers of spreading aquatic invasive	8.4 Pathogens & Microbes	Amphibian Chytrid Fungus may impact populations or directly kill individuals. Bsal (<i>Batrachochytrium salamandrivorans</i>)

	species (AIS), and measures people can take to prevent it (e.g., 'Clean, Drain, Dry').		could cause widespread mortality or morbidity, but mostly affects newts and lungless salamanders, as fungus thrives in cool temperatures.
3.1 Outreach & Communications	Implement beaver conflict mitigation measures and programs to increase tolerance for beavers on the landscape.	7.3 Other Ecosystem Modifications	Loss of floodplain connectivity across forested streams (from resource extraction, fire suppression, stream channel manipulation, and loss of beavers) reduces moist microsites, off-channel wetlands, and coarse woody debris recruitment to stream and streamside habitats, leading to dryer floodplains and potentially higher intensity fires in valley bottoms and riparian areas.
3.1 Outreach & Communications	Use on-site signage to notify the public that they are in an area with exceptional aquatic wildlife resources.	4.1 Roads & Railroads	Road infrastructure and maintenance along streams and headwaters can cause water quality issues, habitat degradation and fragmentation, and direct mortalities.
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Increase patrols by law enforcement officers to address illegal activities (e.g., pioneered campsites, waste dumping, illegal OHV use, and tree cutting or removal in Riparian Management Zones).	1.3 Tourism & Recreation	Recreation sites along streams can affect water quality through increased sediments or pollutants (e.g., trash, human waste, pet waste, vehicle runoff) that may be toxic to salamanders and/or their food base, can increase direct mortalities from vehicles, increase risk of disease introduction, and increase habitat disturbance, including the introduction of invasive plant and animal species.
4.1 Detection & Arrest	Strengthen county and state-level streamside protection laws and reporting of violations to minimize removal of live and dead trees in floodplains. Increase patrols by law enforcement officers to address illegal activities (e.g., pioneered campsites, waste dumping, illegal OHV use, and tree cutting or removal in Riparian Management Zones).	5.3 Logging & Wood Harvesting	Timber harvest can cause loss of old-growth trees and of large woody debris in stream habitats, increase stream temperatures and sediment runoff, lead to shorter or more severe flow events that can cause excessive woody debris inputs, and lower base flow conditions that can lead to desiccation or thermal stress. Homogenous stand structure is less suitable for cover, reproduction, and foraging.
4.3 Non-Criminal Legal Action	Work with DEQ/USFS/FWP to strengthen stream protection laws around mining where possible.	3.2 Mining & Quarrying	Historic, current, and/or future mining practices contribute to impaired water quality (sediment and pollutants), reduce water quantity in streams when water is diverted for mining

			operations, and degrade critical floodplain functions by destabilizing natural channel morphology and reducing in-stream flows.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.3 Land/Water Use Zoning & Designation	Work with USFS to designate predicted or known occupied stream drainages as Conservation Watershed Networks.	3.2 Mining & Quarrying	Historic, current, and/or future mining practices contribute to impaired water quality (sediment and pollutants), reduce water quantity in streams when water is diverted for mining operations, and degrade critical floodplain functions by destabilizing natural channel morphology and reducing in-stream flows.
6.4 Conservation Planning	Implement outreach and education campaigns targeted towards landowners and land managers about alternative options for pest and weed control (e.g., native predators, regenerative grazing, biocontrol, mechanical removal) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Herbicide/pesticide runoff from forest management activities (e.g., weed treatments) introduces toxins to water and may impact prey base for all life stages.
6.4 Conservation Planning	Work with FWP Region 2 Fisheries Division on programs expanding the range of Bull Trout through translocations to make sure they do not inadvertently impact salamanders, and on mountain lake stocking programs to avoid drainages containing salamanders.	8.1 Invasive Non-Native/Alien Plants & Animals	Fish congregations at culvert outflows can increase predation. Non-native fish and fish introduced to naturally fishless areas may compete for food resources. Use of piscicides for removal of non-native fish can be toxic to this species. Introduction and spread of <i>Didymosphenia geminata</i> ("rock snot") can degrade water quality, reduce prey, and impact reproduction sites.
6.4 Conservation Planning	Work with Lolo National Forest on Forest Plan to accommodate conservation considerations for this species around vegetation management.	5.3 Logging & Wood Harvesting	Timber harvest can cause loss of old-growth trees and of large woody debris in stream habitats, increase stream temperatures and sediment runoff, lead to shorter or more severe flow events that can cause excessive woody debris inputs, and lower base flow conditions that can lead to

			desiccation or thermal stress. Homogenous stand structure is less suitable for cover, reproduction, and foraging.
6.4 Conservation Planning	Work with USFS on incorporating habitat considerations for this species into their forest planning and vegetation management efforts. Consider developing a species rescue plan with Lolo National Forest to respond quickly to potential extirpation events (e.g., severe fire, landslides, disease outbreaks).	7.1 Fire & Fire Suppression	Fires can cause landslides and extirpations. Prescribed fire in spring/fall when conditions facilitate terrestrial movement may cause mortalities. Fire suppression can lead to homogenous stand structure unsuitable for cover, reproduction, and foraging, more severe fires that can increase sediments, stream temperatures, and UV radiation, remove habitat features, change runoff levels, and result in dense/immature growth with high water demands that deplete water in micro-habitats.
6.5 Site Infrastructure	Limit degradation of stream banks and streamside vegetation when developing and maintaining campgrounds and other recreation sites (e.g., physical barriers, signage, hardened access points, strategic timber harvest/felling, designated trail construction).	1.3 Tourism & Recreation	Recreation sites along streams can affect water quality through increased sediments or pollutants (e.g., trash, human waste, pet waste, vehicle runoff) that may be toxic to salamanders and/or their food base, can increase direct mortalities from vehicles, increase risk of disease introduction, and increase habitat disturbance, including the introduction of invasive plant and animal species.
6.5 Site Infrastructure	When developing or maintaining access routes, limit degradation of stream banks and streamside vegetation and reduce sediment load. Avoid or minimize the use of culverts for stream crossings in favor of bridges or culverts that accommodate full stream width and marginal habitats with low velocity to facilitate travel, unless that crossing is an important movement barrier to predators (e.g., fish).	4.1 Roads & Railroads	Road infrastructure and maintenance along streams and headwaters can cause water quality issues, habitat degradation and fragmentation, and direct mortalities.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Maintain FWP beaver trapping closure in the Big Creek drainage.	7.3 Other Ecosystem Modifications	Loss of floodplain connectivity across forested streams (from resource extraction, fire suppression, stream channel manipulation, and loss of beavers) reduces moist microsites,

			off-channel wetlands, and coarse woody debris recruitment to stream and streamside habitats, leading to dryer floodplains and potentially higher intensity fires in valley bottoms and riparian areas.
7.1 Laws, Regulations & Codes	Prohibit moving and keeping wild herpetofauna as pets in Montana. Propose and pursue regulations around collecting wild amphibians in Montana.	5.4 Fishing & Harvesting Aquatic Resources	Curiosity by visitors to occupied sites can lead to handling of individuals which could introduce diseases or toxins. Rare species endemic to small areas may be vulnerable to and targeted for the pet trade.
10. Institutional Development			
10.3 Alliance & Partnership Development	Pursue volunteer efforts to maintain recreation sites and conduct outreach to recreationists to fill gaps in staffing at Lolo National Forest. Work closely with Lolo National Forest biologists, hydrologists, and timber managers on conservation measures for this species.	1.3 Tourism & Recreation	Recreation sites along streams can affect water quality through increased sediments or pollutants (e.g., trash, human waste, pet waste, vehicle runoff) that may be toxic to salamanders and/or their food base, can increase direct mortalities from vehicles, increase risk of disease introduction, and increase habitat disturbance, including the introduction of invasive plant and animal species.
10.3 Alliance & Partnership Development	Work closely with Lolo National Forest biologists, hydrologists, and timber managers on conservation measures for this species.	5.3 Logging & Wood Harvesting	Timber harvest can cause loss of old-growth trees and of large woody debris in stream habitats, increase stream temperatures and sediment runoff, lead to shorter or more severe flow events that can cause excessive woody debris inputs, and lower base flow conditions that can lead to desiccation or thermal stress. Homogenous stand structure is less suitable for cover, reproduction, and foraging.
		9.3 Agricultural & Forestry Effluents	Flame retardant chemicals used in fire suppression efforts can contaminate streams and surrounding uplands. Herbicide/pesticide runoff from forest management activities (e.g., weed treatments) introduces toxins to water and may impact prey base for all life stages.
10.3 Alliance & Partnership Development	Work closely with Lolo National Forest biologists, hydrologists, and timber managers on conservation measures for this	4.1 Roads & Railroads	Road infrastructure and maintenance along streams and headwaters can cause water quality issues, habitat degradation and fragmentation, and direct mortalities.

	species. Work with Idaho Fish and Game on management actions to maintain connectivity between populations of Idaho Giant Salamanders in Idaho and Montana.	7.1 Fire & Fire Suppression	Fires can cause landslides and extirpations. Prescribed fire in spring/fall when conditions facilitate terrestrial movement may cause mortalities. Fire suppression can lead to homogenous stand structure unsuitable for cover, reproduction, and foraging, more severe fires that can increase sediments, stream temperatures, and UV radiation, remove habitat features, change runoff levels, and result in dense/immature growth with high water demands that deplete water in micro-habitats.
10.3 Alliance & Partnership Development	Work with Idaho Fish and Game on management actions to maintain connectivity between populations of Idaho Giant Salamanders in Idaho and Montana.	11.3 Changes in Temperature Regimes	Less spring snowpack and warmer ambient temperatures can result in increased water temperatures and reduce late-season stream flows. This can degrade biologically sensitive habitats or result in thermal stress and/or direct mortality. Warmer water temperatures can reduce dissolved oxygen content resulting in physiological stress and/or mortality, and potential reduction in food resources.
		11.4 Changes in Precipitation & Hydrological Regimes	Changes in runoff timing and intensity could create a mismatch with the species' life history patterns (e.g., reproduction), reduce habitat complexity and hyporheic flow exchanges, reduce habitat connectivity, isolate populations, cause desiccation of early life stages, affect food resources, lead to uninhabitable water temperatures, and trigger road repair work detrimental to the species.
		11.5 Severe/Extreme Weather Events	Rain-on-snow storms and other extreme weather events lead to widespread habitat degradation through uncharacteristically damaging floods.

Western Toad Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Avoid or minimize development in floodplain areas, including areas outside of FEMA-mapped floodplains that could be accessed by the river channel via lateral channel migration in the long-term. Avoid or minimize development around potential breeding sites, or maintain vegetated buffers between developed areas and potential breeding sites.	1.1 Housing & Urban Areas	Development adjacent to breeding sites can destroy or degrade habitat.
1.1 Site/Area Stewardship	Protect known occupied wetlands from introduced species. Monitor lentic waterbodies with high potential for release of non-native species (e.g., waterbodies near roads, parks, urban areas, Fishing Access Sites) and respond to outbreaks with immediate and aggressive eradication efforts when and where possible.	8.1 Invasive Non-Native/Alien Plants & Animals	Introduced fish and bullfrogs can result in competition or pathogen introduction while introduced pasture grasses and invasive weeds can diminish natural channel migration (necessary to maintain habitat).
1.1 Site/Area Stewardship	Refrain from building new roads next to breeding sites, unless they have underpasses and fencing to keep toads off roads and allow for permeability.	4.1 Roads & Railroads	Road infrastructure and maintenance next to breeding wetlands can cause water quality issues, habitat degradation and fragmentation, and potentially mass mortalities during juvenile dispersal.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Develop and distribute educational materials to new and existing landowners with potential breeding habitat on or near their	1.1 Housing & Urban Areas	Development can destroy, degrade, and/or fragment habitat.

	properties, about the importance of those sites for Western Toads and other wetland-associated species.		
3.1 Outreach & Communications	Educate fisheries workers, fishing guides (particularly with staff or clients traveling with their own gear), and other users of waterbodies about the importance and procedures for disinfecting gear, how to recognize amphibian die offs and collect samples if encountered. Promote messaging about the dangers of spreading Aquatic Invasive Species and preventative measures (e.g., 'Clean, Drain, Dry').	8.4 Pathogens & Microbes	Chytrid, ranavirus, red-leg disease, and novel pathogens not yet identified or currently not widespread may impact populations or directly kill individuals.
3.1 Outreach & Communications	Educate the public on the environmental harm and illegality of releasing bullfrogs or fish, and how to report bullfrog observations.	8.1 Invasive Non-Native/Alien Plants & Animals	Introduced fish and/or bullfrogs can serve as vectors of novel pathogens.
3.1 Outreach & Communications	Encourage 'look, don't touch' wildlife appreciation. Consider adding signage or other communication at popular recreation areas with breeding amphibians.	12.1 Other	People picking up toads, moving them, and/or stressing them.
3.1 Outreach & Communications	Implement education and outreach campaigns in agricultural communities about the importance of beavers to ecosystem services and natural stream processes, and techniques for mitigating beaver-human conflicts.	2.3 Livestock Farming & Ranching	Livestock grazing can degrade wetland or upland habitat or cause direct mortality by trampling.
3.1 Outreach & Communications	Implement education and outreach campaigns to local and county-level planning departments about the importance of beavers to ecosystem services and tools for mitigating beaver-human conflicts.	7.3 Other Ecosystem Modifications	Loss of beavers from vast areas has reduced available breeding and foraging habitat and maintained stream systems in a degraded state, with a loss or severe reduction of floodplain processes important for the species (e.g., floodplain pool and backwater formation).

3.1 Outreach & Communications	Implement education and outreach campaigns to local, county, and state roads crews about the importance of beavers and techniques for mitigating beaver-human conflicts. Disseminate information about environmental regulations and laws.	4.1 Roads & Railroads	Road infrastructure and maintenance next to breeding wetlands can cause water quality issues, habitat degradation and fragmentation, and potentially mass mortalities during juvenile dispersal.
3.1 Outreach & Communications	Implement education and outreach campaigns to people with stock water ponds or other lentic water bodies about amphibian breeding seasons and how to minimize impacts to Western Toads and other species dependent on predictable water level fluctuations. In irrigation districts, implement education and outreach campaigns about the importance of beavers and ways to mitigate beaver-human conflicts.	7.2 Dams & Water Management / Use	Lack of natural flooding from dams can diminish floodplain processes that maintain backwater habitat while draw downs for water management during breeding season can result in desiccation of habitat (and mortality of tadpoles).
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Fully enforce state and county laws and regulations on the removal or manipulation of riparian vegetation in floodplains and adjacent to wetlands by private landowners, and encourage reporting of violations.	1.1 Housing & Urban Areas	Development can destroy, degrade, and/or fragment habitat.
4.1 Detection & Arrest	Promote adherence to state and county-level laws and regulations around removal and manipulation of riparian vegetation in floodplains by private landowners.	4.1 Roads & Railroads	Road infrastructure and maintenance next to breeding wetlands can cause water quality issues, habitat degradation and fragmentation, and potentially mass mortalities during juvenile dispersal.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Before using piscicides for fish removal in suitable toad breeding habitat, survey for signs of toad breeding. If tadpoles are present, remove and hold them in holding	8.1 Invasive Non-Native/Alien Plants & Animals	The use of piscicides to remove non-native fish (rotenone) may kill toads.

	tanks and return them to the site once free of piscicides. Use rotenone in late summer when most amphibians have metamorphosed out of wetlands and before adults have returned to hibernate.		
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Increase fines for violations of streamside protection laws, to deter vegetation removal or disturbance.	1.1 Housing & Urban Areas	Development adjacent to breeding sites can destroy or degrade habitat.
		2.3 Livestock Farming & Ranching	Livestock grazing can degrade wetland or upland habitat or cause direct mortality by trampling.
7.2 Policies & Guidelines	Regulate the collection and harvest of rare species through permits to prevent population declines.	5.1 Hunting & Collecting Terrestrial Animals	Collection of individuals for pet trade or as personal pets.

Great Plains Toad Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Regulate the collection and harvest of rare species through permits to prevent population declines.	5.1 Hunting & Collecting Terrestrial Animals	Collection of individuals for pet trade or as personal pets.

Northern Leopard Frog Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Reduce abundance and release of bullfrogs and introduced fish from important leopard frog breeding and reintroduction areas. Add water-control structures that allow water to be drawn down periodically to help minimize colonization of predaceous fish and bullfrogs.	8.1 Invasive Non-Native/Alien Plants & Animals	Spread of non-native American Bullfrog and introduced predacious game fish.
2.2 Species Re-Introduction & Translocation	Continue to reintroduce populations in suitable habitats in western Montana, even if Amphibian Chytrid Fungus is identified at reintroduction sites. Consider amphibian Chytrid endemic to the state and present in most high-quality habitats that host amphibians.	8.4 Pathogens & Microbes	Amphibian Chytrid Fungus and ranaviruses.
2.2 Species Re-Introduction & Translocation	Continue to reintroduce populations in suitable habitats in western Montana.	1.1 Housing & Urban Areas	Development can destroy, degrade, and/or fragment habitat.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate the public on the environmental harm and illegality of releasing bullfrogs or fish. Educate the public on reporting bullfrog observations.	8.1 Invasive Non-Native/Alien Plants & Animals	Spread of non-native American Bullfrog and introduced predacious game fish.

3.1 Outreach & Communications	Raise awareness about the harmful effects of lawn and garden fertilizers, pesticides, and herbicides on wildlife species, and alternative approaches and products available for lawn and garden care.	1.1 Housing & Urban Areas	Development can destroy, degrade, and/or fragment habitat.

Rocky Mountain Tailed Frog Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	If piscicide use is the only option available, undertake pre-treatment capture and post-treatment release of frog tadpoles and adults, and apply treatment in the late evening hours so that adults are more likely to exit waters.	8.1 Invasive Non-Native/Alien Plants & Animals	Introduction of fish to formerly fishless streams increases the likelihood of predation on larvae and metamorphs and creates competition for prey for all life stages. Piscicides used to remove non-native fish can be toxic to multiple life stages. Removal of natural or artificial fish barriers increases the likelihood of fish establishing in new areas.
2.2 Species Re-Introduction & Translocation	Conduct fisheries restoration projects (e.g., rotenone and re-stocking) to restore native fish populations in streams with invasive species.	8.1 Invasive Non-Native/Alien Plants & Animals	Introduction of fish to formerly fishless streams increases the likelihood of predation on larvae and metamorphs and creates competition for prey for all life stages. Piscicides used to remove non-native fish can be toxic to multiple life stages. Removal of natural or artificial fish barriers increases the likelihood of fish establishing in new areas.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners and	9.3 Agricultural & Forestry Effluents	Flame retardant chemicals used in fire suppression efforts can contaminate streams and surrounding uplands. Nutrient

	land managers about alternative options for pest and weed control (e.g., native predators, regenerative grazing, biocontrol, mechanical removal) to reduce reliance on pesticides and herbicides.		loading can change the water chemistry in streams, which can affect population distributions and food resources. Pesticides and herbicides reduce invertebrates, the food source for terrestrial life stages, and may also affect the prey base for larval forms.
5. Livelihood Economic & Moral Incentives			
5.3 Market-Based Incentives	Encourage private companies to seek certification for sustainable forestry practices through avenues such as Forest Stewardship Council standards and labeling and/or Sustainable Forestry Initiative standards and certification.	4.1 Roads & Railroads	Maintained and unmaintained roads in headwaters and along streams can introduce pollutants from road use and maintenance, increase sediment loads and reduce water quality, and/or result in degraded terrestrial habitats within streamside habitats.
		5.3 Logging & Wood Harvesting	Timber harvest around streams can increase sediment runoff, increase stream temperatures from lack of overhead cover, and cause loss of mature forest conditions and understory complexity, which can limit movement. Timber harvest in headwater areas can lead to shorter or more severe peak flow events that can lead to excessive woody debris inputs, which can trap sediments and alter channels.
		7.1 Fire & Fire Suppression	Prescribed fire in spring/fall when conditions facilitate terrestrial movement may cause mortalities. Fire suppression can lead to more severe fires that can increase sediments, stream temperatures, and UV radiation, change runoff levels, remove habitat features in stream drainages, and result in dense/immature growth with high water demands that deplete water in micro-habitats.
		9.3 Agricultural & Forestry Effluents	Flame retardant chemicals used in fire suppression efforts can contaminate streams and surrounding uplands. Nutrient loading can change the water chemistry in streams, which can affect population distributions and food resources. Pesticides and herbicides reduce invertebrates, the food source for terrestrial life stages, and may also affect the prey base for larval forms.

C. Enabling Conditions Actions

7. Legal & Policy Frameworks

7.2 Policies & Guidelines	Encourage the use of DNRC's 'Best Management Practices for Forestry in Montana' when working with private landowners, contractors, and timber companies.	2.3 Livestock Farming & Ranching	Overgrazing of riparian areas can increase sediment loads, pollutant and nutrient runoff, and loss/reduction of streamside vegetation which can lead to warmer water temperatures, loss of important streamside habitat features (e.g., downed wood and canopy cover), direct mortalities through trampling, and geomorphic changes to the stream channel (e.g., incision and/or over-widening).
		4.1 Roads & Railroads	Maintained and unmaintained roads in headwaters and along streams can introduce pollutants from road use and maintenance, increase sediment loads and reduce water quality, and/or result in degraded terrestrial habitats within streamside habitats.
		5.3 Logging & Wood Harvesting	Timber harvest around streams can increase sediment runoff, increase stream temperatures from lack of overhead cover, and cause loss of mature forest conditions and understory complexity, which can limit movement. Timber harvest in headwater areas can lead to shorter or more severe peak flow events that can lead to excessive woody debris inputs, which can trap sediments and alter channels.
		7.1 Fire & Fire Suppression	Prescribed fire in spring/fall when conditions facilitate terrestrial movement may cause mortalities. Fire suppression can lead to more severe fires that can increase sediments, stream temperatures, and UV radiation, change runoff levels, remove habitat features in stream drainages, and result in dense/immature growth with high water demands that deplete water in micro-habitats.
		9.3 Agricultural & Forestry Effluents	Flame retardant chemicals used in fire suppression efforts can contaminate streams and surrounding uplands. Nutrient loading can change the water chemistry in streams, which can

			affect population distributions and food resources. Pesticides and herbicides reduce invertebrates, the food source for terrestrial life stages, and may also affect the prey base for larval forms.
10. Institutional Development			
10.3 Alliance & Partnership Development	Work with FWP fisheries biologists and other fisheries/aquatics professionals in western Montana to encourage recording observations of Rocky Mountain Tailed Frog and provide those data to the Montana Natural Heritage Program.	12.1 Other	Lack of research makes targeted conservation actions difficult, including distribution, dispersal, recruitment, requirements for terrestrial life stages, genetic connectivity, effective buffer sizes for vegetation management and road building, and impacts of fire, fire suppression tactics, chemical retardants, livestock grazing, piscicides, and predation by native and non-native fish.

Plains Spadefoot Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Regulate the collection and harvest of rare species through permits to prevent population declines.	5.1 Hunting & Collecting Terrestrial Animals	Collection of individuals for pet trade or as personal pets.

Whooping Crane Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Continue to include Whooping Crane identification and sight reporting information in annual Migratory Birds Hunting Regulations and Hunter Education programing. Develop an online test on species identification. Target media campaigns on reporting Whooping Crane observations in spring and fall. Promote 'Look twice before you shoot' campaign during Sandhill Crane hunting season.	5.1 Hunting & Collecting Terrestrial Animals	Accidental shooting by hunters.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Recommend that wind developers follow most recent Renewable Energy Wildlife Institute guidance documents to avoid siting wind facilities in wetlands and other habitats that provide suitable stopover sites.	3.3 Renewable Energy	Collisions with wind turbines cause mortality.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	In the event of a Whooping or Sandhill Crane collision, recommend that the utility company buries existing power lines. As a less preferred alternative, recommend that power lines be marked according to guidance from the Avian Power Line Interaction Committee (APLIC). Follow APLIC guidance	4.2 Utility & Service Lines	Collisions with power lines cause mortality.

	to reduce bird collisions with power lines in wetlands and stopover sites. Encourage the burying of power lines near wetlands within the migration corridor.		
7.2 Policies & Guidelines	Continue to engage with the Central Flyway Technical Committee and participate in range-wide conservation plans and actions as appropriate.	2.1 Annual & Perennial Non-Timber Crops	Degradation and fragmentation of native prairies and wetlands reduces habitat for this species.

Black Rosy-Finch Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Add closure signs or gates to protect mine shafts from disturbance, but avoid fully sealing mine shafts.	6.1 Recreational Activities	Recreation in alpine habitat brings unnatural food sources that attract nest predators and spread invasive plants. Recreational use of mine shafts disturbs roosting birds, and mine shaft closures lead to habitat loss.
1.1 Site/Area Stewardship	Allow natural fires to burn to maintain open alpine habitat and mitigate encroachment of trees and shrubs.	11.1 Ecosystem Encroachment	Ecosystem encroachment in alpine tundra and sparsely vegetated areas.
1.1 Site/Area Stewardship	If critical overwintering areas are identified, engage and support partner agencies and NGOs in actions that promote the retention of native seed-producing grasses.	2.3 Livestock Farming & Ranching	Improper livestock grazing intensities can decrease availability of seeds in open landscapes used for forage during the winter months.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			

3.1 Outreach & Communications	Educate and engage the public in preventing the spread of invasive grass species, and encourage reporting to facilitate early detection. Encourage citizen science engagement involving alpine recreationists in reporting observations during the breeding season. Post signs at trailheads to raise awareness of the impacts of providing unnatural food sources in sensitive alpine environments.	6.1 Recreational Activities	Recreation in alpine habitat brings unnatural food sources that attract nest predators and spread invasive plants. Recreational use of mine shafts disturbs roosting birds, and mine shaft closures lead to habitat loss.
3.1 Outreach & Communications	Encourage citizen science engagement in reporting observations throughout the nonbreeding season to identify migration patterns and overwintering areas.	2.1 Annual & Perennial Non-Timber Crops	Land conversion and agricultural practices can reduce the availability of open landscapes with available seed forage.
		2.3 Livestock Farming & Ranching	Improper livestock grazing intensities can decrease availability of seeds in open landscapes used for forage during the winter months.
		3.3 Renewable Energy	Collisions with wind towers can cause mortalities during the non-breeding season.
3.1 Outreach & Communications	Encourage citizen science engagement in reporting observations throughout the nonbreeding season to identify migration patterns and overwintering areas. Conduct public outreach on strategies that mitigate elevated avian mortality in developed areas in the winter.	1.1 Housing & Urban Areas	Bird feeders can attract wintering flocks to developed areas where mortality risk may be elevated.
3.1 Outreach & Communications	Encourage citizen science engagement involving alpine recreationists in reporting observations during the breeding season.	11.1 Ecosystem Encroachment	Ecosystem encroachment in alpine tundra and sparsely vegetated areas.
		11.3 Changes in Temperature Regimes	Increased temperatures can decrease foraging habitat and opportunities during critical breeding periods.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Consider employing curtailments during intense migration periods to reduce risk of mortality.	3.3 Renewable Energy	Collisions with wind towers can cause mortalities during the non-breeding season.

5.2 Better Products & Management Practices	Discontinue the practice of fish stocking in alpine lakes that regularly winterkill and have low recreational demand for stocking.	11.3 Changes in Temperature Regimes	Increased temperatures can decrease foraging habitat and opportunities during critical breeding periods.
		8.1 Invasive Non-Native/Alien Plants & Animals	Stocking of trout in previously fishless alpine lakes reduces the availability of emerging aquatic insects for forage.
C. Enabling Conditions Actions			
10. Institutional Development			
10.3 Alliance & Partnership Development	Continue to participate in the regional Rosy-Finch working group to effectively collaborate on ongoing regional projects.	11.1 Ecosystem Encroachment	Ecosystem encroachment in alpine tundra and sparsely vegetated areas.
		11.3 Changes in Temperature Regimes	Increased temperatures can decrease foraging habitat and opportunities during critical breeding periods.
		6.1 Recreational Activities	Recreation in alpine habitat brings unnatural food sources that attract nest predators and spread invasive plants. Recreational use of mine shafts disturbs roosting birds, and mine shaft closures lead to habitat loss.
		8.1 Invasive Non-Native/Alien Plants & Animals	Stocking of trout in previously fishless alpine lakes reduces the availability of emerging aquatic insects for forage.

Gray-crowned Rosy-Finch Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Add closure signs or gates to protect mine shafts from disturbance, but avoid fully sealing mine shafts.	6.1 Recreational Activities	Recreation in alpine habitat brings unnatural food sources that attract nest predators and introduce invasive plant

			species. Recreational use of mine shafts disturbs roosting birds, and mine shaft closures lead to habitat loss.
1.1 Site/Area Stewardship	Allow natural fires to burn to maintain open alpine habitat and mitigate encroachment of trees and shrubs.	11.1 Ecosystem Encroachment	Ecosystem encroachment in alpine tundra and sparsely vegetated areas.
1.1 Site/Area Stewardship	If critical overwintering areas are identified, engage and support partner agencies and NGOs in actions that promote the retention of native seed-producing grasses.	2.3 Livestock Farming & Ranching	Improper livestock grazing intensities can decrease availability of seeds in open landscapes used for forage during the winter months.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate and engage the public in preventing the spread of invasive grass species, and encourage reporting to facilitate early detection. Encourage citizen science engagement involving alpine recreationists in reporting observations during the breeding season. Post signs at trailheads to raise awareness of the impacts of providing unnatural food sources in sensitive alpine environments.	6.1 Recreational Activities	Recreation in alpine habitat brings unnatural food sources that attract nest predators and introduce invasive plant species. Recreational use of mine shafts disturbs roosting birds, and mine shaft closures lead to habitat loss.
3.1 Outreach & Communications	Encourage citizen science engagement in reporting observations throughout the nonbreeding season to identify migration patterns and overwintering areas.	2.1 Annual & Perennial Non-Timber Crops	Land conversion and agricultural practices can reduce the availability of open landscapes with available seed forage.
		2.3 Livestock Farming & Ranching	Improper livestock grazing intensities can decrease availability of seeds in open landscapes used for forage during the winter months.
		3.3 Renewable Energy	Collisions with wind towers can cause mortalities during the non-breeding season.
3.1 Outreach & Communications	Encourage citizen science engagement in reporting observations throughout the nonbreeding season to identify migration	1.1 Housing & Urban Areas	Bird feeders can attract wintering flocks to developed areas where mortality risk may be elevated.

	patterns and overwintering areas. Conduct public outreach on strategies that mitigate elevated avian mortality in developed areas in the winter.		
3.1 Outreach & Communications	Encourage citizen science engagement involving alpine recreationists in reporting observations during the breeding season.	11.1 Ecosystem Encroachment	Ecosystem encroachment in alpine tundra and sparsely vegetated areas.
		11.3 Changes in Temperature Regimes	Increased temperatures can decrease foraging habitat and opportunities during critical breeding periods.
		8.1 Invasive Non-Native/Alien Plants & Animals	Stocking of trout in previously fishless alpine lakes reduces the availability of emerging aquatic insects for forage.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Consider employing curtailments during intense migration periods to reduce risk of mortality.	3.3 Renewable Energy	Collisions with wind towers can cause mortalities during the non-breeding season.
5.2 Better Products & Management Practices	Discontinue the practice of fish stocking in alpine lakes that regularly winterkill and have low recreational demand for stocking.	11.3 Changes in Temperature Regimes	Increased temperatures can decrease foraging habitat and opportunities during critical breeding periods.
		8.1 Invasive Non-Native/Alien Plants & Animals	Stocking of trout in previously fishless alpine lakes reduces the availability of emerging aquatic insects for forage.
C. Enabling Conditions Actions			
10. Institutional Development			
10.3 Alliance & Partnership Development	Continue to participate in the regional Rosy-Finch working group to effectively collaborate on ongoing regional projects across the species range.	11.1 Ecosystem Encroachment	Ecosystem encroachment in alpine tundra and sparsely vegetated areas.
		11.3 Changes in Temperature Regimes	Increased temperatures can decrease foraging habitat and opportunities during critical breeding periods.
		6.1 Recreational Activities	Recreation in alpine habitat brings unnatural food sources that attract nest predators and introduce invasive plant species. Recreational use of mine shafts disturbs roosting birds, and mine shaft closures lead to habitat loss.

		8.1 Invasive Non-Native/Alien Plants & Animals	Stocking of trout in previously fishless alpine lakes reduces the availability of emerging aquatic insects for forage.

Greater Sage-Grouse Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Applying seasonal closures for motorized use to discourage concentrations of hunters in critical seasonal habitats (e.g., during late big-game seasons) when Greater Sage-Grouse are present. Encourage recreationists to avoid continuous or concentrated use within 1.5 miles of leks from 15 March-15 May. Notify user group of the impacts of disturbance during the sensitive nesting period.	4.1 Roads & Railroads	Roads contribute to habitat loss and population declines. Roads/off-road travel can cause habitat fragmentation, habitat loss, and a potential decline or shift in populations. Vehicle use on federal, state, and tribal lands impacts habitat quality. Recreation/commercial activities (energy facilities and high-volume road traffic) impacts breeding and reproduction through disturbance and reduces habitat quality through spread of invasive plants.
1.1 Site/Area Stewardship	Design impoundments and manage discharge so as not to degrade or inundate leks, nesting sites, and wintering sites. Protect natural springs from any source of disturbance or degradation from energy-related activities. Mitigate habitat degradation at existing energy facilities within 2 miles of leks. Place storage facilities, generators, and holding tanks outside the	3.2 Mining & Quarrying 3.3 Renewable Energy	Mining and renewable energy operations and associated impacts degrade habitat through direct destruction (e.g., sagebrush clearing) and through disturbance (e.g., lights and traffic near nests and leks, need for towers and powerlines, fencing).

	line of sight/sound of breeding habitat. Minimize ground disturbance in sagebrush stands with documented use (leks, nesting habitat within 2 miles of leks, and sagebrush stands with portions that remain above ground when in deep-snow conditions, used for wintering).		
1.1 Site/Area Stewardship	Design impoundments and manage discharge so as to not degrade or inundate leks, nesting sites, and wintering sites. Protect natural springs from any source of disturbance or degradation from energy-related activities. Mitigate habitat degradation at existing energy facilities within 2 miles of leks. Place storage facilities, generators, and holding tanks outside the line of sight/sound of breeding habitat. Minimize ground disturbance in sagebrush stands with documented use (leks, nesting habitat within 2 miles of leks, and sagebrush stands with portions that remain above ground when in deep-snow conditions, used for wintering).	3.1 Oil & Gas Drilling	Development of oil and gas and associated structures for electrical generation and transmission can decrease Greater Sage-Grouse habitat in western US. Fence wires and power poles can contribute to mortality and increase the risk of predation by providing perches. Coal bed methane poses a risk. Wind turbines contribute to collisions.
1.1 Site/Area Stewardship	Develop objectives for breeding and winter habitats. Where appropriate, interrupt seral stages in patches of appropriate size (e.g., brush beating, chaining, chemical means, fire). Avoid placing salt or mineral supplements near leks during the breeding season (March-June) to discourage aggregation of livestock. Avoid supplemental	2.3 Livestock Farming & Ranching	Plowing and introduction of cultivated crops or other non-native species for pasture leads to the long-term loss of Greater Sage-Grouse habitat. As habitats become more fragmented by conversion to cropland, nests are more susceptible to predation, which significantly reduces productivity. Grazing affects sagebrush-grassland habitat through direct effects on plants and indirect effects on soil and microclimate. Continuous use by domestic livestock and wild ungulates might not leave suitable cover or maintain the

	feeding of livestock in winter habitat and around leks.		site potential for seasonal or year-long habitats. Herbicide/pesticide use can reduce sagebrush and forbs and reduce the production/survival of Greater Sage-Grouse through reduced nutritional levels and increased predation. Herbicides can alter the composition of plant species and the availability of insects for food. Loss of food sources critical to early survival of chicks may also have long-term effects on Greater-Sage Grouse populations.
1.2 Ecosystem & Natural Process (Re)Creation	Schedule annual meetings to coordinate with fire specialists, wildlife biologists, and range ecologists to incorporate new habitat information when setting wildfire suppression priorities. Distribute updates to fire dispatchers for initial attack planning.	7.1 Fire & Fire Suppression	Wildfire and prescribed fire can result in a net loss of sagebrush habitat, especially mature sagebrush and sagebrush canopy in breeding, brood-rearing, and winter habitats.
2. Species Management			
2.1 Species Stewardship	Where predation affects Greater Sage-Grouse populations, consider management actions specific to the predator species and location. Through state agencies, manage for healthy populations of species classified as non-game, furbearer, or predator to ensure healthy populations of ground-nesting upland game birds.	8.2 Problematic Native Plants & Animals	Predation by native mammals and birds on eggs, juveniles, or occasionally adults. Changes in the composition and abundance of avian and mammalian predator populations since termination of widespread predator control in the early 1970s.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Develop educational materials detailing the effects of pesticides and herbicides that can be used to evaluate their effects on Greater Sage-Grouse.	2.3 Livestock Farming & Ranching	Plowing and introduction of cultivated crops or other non-native species for pasture leads to the long-term loss of Greater Sage-Grouse habitat. As habitats become more fragmented by conversion to cropland, nests are more susceptible to predation, which significantly reduces productivity. Grazing affects sagebrush-grassland habitat

			through direct effects on plants and indirect effects on soil and microclimate. Continuous use by domestic livestock and wild ungulates might not leave suitable cover or maintain the site potential for seasonal or year-long habitats. Herbicide/pesticide use can reduce sagebrush and forbs and reduce the production/survival of Greater Sage-Grouse through reduced nutritional levels and increased predation. Herbicides can alter the composition of plant species and the availability of insects for food. Loss of food sources critical to early survival of chicks may also have long-term effects on Greater-Sage Grouse populations.
		9.3 Agricultural & Forestry Effluents	Runoff of agricultural pesticides, herbicides, and fertilizers can reduce prey base and introduce toxins to waters in Greater Sage-Grouse habitat.
3.1 Outreach & Communications	Provide educational materials to the public on the effects of recreational activities and the importance of seasonal ranges to Greater Sage-Grouse. Encourage recreationists to avoid continuous or concentrated use within 1.5 miles of leks from 15 March-15 May and notify them of the impact of disturbance during the sensitive nesting season.	4.1 Roads & Railroads	Roads contribute to habitat loss and population declines. Roads/off-road travel can cause habitat fragmentation, habitat loss, and a potential decline or shift in populations. Vehicle use on federal, state, and tribal lands impacts habitat quality. Recreation/commercial activities (energy facilities and high-volume road traffic) impacts breeding and reproduction through disturbance and reduces habitat quality through spread of invasive plants.
3.1 Outreach & Communications	Provide information to land developers on clustering homes, road and utility placement, and fence design and placement. Provide grouse habitat maps and management recommendations to county planners, public land agencies, and land managers. Encourage counties to offer incentives to developers who protect grouse habitat. Provide the public and agencies information on methods for conserving sagebrush.	1.1 Housing & Urban Areas	Increases in the human population, development, housing, and land subdivision continue to reduce and fragment Greater Sage-Grouse habitat.

4. Law Enforcement & Prosecution			
4.2 Criminal Prosecution & Conviction	Enforce laws regarding illegal shooting.	5.1 Hunting & Collecting Terrestrial Animals	Illegal shooting/poaching.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Consider Greater Sage-Grouse needs when developing roads and OHV management plans. Identify, map, quantify, and evaluate impacts of existing roads, including 2-tracks, in relation to known lek locations and Greater Sage-Grouse winter ranges. Consider impacts to Greater Sage-Grouse when designing new roads and modifying existing roads. Consider seasonal use restrictions or signing to avoid disturbance of critical Greater Sage-Grouse habitats. Consider the use of speed bumps where appropriate to reduce vehicle speeds near leks (e.g., during oil and gas development).	4.1 Roads & Railroads	Roads contribute to habitat loss and population declines. Roads/off-road travel can cause habitat fragmentation, habitat loss, and a potential decline or shift in populations. Vehicle use on federal, state, and tribal lands impacts habitat quality. Recreation/commercial activities (energy facilities and high-volume road traffic) impacts breeding and reproduction through disturbance and reduces habitat quality through spread of invasive plants.
5.2 Better Products & Management Practices	Design fences in a way that minimizes impacts on grouse. On state and federal lands, continue to avoid placing fences on leks and winter ranges, and consider similar practices on private and tribal lands. Avoid placing salt or mineral supplements near leks during the breeding season (March-June) to discourage aggregation of livestock. Avoid supplemental feeding of livestock in winter habitat and around leks.	2.3 Livestock Farming & Ranching	Plowing and introduction of cultivated crops or other non-native species for pasture leads to the long-term loss of Greater Sage-Grouse habitat. As habitats become more fragmented by conversion to cropland, nests are more susceptible to predation, which significantly reduces productivity. Grazing affects sagebrush-grassland habitat through direct effects on plants and indirect effects on soil and microclimate. Continuous use by domestic livestock and wild ungulates might not leave suitable cover or maintain the site potential for seasonal or year-long habitats. Herbicide/pesticide use can reduce sagebrush and forbs and reduce the production/survival of Greater Sage-Grouse

			through reduced nutritional levels and increased predation. Herbicides can alter the composition of plant species and the availability of insects for food. Loss of food sources critical to early survival of chicks may also have long-term effects on Greater-Sage Grouse populations.
5.2 Better Products & Management Practices	Provide Greater Sage-Grouse maps and best management recommendations to county planners, public land agencies, and other interest groups and land managers. Encourage county governments to offer incentives to developers who protect or enhance Greater Sage-Grouse habitat.	1.1 Housing & Urban Areas	Increases in the human population, development, housing, and land subdivision continue to reduce and fragment Greater Sage-Grouse habitat.
5.2 Better Products & Management Practices	Work with developers, agencies, utilities, and landowners to identify and protect important breeding, nesting, brood-rearing, and wintering habitats. Minimize densities of roads, pipelines, and power lines in important grouse habitats. Place structures outside the line of sight/sound of breeding habitat and > 0.25 miles from leks. Mitigate habitat degradation and minimize sagebrush disturbance within 2 miles of leks and in used wintering habitats, and reclaim abandoned wells. Restrict noise levels to < 49 decibels within 2 miles of leks from 4-8 am and 7-10 pm during March 1-June 15 to prevent lek abandonment.	3.1 Oil & Gas Drilling	Development of oil and gas and associated structures for electrical generation and transmission can decrease Greater Sage-Grouse habitat in western US. Fence wires and power poles can contribute to mortality and increase the risk of predation by providing perches. Coal bed methane poses a risk. Wind turbines contribute to collisions.
		3.2 Mining & Quarrying	Mining and renewable energy operations and associated impacts degrade habitat through direct destruction (e.g., sagebrush clearing) and through disturbance (e.g., lights and traffic near nests and leks, need for towers and powerlines, fencing).
		3.3 Renewable Energy	
5.3 Market-Based Incentives	Provide incentives for habitat conservation, like the state-administered Landowner Incentive Program, which provides an incentive payment to private landowners for	2.3 Livestock Farming & Ranching	Plowing and introduction of cultivated crops or other non-native species for pasture leads to the long-term loss of Greater Sage-Grouse habitat. As habitats become more fragmented by conversion to cropland, nests are more susceptible to predation, which significantly reduces

	protecting sagebrush habitats from plowing, herbicides, and burning.		productivity. Grazing affects sagebrush-grassland habitat through direct effects on plants and indirect effects on soil and microclimate. Continuous use by domestic livestock and wild ungulates might not leave suitable cover or maintain the site potential for seasonal or year-long habitats. Herbicide/pesticide use can reduce sagebrush and forbs and reduce the production/survival of Greater Sage-Grouse through reduced nutritional levels and increased predation. Herbicides can alter the composition of plant species and the availability of insects for food. Loss of food sources critical to early survival of chicks may also have long-term effects on Greater-Sage Grouse populations.
		7.1 Fire & Fire Suppression	Wildfire and prescribed fire can result in a net loss of sagebrush habitat, especially mature sagebrush and sagebrush canopy in breeding, brood-rearing, and winter habitats.
5.4 Direct Economic Incentives	Create a list of the current incentive programs for preventing the loss of Greater Sage-Grouse habitat. Provide habitat maps and best management recommendations to county planners, public land agencies, other interest groups and land managers. Encourage county governments to offer incentives to developers who protect and enhance Greater Sage-Grouse habitat.	1.1 Housing & Urban Areas	Increases in the human population, development, housing, and land subdivision continue to reduce and fragment Greater Sage-Grouse habitat.
5.4 Direct Economic Incentives	Encourage the voluntary use of habitat incentive programs (e.g., CRP), and secure additional funding sources for such programs. Offer private landowners additional incentives for achieving Greater Sage-Grouse objectives.	2.3 Livestock Farming & Ranching	Plowing and introduction of cultivated crops or other non-native species for pasture leads to the long-term loss of Greater Sage-Grouse habitat. As habitats become more fragmented by conversion to cropland, nests are more susceptible to predation, which significantly reduces productivity. Grazing affects sagebrush-grassland habitat through direct effects on plants and indirect effects on soil

			and microclimate. Continuous use by domestic livestock and wild ungulates might not leave suitable cover or maintain the site potential for seasonal or year-long habitats. Herbicide/pesticide use can reduce sagebrush and forbs and reduce the production/survival of Greater Sage-Grouse through reduced nutritional levels and increased predation. Herbicides can alter the composition of plant species and the availability of insects for food. Loss of food sources critical to early survival of chicks may also have long-term effects on Greater-Sage Grouse populations.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.3 Land/Water Use Zoning & Designation	Request counties and agencies to designate a Greater Sage-Grouse contact person to interface with county planning authorities. Designate important Greater Sage-Grouse habitat areas within each county.	1.1 Housing & Urban Areas	Increases in the human population, development, housing, and land subdivision continue to reduce and fragment Greater Sage-Grouse habitat.
6.4 Conservation Planning	Develop local or regional guidelines for prescribed fire. Analyze cumulative effects of sagebrush treatment by considering ecological units, evaluate the degree of fragmentation, maintain a good representation of mature sagebrush, and determine treatment types and intervals based on the predicted time necessary for sagebrush to return to desired condition.	7.1 Fire & Fire Suppression	Wildfire and prescribed fire can result in a net loss of sagebrush habitat, especially mature sagebrush and sagebrush canopy in breeding, brood-rearing, and winter habitats.
6.4 Conservation Planning	Ensure grazing allotment plans include objectives for sagebrush habitats and Greater Sage-Grouse. Manage grazing rotations across jurisdictional boundaries where possible. In FWP grazing plans,	2.3 Livestock Farming & Ranching	Plowing and introduction of cultivated crops or other non-native species for pasture leads to the long-term loss of Greater Sage-Grouse habitat. As habitats become more fragmented by conversion to cropland, nests are more susceptible to predation, which significantly reduces

	include sagebrush management, state-owned and adjacent private land, grazing livestock, and wild herbivores. Where data are lacking, inventory sagebrush density and species. Identify remaining Greater Sage-Grouse breeding and wintering areas. Identify conservation priorities across Montana.		productivity. Grazing affects sagebrush-grassland habitat through direct effects on plants and indirect effects on soil and microclimate. Continuous use by domestic livestock and wild ungulates might not leave suitable cover or maintain the site potential for seasonal or year-long habitats. Herbicide/pesticide use can reduce sagebrush and forbs and reduce the production/survival of Greater Sage-Grouse through reduced nutritional levels and increased predation. Herbicides can alter the composition of plant species and the availability of insects for food. Loss of food sources critical to early survival of chicks may also have long-term effects on Greater-Sage Grouse populations.
6.4 Conservation Planning	Map and evaluate impacts of proposed and existing roads, including 2-tracks, and OHVs near leks and winter ranges. Consider seasonal use restrictions and signage to prevent disturbance of critical habitats. Consider installing speed bumps near leks (e.g., during oil and gas development). Work with MDT, FHWA, industry, and counties and provide habitat data during the planning phases of transportation development. Develop a transportation management plan across ownership boundaries in critical habitats. Participate in travel planning efforts and educate the public about the impacts of roads on the species and critical habitats.	4.1 Roads & Railroads	Roads contribute to habitat loss and population declines. Roads/off-road travel can cause habitat fragmentation, habitat loss, and a potential decline or shift in populations. Vehicle use on federal, state, and tribal lands impacts habitat quality. Recreation/commercial activities (energy facilities and high-volume road traffic) impacts breeding and reproduction through disturbance and reduces habitat quality through spread of invasive plants.
6.4 Conservation Planning	Mitigate habitat degradation at existing energy facilities within 2 miles of leks. Place storage facilities, generators, and holding tanks outside the line of sight/sound of	3.1 Oil & Gas Drilling	Development of oil and gas and associated structures for electrical generation and transmission can decrease Greater Sage-Grouse habitat in western US. Fence wires and power poles can contribute to mortality and increase the risk of

	breeding habitat. Minimize ground disturbance in sagebrush stands with documented use (leks, nesting habitat within 2 miles of leks, and sagebrush stands with portions that remain above ground when in deep-snow conditions, used for wintering).		predation by providing perches. Coal bed methane poses a risk. Wind turbines contribute to collisions.
		3.2 Mining & Quarrying	Mining and renewable energy operations and associated impacts degrade habitat through direct destruction (e.g., sagebrush clearing) and through disturbance (e.g., lights and traffic near nests and leks, need for towers and powerlines, fencing).
		3.3 Renewable Energy	
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Develop educational materials (brochure, Power Point presentation, camera-ready ads, press releases, public service announcements, event invitations, surveys, websites, newsletters, and research information). Present materials in a series of community meetings that bring statewide technical group participants and regional agency staff together with local people.	1.1 Housing & Urban Areas	Increases in the human population, development, housing, and land subdivision continue to reduce and fragment Greater Sage-Grouse habitat.
7.2 Policies & Guidelines	Engage inter-agency collaboration to update energy guidelines for sagebrush and Greater Sage-Grouse habitat.	3.1 Oil & Gas Drilling	Development of oil and gas and associated structures for electrical generation and transmission can decrease Greater Sage-Grouse habitat in western US. Fence wires and power poles can contribute to mortality and increase the risk of predation by providing perches. Coal bed methane poses a risk. Wind turbines contribute to collisions.
		3.2 Mining & Quarrying	Mining and renewable energy operations and associated impacts degrade habitat through direct destruction (e.g., sagebrush clearing) and through disturbance (e.g., lights and traffic near nests and leks, need for towers and powerlines, fencing).
		3.3 Renewable Energy	
9. Education & Training			

9.1 Formal Education	Use cooperative integrated weed management efforts, essential to successful Greater Sage-Grouse habitat.	8.1 Invasive Non-Native/Alien Plants & Animals	Noxious weeds have displaced more desirable native plant species across Montana. Reduction of forbs important to Greater Sage-grouse during brood rearing could pose a major threat. Recreation/commercial activities (related to energy facilities/high-volume traffic on roads) can adversely affect breeding/reproduction through disturbance and reduce habitat quality through the spread of noxious weeds.
9.2 Training & Individual Capacity Development	Focus site management (e.g., prescribed fire, mechanical removal) in areas where woody expansion is in its initial stages, to retain key foraging meadows. Create forest openings in the summer range, as part of a forestry prescription on both public and private lands. Conserve native shrublands and grasslands used by grouse during summer. Provide technical assistance on habitat improvement projects to private landowners.	7.1 Fire & Fire Suppression	Fire suppression has allowed for conifer encroachment in and adjacent to forest openings. Conifer encroachment reduces sagebrush habitat with the encroachment of juniper.
9.2 Training & Individual Capacity Development	Provide technical assistance to developers, private industry, landowners, and homeowners about road placement in Greater Sage-Grouse habitat.	4.1 Roads & Railroads	Roads contribute to habitat loss and population declines. Roads/off-road travel can cause habitat fragmentation, habitat loss, and a potential decline or shift in populations. Vehicle use on federal, state, and tribal lands impacts habitat quality. Recreation/commercial activities (energy facilities and high-volume road traffic) impacts breeding and reproduction through disturbance and reduces habitat quality through spread of invasive plants.
9.2 Training & Individual Capacity Development	Provide technical assistance to landowners on conservation strategies for Greater Sage-Grouse and incentive programs for sagebrush management.	2.3 Livestock Farming & Ranching	Plowing and introduction of cultivated crops or other non-native species for pasture leads to the long-term loss of Greater Sage-Grouse habitat. As habitats become more fragmented by conversion to cropland, nests are more susceptible to predation, which significantly reduces productivity. Grazing affects sagebrush-grassland habitat through direct effects on plants and indirect effects on soil

			and microclimate. Continuous use by domestic livestock and wild ungulates might not leave suitable cover or maintain the site potential for seasonal or year-long habitats. Herbicide/pesticide use can reduce sagebrush and forbs and reduce the production/survival of Greater Sage-Grouse through reduced nutritional levels and increased predation. Herbicides can alter the composition of plant species and the availability of insects for food. Loss of food sources critical to early survival of chicks may also have long-term effects on Greater-Sage Grouse populations.
9.2 Training & Individual Capacity Development	Provide technical assistance to landowners regarding their application of pesticides, herbicides and fertilizers during spring and early summer in the vicinity of Greater Sage-Grouse nesting and foraging habitat.	9.3 Agricultural & Forestry Effluents	Runoff of agricultural pesticides, herbicides, and fertilizers can reduce prey base and introduce toxins to waters in Greater Sage-Grouse habitat.
9.2 Training & Individual Capacity Development	Provide technical assistance to private landowners who lease privately owned fee minerals.	3.1 Oil & Gas Drilling	Development of oil and gas and associated structures for electrical generation and transmission can decrease Greater Sage-Grouse habitat in western US. Fence wires and power poles can contribute to mortality and increase the risk of predation by providing perches. Coal bed methane poses a risk. Wind turbines contribute to collisions.
		3.2 Mining & Quarrying	Mining and renewable energy operations and associated impacts degrade habitat through direct destruction (e.g., sagebrush clearing) and through disturbance (e.g., lights and traffic near nests and leks, need for towers and powerlines, fencing).
		3.3 Renewable Energy	
9.2 Training & Individual Capacity Development	Use cooperative integrated weed management efforts, essential to successful Greater Sage-Grouse habitat.	8.1 Invasive Non-Native/Alien Plants & Animals	Noxious weeds have displaced more desirable native plant species across Montana. Reduction of forbs important to Greater Sage-grouse during brood rearing could pose a major threat. Recreation/commercial activities (related to energy facilities/high-volume traffic on roads) can adversely affect

			breeding/reproduction through disturbance and reduce habitat quality through the spread of noxious weeds.
10. Institutional Development			
10.1 Internal Organizational Management & Administration	Use cooperative integrated weed management efforts, essential to successful Greater Sage-Grouse habitat.	8.1 Invasive Non-Native/Alien Plants & Animals	Noxious weeds have displaced more desirable native plant species across Montana. Reduction of forbs important to Greater Sage-grouse during brood rearing could pose a major threat. Recreation/commercial activities (related to energy facilities/high-volume traffic on roads) can adversely affect breeding/reproduction through disturbance and reduce habitat quality through the spread of noxious weeds.
10.3 Alliance & Partnership Development	Convene meetings of local stakeholders, and state and federal agencies to share information about similar practices being conducted by a variety of groups. Work with landowners to re-establish sagebrush-grassland habitats through programs such as the Upland Game Bird Habitat Enhancement Program or CRP. Promote sagebrush-grassland habitat conservation through USDA programs. Develop inter-agency management plans specifically focused on new information gathered on sagebrush and Greater Sage-Grouse interactions.	2.3 Livestock Farming & Ranching	Plowing and introduction of cultivated crops or other non-native species for pasture leads to the long-term loss of Greater Sage-Grouse habitat. As habitats become more fragmented by conversion to cropland, nests are more susceptible to predation, which significantly reduces productivity. Grazing affects sagebrush-grassland habitat through direct effects on plants and indirect effects on soil and microclimate. Continuous use by domestic livestock and wild ungulates might not leave suitable cover or maintain the site potential for seasonal or year-long habitats. Herbicide/pesticide use can reduce sagebrush and forbs and reduce the production/survival of Greater Sage-Grouse through reduced nutritional levels and increased predation. Herbicides can alter the composition of plant species and the availability of insects for food. Loss of food sources critical to early survival of chicks may also have long-term effects on Greater-Sage Grouse populations.
10.3 Alliance & Partnership Development	Engage inter-agency collaboration to update energy guidelines for sagebrush and Greater Sage-Grouse habitat. Work with agencies, utilities, and landowners to identify and map	3.1 Oil & Gas Drilling	Development of oil and gas and associated structures for electrical generation and transmission can decrease Greater Sage-Grouse habitat in western US. Fence wires and power poles can contribute to mortality and increase the risk of

	important seasonal ranges for Greater Sage-Grouse.		predation by providing perches. Coal bed methane poses a risk. Wind turbines contribute to collisions.
		3.2 Mining & Quarrying	Mining and renewable energy operations and associated impacts degrade habitat through direct destruction (e.g., sagebrush clearing) and through disturbance (e.g., lights and traffic near nests and leks, need for towers and powerlines, fencing).
		3.3 Renewable Energy	
10.3 Alliance & Partnership Development	Establish partnerships with county weed districts. Work with private landowners, developers, and private industry to protect intact sagebrush habitat from invasive weeds. Work with state, federal, and private landowners to collectively mitigate and proactively prevent the spread of noxious weeds in a timely manner.	8.1 Invasive Non-Native/Alien Plants & Animals	Noxious weeds have displaced more desirable native plant species across Montana. Reduction of forbs important to Greater Sage-grouse during brood rearing could pose a major threat. Recreation/commercial activities (related to energy facilities/high-volume traffic on roads) can adversely affect breeding/reproduction through disturbance and reduce habitat quality through the spread of noxious weeds.
10.3 Alliance & Partnership Development	Map and evaluate impacts of proposed and existing roads near leks and winter ranges. Work with MDT, FHWA, industry, and counties and provide habitat data during the planning phases of transportation development. Develop a transportation management plan across ownership boundaries in critical habitats. Participate in travel planning efforts and educate the public about the impacts of roads on the species and critical habitats.	4.1 Roads & Railroads	Roads contribute to habitat loss and population declines. Roads/off-road travel can cause habitat fragmentation, habitat loss, and a potential decline or shift in populations. Vehicle use on federal, state, and tribal lands impacts habitat quality. Recreation/commercial activities (energy facilities and high-volume road traffic) impacts breeding and reproduction through disturbance and reduces habitat quality through spread of invasive plants.

Black Swift Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Protect known sites as best as possible; buffer any proposed development (such as trails or forestry work) to avoid disturbance or possibly detrimental habitat alterations, including loss of water.	11.4 Changes in Precipitation & Hydrological Regimes	Drought, higher temperatures, loss of glaciers and perennial snow/ice, lower snowpack and earlier snow melt due to climate change may cause breeding waterfalls to dry up prior to nesting fledge dates. Potential mismatch of breeding phenology and prey availability.

Caspian Tern Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Protect known breeding sites (islands) through coordinated management of water levels. Ensure islands remain surrounded by water throughout the breeding season, which is critical.	11.1 Ecosystem Encroachment	Reduction in breeding habitat through drought. Shift in breeding or winter range.
1.2 Ecosystem & Natural Process (Re)Creation	Manage (reduce) vegetation at breeding sites to increase habitat availability.	8.2 Problematic Native Plants & Animals	Displacement of Caspian Terns at breeding sites by more common gulls can reduce reproduction.
2. Species Management			

2.1 Species Stewardship	Create artificial sites for nesting. Exclude predators (night herons and gulls) and displace gulls from breeding sites. Refrain from recommending or using lethal gull control, as it has shown mixed results.	11.1 Ecosystem Encroachment	Reduction in breeding habitat through drought. Shift in breeding or winter range.
2.1 Species Stewardship	When researchers are working in small colonies (<100 nests), use nest covers to significantly reduce egg predation by gulls.	8.2 Problematic Native Plants & Animals	Displacement of Caspian Terns at breeding sites by more common gulls can reduce reproduction.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Install educational signs to convey the sensitivity of nest sites.	6.3 Work & Other Activities	Sensitive to human disturbance, especially early in breeding.

Chestnut-collared Longspur Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Limit construction and disturbance during grassland bird breeding, nesting, and brood-rearing season (April 1- July 15), keep noise levels < 49 dBA during the breeding season, and ensure sites and surroundings are reclaimed back to native grassland habitat post-construction.	3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.

1.1 Site/Area Stewardship	See Black-tailed/White-tailed Prairie Dog Threats and Actions.	5.1 Hunting & Collecting Terrestrial Animals	Loss of Black-tailed Prairie Dogs due to recreational shooting and direct and indirect mortality from poisoning can alter vegetation compositions and degrade habitat for grassland birds.
		8.4 Pathogens & Microbes	Loss of Black-tailed Prairie Dogs due to sylvatic plague can alter vegetation compositions and degrade habitat for grassland birds.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Provide signage on public lands indicating no off-road travel. Conduct outreach campaigns to clean and dry recreational machines before and after use to minimize the spread of non-native species. Increase enforcement on public lands to ensure signage and recreational rules are being met.	6.1 Recreational Activities	ATV/UTV recreational use causes degradation of grassland habitats by impacting vegetation and soil, spreading non-native vegetation, potentially driving over nests. Human activities and noise may interfere with nesting, foraging, and brood-rearing.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Provide agency comments and review of potential new transmission line builds to mitigate pre/post construction effects and ensure species and habitats of concern are considered.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.
4.3 Non-Criminal Legal Action	Reduce permitting of new dams, reservoirs, and other water impoundments in important grassland bird habitat, except where livestock cannot access water from other sources (e.g., groundwater, rural water systems).	7.2 Dams & Water Management / Use	Disruption of natural hydrological processes (e.g., artificial dam construction, loss of beavers) that impact function of ephemeral or perennial prairie streams and floodplains can degrade habitat.
4.3 Non-Criminal Legal Action	Through the agency review process of new road and railroad construction, provide recommendations to mitigate effects and	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-

	ensure species and habitats of concern are considered.		native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
4.3 Non-Criminal Legal Action	Through the agency, provide project-specific comments and recommendations to companies to mitigate pre- and post-construction effects and ensure that species of concern are considered.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
4.3 Non-Criminal Legal Action	Through the agency, provide project-specific comments and recommendations to development companies to mitigate pre- and post-construction effects and ensure species and habitats of concern are considered. Consult FWP's Crucial Areas Planning System (CAPS) and other sites such as Montana Natural Heritage Program for indications of species of concern.	1.1 Housing & Urban Areas	Housing development in core grassland habitat will decrease breeding habitat via fragmentation and conversion, including destruction of native vegetation, installation of vertical structures avoided by grassland birds, introduction or expansion of meso-predators and human commensal species (e.g., cats, crows, raccoons), noise disturbance, and increase of non-native plant species.
5. Livelihood Economic & Moral Incentives			
5.1 Linked Enterprises & Alternative Livelihoods	Incentivize ranching over farming.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.2 Better Products & Management Practices	Manage wireless technology by constructing shorter cellular towers or reducing reliance on cell towers (i.e., move towards satellite or other alternatives).	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.

5.2 Better Products & Management Practices	Provide information to landowners about management practices that minimize negative effects on grassland bird nesting success. Mow fields after July 15 so nestlings can fledge. Seed fields early, before May 10 to limit nest destruction by machinery. Minimize tillage and use of pesticides and herbicides.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.3 Market-Based Incentives	Incentivize meat and fiber produced on properties with a grazing management plan compatible with grassland bird habitat.	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.
5.3 Market-Based Incentives	Promote the value of agriculture products produced while stewarding grassland, such as beef, bison and fiber.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.4 Direct Economic Incentives	Compensate livestock producers when production goals and wildlife habitat goals do not align (e.g., resting and heavy grazing).	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.
5.4 Direct Economic Incentives	Incentivize ranching over farming.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.5 Non-Monetary Values	Convey the link between conservation and the effects of a changing climate on human health and populations.	11.3 Changes in Temperature Regimes	Changes in temperature can lengthen growing seasons, increase non-native vegetation monocultures, and impact the timing of the breeding season of grassland birds and cause their range to expand or contract. Hotter/drier summers can lead to droughts. Cooler temperatures can promote additional biomass growth throughout grasslands.
		11.4 Changes in Precipitation & Hydrological Regimes	Increased precipitation in the spring could increase non-native vegetation monocultures (Cheatgrass, Sweetclover, Kentucky Bluegrass, Smooth Brome) and woody vegetation expansion. Low moisture could impact prey populations for grassland birds. High moisture could promote cropland expansion.

		11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
5.5 Non-Monetary Values	Educating the public on the importance of minimal disturbance and the impacts of habitat destruction on grassland birds.	6.1 Recreational Activities	ATV/UTV recreational use causes degradation of grassland habitats by impacting vegetation and soil, spreading non-native vegetation, potentially driving over nests. Human activities and noise may interfere with nesting, foraging, and brood-rearing.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Identify areas of highest population densities and quality habitat for focused conservation attention. Prioritize conservation needs as projects/development are proposed.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Maintain strong adherence to the Montana Environmental Policy Act (MEPA).	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil

			and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
7.1 Laws, Regulations & Codes	Pass laws/bills to minimize the use of pesticides, particularly insecticides including neonicotinoid seed treatments. Make highly toxic pesticides illegal.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
7.1 Laws, Regulations & Codes	Promote native vegetation seeding and prohibit persistent non-native species seeding during reclamation or restoration (e.g., along roadsides, energy production).	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
7.1 Laws, Regulations & Codes	Re-seed with native species only, without persistent non-native species. Restrict the construction of new roads and railroads (especially elevated roads) in grassland bird habitat. Apply Migratory Bird Treaty Act timing restrictions for construction in core habitat of ground-nesting bird species.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
7.1 Laws, Regulations & Codes	Reduce disparity in subsidies between annual cropland and grass-based agriculture. Implement policies that better mitigate risk for ranching operations.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
7.1 Laws, Regulations & Codes	Restrict construction of new utility and service lines. Require seeding of native vegetation, without persistent non-native species, at all utility installation sites, including waterlines.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.

7.1 Laws, Regulations & Codes	Support science-based laws and bills to address climate change.	11.3 Changes in Temperature Regimes	Changes in temperature can lengthen growing seasons, increase non-native vegetation monocultures, and impact the timing of the breeding season of grassland birds and cause their range to expand or contract. Hotter/drier summers can lead to droughts. Cooler temperatures can promote additional biomass growth throughout grasslands.
		11.4 Changes in Precipitation & Hydrological Regimes	Increased precipitation in the spring could increase non-native vegetation monocultures (Cheatgrass, Sweetclover, Kentucky Bluegrass, Smooth Brome) and woody vegetation expansion. Low moisture could impact prey populations for grassland birds. High moisture could promote cropland expansion.
		11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
7.2 Policies & Guidelines	Reduce disparity in subsidies between annual cropland and grass-based agriculture. Implement policies that better mitigate risk for ranching operations.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
9. Education & Training			
9.2 Training & Individual Capacity Development	Increase agencies' and public awareness of the threat posed by non-native vegetation to grassland species and habitats.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
9.2 Training & Individual Capacity Development	Provide technical assistance and information to landowners about woody vegetation encroachment and management guides.	8.2 Problematic Native Plants & Animals	Encroachment of native woody vegetation (Rocky Mountain Juniper, Ponderosa Pine) results in a complete loss of habitat for most grassland songbirds.
9.2 Training & Individual Capacity Development	Provide technical assistance to landowners through incentive programs and workshops.	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.

	Support rancher-led organizations such as the Ranchers Stewardship Alliance.		
9.2 Training & Individual Capacity Development	Provide trainings and information to stakeholders and agencies on pesticide use and effects on grassland birds.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
9.2 Training & Individual Capacity Development	Providing office and in-field trainings for agency personnel and workshops to landowners about prescribed fire management.	7.1 Fire & Fire Suppression	Altered fire regimes and fire suppression leading to high intensity fires reduces local breeding densities and leads to encroachment of woody vegetation in grassland habitat.
10. Institutional Development			
10.3 Alliance & Partnership Development	Proactively improve and increase partnerships with pesticide applicators to ensure that the methods and products used are the best available for wildlife and habitats.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
10.3 Alliance & Partnership Development	Work proactively with oil and gas contractors and companies to ensure best methods for wildlife and habitats are incorporated.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
10.3 Alliance & Partnership Development	Work proactively with renewable energy contractors and companies to ensure best methods for wildlife and habitats are incorporated.	3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
10.3 Alliance & Partnership Development	Work proactively with road and railroad contractors and companies to ensure best methods for wildlife and habitats are incorporated.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
10.3 Alliance & Partnership Development	Work proactively with utility and service line contractors and companies to ensure best methods for wildlife and habitats are incorporated.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.

10.3 Alliance & Partnership Development	Work with ranching communities, agricultural extensions, and universities to find and share common solutions.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
10.4 Financing Conservation	Promote incentive programs for landowners to manage non-native species. Create available funding for district/city weed managers.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.

Harlequin Duck Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Refrain from stocking fish in headwaters of Harlequin Duck breeding streams.	8.2 Problematic Native Plants & Animals	Stocked sport fish compete with Harlequin Ducks for invertebrate food resources.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate boaters, fishers, and other recreationists on how they can reduce their impact on Harlequin Ducks. Provide education materials to fly shops, outfitters, and boat shops.	6.1 Recreational Activities	Disturbance from recreational activities on breeding waters can disrupt breeding and nesting.
C. Enabling Conditions Actions			

6. Conservation Designation & Planning			
6.4 Conservation Planning	Consider seasonal boating and fishing closures or restrictions in sensitive areas. Consider prohibiting commercial boating and fishing outfitter permits in sensitive areas. Do not permit new or expanded outfitting on breeding streams. Emphasize restrictions during early brood-rearing season when chicks are most vulnerable, especially from mid-July to mid-Aug.	6.1 Recreational Activities	Disturbance from recreational activities on breeding waters can disrupt breeding and nesting.
6.4 Conservation Planning	Manage anthropogenic stressors that can exacerbate limited brood-rearing habitat during low water. In high recreation areas, consider closing access to critical foraging areas during sensitive brood-rearing times in years with critically low water levels. Work to revegetate and prevent social trails along breeding streams.	11.4 Changes in Precipitation & Hydrological Regimes	Improper grazing can negatively impact habitat. Livestock related persecution. Poisoning by livestock euthanasia drugs, predator/rodent poison, or lead from rodent shooting.
6.4 Conservation Planning	Work with Pacific Flyway partners to discuss this issue.	5.1 Hunting & Collecting Terrestrial Animals	Legal hunting in winter range results in direct mortality.
6.4 Conservation Planning	Work with state land managers and private timber companies to increase Streamside Management Zones (SMZs) in breeding streams to > 50 feet. For federal lands, consider any breeding stream (occupied HUC 12) to have a maximum Riparian Management Zone (RMZ) of 300 ft.	5.3 Logging & Wood Harvesting	Logging can degrade aquatic and riparian breeding habitat.

Least Tern Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Close and limit access to nesting sites when appropriate during the breeding season.	6.1 Recreational Activities	Motorized and non-motorized recreation on gravel/sand bars and islands increases human disturbance at and around nesting/foraging sites and increases possibility for nest abandonment, destruction, and chick mortality.
1.1 Site/Area Stewardship	Prior to the arrival of Least Terns to their breeding sites, mechanically remove and manage vegetation encroachment on sand bars, gravel bars, and islands used for nesting.	7.2 Dams & Water Management / Use	Altered hydrological regimes due to dams, water diversions, and other structures on the Yellowstone and Missouri rivers can convert shallow riverine and floodplain aquatic habitats into deep water habitats creating unsuitable foraging sites as well as alter the natural course of waterflow and decrease habitat suitability for nesting.
1.1 Site/Area Stewardship	Remove human-created structures utilized by predators (e.g., abandoned buildings). Use site-specific predator deterrents (e.g., nest fences).	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native species (Russian Olives, Salt Cedar/tamarisk) on gravel/sand bars and riverbanks creates unsuitable nesting habitats and increases vegetation cover for predators.
		8.2 Problematic Native Plants & Animals	Encroachment of native vegetation species (cottonwoods, willows) on priority nesting gravel/sand bars creates unsuitable habitat and increases vegetation cover for predators.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate water and land recreationists about Least Tern habitat, nests, and challenges they face, and ways people can help.	6.1 Recreational Activities	Motorized and non-motorized recreation on gravel/sand bars and islands increases human disturbance at and around nesting/foraging sites and increases possibility for nest abandonment, destruction, and chick mortality.

4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Through the agency, provide project-specific comments and recommendations on developments to mitigate effects and ensure species of concern are considered.	7.2 Dams & Water Management / Use	Altered hydrological regimes due to dams, water diversions, and other structures on the Yellowstone and Missouri rivers can convert shallow riverine and floodplain aquatic habitats into deep water habitats creating unsuitable foraging sites as well as alter the natural course of waterflow and decrease habitat suitability for nesting.
5. Livelihood Economic & Moral Incentives			
5.5 Non-Monetary Values	Convey the link between conservation and the effects of a changing climate on human health and populations.	11.3 Changes in Temperature Regimes	Changes in temperature regimes may decrease prey availability.
		11.4 Changes in Precipitation & Hydrological Regimes	Changes in timing of precipitation and an increase in extreme precipitation events can create peaks of large water runoffs during breeding/nesting season and potentially flood nests and cause adult and chick mortality.
		11.5 Severe/Extreme Weather Events	Severe and extreme weather events (e.g., hailstorms) can be detrimental to adult and chick survival.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Continue annual monitoring of interior Least Tern populations to update management plans by collaborating with neighboring state agencies (e.g., North Dakota Game and Fish), U.S. Army Corps of Engineers, and U.S. Fish and Wildlife Service.	7.2 Dams & Water Management / Use	Altered hydrological regimes due to dams, water diversions, and other structures on the Yellowstone and Missouri rivers can convert shallow riverine and floodplain aquatic habitats into deep water habitats creating unsuitable foraging sites as well as alter the natural course of waterflow and decrease habitat suitability for nesting.
6.5 Site Infrastructure	Use signage near river access points and fishing access sites to discourage recreationists from disturbing nesting birds.	6.1 Recreational Activities	Motorized and non-motorized recreation on gravel/sand bars and islands increases human disturbance at and around nesting/foraging sites and increases possibility for nest abandonment, destruction, and chick mortality.
10. Institutional Development			

10.3 Alliance & Partnership Development	Proactively improve and increase partnerships with pesticide applicators to ensure that the methods and products used are the best available for wildlife and habitats.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide application and runoff can negatively affect least tern prey.

Lewis's Woodpecker Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Develop and distribute educational materials and best management practices when administering firewood permits, focused on discouraging cutting of burned, dead, and dying large-diameter trees.	4.1 Roads & Railroads	Roads, railroads, and other transportation infrastructure running along or through floodplains constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests. Roads used to access forested areas can increase snag and snag recruit removal for use as firewood.
3.1 Outreach & Communications	Develop and distribute educational materials and best management practices when administering firewood permits, focused on discouraging cutting of trees >9 inches DBH and avoiding Western Larch, Black Cottonwood, Aspen, and Ponderosa Pine.	5.3 Logging & Wood Harvesting	Post-fire salvage logging removes nesting and forage trees. Timber harvest, including thinning, in mature and old-growth forests can disturb succession and the creation of future habitat following high-severity fire. Removal of dead and dying cottonwood trees in riparian habitats eliminates nest structures.
3.1 Outreach & Communications	Develop and distribute educational materials to livestock producers in forested areas and river bottoms with large-diameter trees, about the importance of those trees to	2.3 Livestock Farming & Ranching	Removal of injured, dead, and dying large-diameter trees on private properties to maintain open rangelands removes important nesting and foraging trees. Overgrazing of riparian areas can limit establishment and growth of cottonwood trees used for nesting and foraging.

	nesting and foraging woodpeckers and other species.		
3.1 Outreach & Communications	Develop and distribute educational materials to new and existing landowners in forested areas and river bottoms with large-diameter trees, about the importance of those trees to nesting and foraging woodpeckers and other species.	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees on private properties in river bottoms and in forested areas removes important nest trees and foraging resources.
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners and land managers about alternative options for pest and weed control (e.g., native predators, regenerative grazing, biocontrol, mechanical removal) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Strengthen and promote enforcement of state and county laws and regulations around removal and manipulation of riparian vegetation in floodplains by private landowners, and encourage reporting and remedy of violations.	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees on private properties in river bottoms and in forested areas removes important nest trees and foraging resources.
4.1 Detection & Arrest	Strengthen and promote enforcement of state and county laws and regulations around removal and manipulation of riparian vegetation in floodplains.	2.3 Livestock Farming & Ranching	Removal of injured, dead, and dying large-diameter trees on private properties to maintain open rangelands removes important nesting and foraging trees. Overgrazing of riparian areas can limit establishment and growth of cottonwood trees used for nesting and foraging.
		4.1 Roads & Railroads	Roads, railroads, and other transportation infrastructure running along or through floodplains constricts lateral channel migration, reducing floodplain processes that create and

			maintain cottonwood forests. Roads used to access forested areas can increase snag and snag recruit removal for use as firewood.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Promote increasing fines for violations of streamside protection laws so that fines do not become a 'fee' for vegetation removal/disturbance.	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees on private properties in river bottoms and in forested areas removes important nest trees and foraging resources.
		2.3 Livestock Farming & Ranching	Removal of injured, dead, and dying large-diameter trees on private properties to maintain open rangelands removes important nesting and foraging trees. Overgrazing of riparian areas can limit establishment and growth of cottonwood trees used for nesting and foraging.
9. Education & Training			
9.2 Training & Individual Capacity Development	Develop a document that provides best management practices for timber in mature and old-growth stands, with a focus on maintaining important patch sizes and habitat features for Species of Greatest Conservation Need dependent on old-growth stands. Facilitate communication on vegetation management between foresters and biologists by developing a document with common terms used in forest management and in descriptions of biological needs of forest-dependent Species of Greatest Conservation Need.	5.3 Logging & Wood Harvesting	Post-fire salvage logging removes nesting and forage trees. Timber harvest, including thinning, in mature and old-growth forests can disturb succession and the creation of future habitat following high-severity fire. Removal of dead and dying cottonwood trees in riparian habitats eliminates nest structures.

10. Institutional Development			
10.3 Alliance & Partnership Development	Encourage landowners with forested areas on their properties to engage with DNRC's Forest Stewardship Program to responsibly manage their forests.	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees on private properties in river bottoms and in forested areas removes important nest trees and foraging resources.
		5.3 Logging & Wood Harvesting	Post-fire salvage logging removes nesting and forage trees. Timber harvest, including thinning, in mature and old-growth forests can disturb succession and the creation of future habitat following high-severity fire. Removal of dead and dying cottonwood trees in riparian habitats eliminates nest structures.

Mountain Plover Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Restrict timing of recreational shooting on public lands during peak breeding season in spring and summer.	5.1 Hunting & Collecting Terrestrial Animals	Shooting (recreational and landowner control) and poisoning of prairie dog colonies leads to loss of habitat conditions required for breeding Mountain Plovers.
2.1 Species Stewardship	Target larger prairie dog colonies (>1,500 acres) for plague management (vaccine or insecticides to control fleas).	8.4 Pathogens & Microbes	Declines in prairie dog populations due to sylvatic plague leads to loss of habitat conditions required by nesting Mountain Plovers.
B. Behavioral Change/Threat Reduction			

3. Awareness Raising			
3.1 Outreach & Communications	Create educational materials describing how prescribed burning can increase the nutritional value of plants for livestock in addition to optimizing Mountain Plovers habitat in areas identified as 'high importance' for Mountain Plovers.	7.1 Fire & Fire Suppression	Reduced fire frequency and intensity has created habitat conditions unsuitable for nesting Mountain Plovers.
3.1 Outreach & Communications	Develop a program to educate local communities on the ecosystem importance of prairie dog colonies for associated species like the Mountain Plover and the Burrowing Owl. Use information from the International Mountain Plover Working Group to inform these efforts.	5.1 Hunting & Collecting Terrestrial Animals	Shooting (recreational and landowner control) and poisoning of prairie dog colonies leads to loss of habitat conditions required for breeding Mountain Plovers.
3.1 Outreach & Communications	Promote public awareness of the importance of controlling invasive species for Mountain Plovers and other grassland-dependent species.	8.1 Invasive Non-Native/Alien Plants & Animals	Exotic grasses/plants outcompete native species and create vegetation conditions unsuitable for Mountain Plovers.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Work with landowners and public land management agencies to mitigate impacts of development. Avoid removing or fragmenting native grassland and native shrub habitat patches >25 acres. Reduce noise levels of human activity to <49 dBA within songbird breeding habitat during breeding season. Avoid development in areas of large prairie dog complexes (>1,500 acres).	3.3 Renewable Energy	Wind and solar energy development can cause habitat fragmentation.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Work with Audubon Society or other organizations who certify bird-friendly beef to	2.3 Livestock Farming & Ranching	Current grazing regimes do not promote habitat conditions suitable for nesting Mountain Plovers.

	incorporate conditions needed by Mountain Plovers (short grass with open, bare patches, or active prairie dog complexes).		
5.4 Direct Economic Incentives	Provide monetary incentives for sustainable approaches to grazing practices on private lands to increase favorable habitat conditions for Mountain Plovers.	2.3 Livestock Farming & Ranching	Current grazing regimes do not promote habitat conditions suitable for nesting Mountain Plovers.
5.4 Direct Economic Incentives	Provide monetary incentives to maintain rangeland over conversion to cropland or to restore cropland to native plants through programs like the Environmental Quality Incentives Program - Targeted Implementation Plan (EQIP-TIP) with NRCS.	2.1 Annual & Perennial Non-Timber Crops	Conversion of short-grass prairie and sagebrush grassland to cropland.
5.4 Direct Economic Incentives	Provide payments to private landowners to conserve prairie dogs (e.g., Black-footed Ferret Initiative with NRCS in Colorado).	5.1 Hunting & Collecting Terrestrial Animals	Shooting (recreational and landowner control) and poisoning of prairie dog colonies leads to loss of habitat conditions required for breeding Mountain Plovers.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.2 Easements & Resource Rights	Establish conservation contracts, leases, and/or easements that maintain or restore active prairie dog colonies.	5.1 Hunting & Collecting Terrestrial Animals	Shooting (recreational and landowner control) and poisoning of prairie dog colonies leads to loss of habitat conditions required for breeding Mountain Plovers.
6.4 Conservation Planning	Develop best management practices for land management agencies, targeting the avoidance of development in areas of large prairie dog complexes (>1,500 acres).	3.3 Renewable Energy	Wind and solar energy development can cause habitat fragmentation.
6.4 Conservation Planning	Restrict access to prairie dog colonies identified as important breeding grounds for Mountain Plovers on public lands by decommissioning unessential roads or placing season restrictions to minimize access for recreational shooting. Work with	5.1 Hunting & Collecting Terrestrial Animals	Shooting (recreational and landowner control) and poisoning of prairie dog colonies leads to loss of habitat conditions required for breeding Mountain Plovers.

	land management agencies to improve prairie dog protection on public lands (e.g., shooting restrictions, poison bans).		
9. Education & Training			
9.1 Formal Education	Teach adaptive management practices as part of a university or high school curriculum in agriculture or natural resource track majors.	2.1 Annual & Perennial Non-Timber Crops	Conversion of short-grass prairie and sagebrush grassland to cropland.
		2.3 Livestock Farming & Ranching	Current grazing regimes do not promote habitat conditions suitable for nesting Mountain Plovers.
9.2 Training & Individual Capacity Development	Provide outreach to landowners about alternatives and benefits of maintaining rangeland/native grassland over conversion to cropland.	2.1 Annual & Perennial Non-Timber Crops	Conversion of short-grass prairie and sagebrush grassland to cropland.
9.2 Training & Individual Capacity Development	Provide technical assistance and host workshops for landowners on prescribed fire techniques, adaptive grazing management, and other tools to help conserve areas highly important for Mountain Plovers.	7.1 Fire & Fire Suppression	Reduced fire frequency and intensity has created habitat conditions unsuitable for nesting Mountain Plovers.
9.2 Training & Individual Capacity Development	Provide technical assistance and host workshops for landowners on prescribed fire techniques, grassland species conservation, and other tools to help conserve areas highly important for Mountain Plovers.	2.3 Livestock Farming & Ranching	Current grazing regimes do not promote habitat conditions suitable for nesting Mountain Plovers.
10. Institutional Development			
10.3 Alliance & Partnership Development	Facilitating partnerships with local groups (e.g., Winnett Aces) to promote adaptive management practices.	2.3 Livestock Farming & Ranching	Current grazing regimes do not promote habitat conditions suitable for nesting Mountain Plovers.

Piping Plover Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Close off and limit access to nesting areas and suitable nesting habitat during breeding season.	6.1 Recreational Activities	Motorized and non-motorized recreation at breeding sites, like beaches, damages and destroys nests and nesting sites during breeding season, which causes egg and fledgling mortality and nest abandonment.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct outreach to the media and public on the sensitivity of the species, identifying nests, and cautioning recreationists from disturbing critical habitat during breeding season.	6.1 Recreational Activities	Motorized and non-motorized recreation at breeding sites, like beaches, damages and destroys nests and nesting sites during breeding season, which causes egg and fledgling mortality and nest abandonment.
3.1 Outreach & Communications	Develop an outreach program to garner stewardship and responsibility for the birds and their habitat.	2.1 Annual & Perennial Non-Timber Crops	Decreased waterflow from climate change can decrease or alter nesting habitat (e.g., decreased space, proximity to vegetation). Draining of wetlands in the Prairie Pothole Region, often in connection with agricultural conversion.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Use organic additives, polymers, or biodegradable additives instead of oil-based mud to reduce toxicity. Lubricate with mineral oil and lubra-breads instead of diesel oil. Implement remote monitoring to identify leaks early. Use habitat mapping from Ellis et al. (2023) to focus conservation efforts and limit oil and gas development in these areas.	3.1 Oil & Gas Drilling	Development of oil and natural gas in proximity to breeding sites, especially in alkali wetlands and the associated risk of spills.

5.4 Direct Economic Incentives	Create and promote tax incentives to maintain rangeland over conversion to cropland. Create farm bill incentives and/or a Targeted Implementation Plan with NRCS.	2.1 Annual & Perennial Non-Timber Crops	Decreased waterflow from climate change can decrease or alter nesting habitat (e.g., decreased space, proximity to vegetation). Draining of wetlands in the Prairie Pothole Region, often in connection with agricultural conversion.
		3.1 Oil & Gas Drilling	Development of oil and natural gas in proximity to breeding sites, especially in alkali wetlands and the associated risk of spills.
		6.1 Recreational Activities	Motorized and non-motorized recreation at breeding sites, like beaches, damages and destroys nests and nesting sites during breeding season, which causes egg and fledgling mortality and nest abandonment.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.5 Site Infrastructure	Implement signage at nesting areas cautioning recreationalists from disturbing nesting areas and birds.	6.1 Recreational Activities	Motorized and non-motorized recreation at breeding sites, like beaches, damages and destroys nests and nesting sites during breeding season, which causes egg and fledgling mortality and nest abandonment.

Solitary Sandpiper Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Through the agency review process of projects, identify opportunities to protect appropriate habitat.	5.3 Logging & Wood Harvesting	Logging near nesting areas can disturb nesting.

Black-backed Woodpecker Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Develop and distribute educational materials and best management practices when administering firewood permits, focused on discouraging cutting of burned, dead, and dying trees >9 inches DBH.	4.1 Roads & Railroads	Roads used to access forested areas can increase snag and snag recruit removal for use as firewood.
3.1 Outreach & Communications	Develop and distribute educational materials on the value of post-fire habitats and best management practices. When administering firewood permits, discourage cutting of burned, dead, and dying trees >9 inches DBH.	5.3 Logging & Wood Harvesting	Post-fire salvage logging removes nesting and forage trees. Timber harvest, including thinning, in mature and old-growth forests can disturb succession and the creation of future habitat following high-severity fire.
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards land managers about alternative options for pest and weed control in burned forests.	9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).
C. Enabling Conditions Actions			
9. Education & Training			
9.2 Training & Individual Capacity Development	Develop a document that provides best management practices for timber in post-fire habitat, with a focus on maintaining important patch sizes and habitat features for Species of Greatest Conservation Need	5.3 Logging & Wood Harvesting	Post-fire salvage logging removes nesting and forage trees. Timber harvest, including thinning, in mature and old-growth forests can disturb succession and the creation of future habitat following high-severity fire.

	dependent on burned forest. Facilitate communication on vegetation management between foresters and biologists by developing a document with common terms used in forest management and in descriptions of biological needs of forest-dependent Species of Greatest Conservation Need.		
10. Institutional Development			
10.3 Alliance & Partnership Development	Encourage landowners with forested areas on their properties to engage with DNRC's Forest Stewardship Program to responsibly manage their forests.	5.3 Logging & Wood Harvesting	Post-fire salvage logging removes nesting and forage trees. Timber harvest, including thinning, in mature and old-growth forests can disturb succession and the creation of future habitat following high-severity fire.

Boreal Chickadee Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners and land managers about alternative options for pest and weed control (e.g., native predators, regenerative grazing, biocontrol, mechanical removal) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).
4. Law Enforcement & Prosecution			

4.1 Detection & Arrest	Strengthen and promote enforcement of county and state laws protecting streamsid es to combat removal of important nest trees in floodplains.	5.3 Logging & Wood Harvesting	Forest management practices that remove snags and injured or dying trees reduce or eliminate nest trees at the stand scale. Timber harvest of mature and old-growth forests reduces or eliminates this species' habitat at the landscape scale.
C. Enabling Conditions Actions			
9. Education & Training			
9.2 Training & Individual Capacity Development	Develop a document of best management practices for timber in mature and old-growth stands, with a focus on maintaining important patch sizes and habitat features for Species of Greatest Conservation Need dependent on old-growth stands. Facilitate communication on vegetation management between foresters and biologists by developing a document with common terms used in forest management and in descriptions of biological needs of forest-dependent Species of Greatest Conservation Need.	5.3 Logging & Wood Harvesting	Forest management practices that remove snags and injured or dying trees reduce or eliminate nest trees at the stand scale. Timber harvest of mature and old-growth forests reduces or eliminates this species' habitat at the landscape scale.
10. Institutional Development			
10.3 Alliance & Partnership Development	Encourage landowners with forested areas on their properties to engage with DNRC's Forest Stewardship Program to responsibly manage their forests.	11.1 Ecosystem Encroachment	Widespread stream degradation and lack of fire-related disturbance leads to encroachment of conifers into floodplain portions of valley bottoms, potentially reducing important nest trees through over-crowding (e.g., aspen, birch, cottonwood).
		5.3 Logging & Wood Harvesting	Forest management practices that remove snags and injured or dying trees reduce or eliminate nest trees at the stand scale. Timber harvest of mature and old-growth forests reduces or eliminates this species' habitat at the landscape scale.

		9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).

Brown Creeper Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct education and outreach campaigns about the importance of dead and dying trees and tree components in more urban areas. Seek opportunities to retain large-diameter snags and downed wood in urban areas, and use those trees as educational opportunities (e.g., signage, field trips).	7.3 Other Ecosystem Modifications	Removal of downed woody debris, snags, and injured or dying trees from parks, residential areas, and along streams and rivers removes important wintering habitat for Brown Creepers.
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners and land managers about alternative options for pest and weed control (e.g., native predators, regenerative grazing, biocontrol, mechanical removal) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Strengthen and promote enforcement of county and state laws protecting streamsid es to combat removal of important nest trees in floodplains.	5.3 Logging & Wood Harvesting	Timber harvest removes large trees, injured and dying trees, and snags in otherwise suitable forests at the stand scale. Timber harvest reduces the size of forest patches with appropriate habitat components (i.e., large living and dead

			trees and coarse woody debris) suitable for breeding at the landscape scale.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Work with city and county governments to change policies around dead and dying tree removal in parks and other urban areas important for wildlife.	7.3 Other Ecosystem Modifications	Removal of downed woody debris, snags, and injured or dying trees from parks, residential areas, and along streams and rivers removes important wintering habitat for Brown Creepers.
9. Education & Training			
9.2 Training & Individual Capacity Development	Develop a document of best management practices for timber in mature and old-growth stands, with a focus on maintaining important patch sizes and habitat features for Species of Greatest Conservation Need dependent on old-growth stands. To facilitate communication on vegetation management between foresters and biologists, develop a document with common terms used in forest management and in descriptions of biological needs of forest-dependent Species of Greatest Conservation Need.	5.3 Logging & Wood Harvesting	Timber harvest removes large trees, injured and dying trees, and snags in otherwise suitable forests at the stand scale. Timber harvest reduces the size of forest patches with appropriate habitat components (i.e., large living and dead trees and coarse woody debris) suitable for breeding at the landscape scale.
10. Institutional Development			
10.3 Alliance & Partnership Development	Encourage landowners with forested areas on their properties to engage with DNRC's Forest Stewardship Program to responsibly manage their forests.	11.1 Ecosystem Encroachment	Widespread stream degradation and lack of fire-related disturbance leads to encroachment of conifers into floodplain portions of valley bottoms, potentially reducing important nest trees (e.g., aspen, birch, cottonwood, mature and old-growth stands).
		5.3 Logging & Wood Harvesting	Timber harvest removes large trees, injured and dying trees, and snags in otherwise suitable forests at the stand scale. Timber harvest reduces the size of forest patches with appropriate habitat components (i.e., large living and dead

			trees and coarse woody debris) suitable for breeding at the landscape scale.
		7.1 Fire & Fire Suppression	Lack of fire-related disturbance leads to severe wildfires that reduce or eliminate mature and old-growth forest stands in some forest types. Lack of historical fire-induced disturbance regimes due to fire suppression leads to overly dense stands with relatively low amounts of large trees, snags, and large downed woody debris.
		9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).

Cassin's Finch Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct targeted outreach addressing the impacts of domestic cats on wildlife populations.	8.1 Invasive Non-Native/Alien Plants & Animals	Predation by domestic and feral cats.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Consider seasonality of harvest or clearcutting operations to avoid disturbance during breeding season.	5.3 Logging & Wood Harvesting	Clearcutting removes habitat.

Clark's Nutcracker Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.2 Species Re-Introduction & Translocation	Use nursery-raised Whitebark Pine stock resistant to White Pine Blister Rust for transplant to suitable habitats.	8.4 Pathogens & Microbes	Highly pathogenic avian influenza may have localized impacts. Large scale habitat loss and degradation of Whitebark Pine due to Whitebark Pine blister rust.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Disseminate Whitebark Pine research to agencies and committees within USFS, grizzly bear conservation, forest health, and Whitebark Pine conservation to help review and redesign Whitebark Pine and/or grizzly management plans.	7.1 Fire & Fire Suppression	Fire suppression leads to high intensity fires, which impacts Whitebark Pine with compounding effects from the loss of mature trees from beetle kill. Large replacement fires cause widespread mortality of all Whitebark Pine. Post-fire regeneration may be reduced due to a large proportion of cone-bearing trees having been previously killed, reducing available seed source/cone production. Altered fire regimes lead to Subalpine Fir/Lodgepole Pine encroachment and competition for resources.
		8.4 Pathogens & Microbes	Highly pathogenic avian influenza may have localized impacts. Large scale habitat loss and degradation of Whitebark Pine due to Whitebark Pine blister rust.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Work with the USFS to develop best management practices that allow using	7.1 Fire & Fire Suppression	Fire suppression leads to high intensity fires, which impacts Whitebark Pine with compounding effects from the loss of mature trees from beetle kill. Large replacement fires cause

	prescribed fire as a tool where appropriate, to maintain healthy Whitebark Pine stands.		widespread mortality of all Whitebark Pine. Post-fire regeneration may be reduced due to a large proportion of cone-bearing trees having been previously killed, reducing available seed source/cone production. Altered fire regimes lead to Subalpine Fir/Lodgepole Pine encroachment and competition for resources.
10. Institutional Development			
10.3 Alliance & Partnership Development	Convene local Forest Service working groups to share concerns for disturbance to Whitebark Pine if mining and quarrying activity are located within this forest type, and develop and support an agreed upon set of best management practices.	3.2 Mining & Quarrying	Mining or quarrying activity located within Whitebark Pine stands could cause loss of trees or entire stands through direct removal or damage.
10.3 Alliance & Partnership Development	Convene meetings with local stakeholders, U.S. Forest Service, watershed organizations, and agency personnel to educate on forestry practices important to minimize the impacts of Mountain Pine Beetle to Whitebark Pine conservation.	7.1 Fire & Fire Suppression	Fire suppression leads to high intensity fires, which impacts Whitebark Pine with compounding effects from the loss of mature trees from beetle kill. Large replacement fires cause widespread mortality of all Whitebark Pine. Post-fire regeneration may be reduced due to a large proportion of cone-bearing trees having been previously killed, reducing available seed source/cone production. Altered fire regimes lead to Subalpine Fir/Lodgepole Pine encroachment and competition for resources.
		8.2 Problematic Native Plants & Animals	Mountain Pine Beetle kills lead to large scale habitat loss and degradation of Whitebark Pine. Historic logging practices (i.e., large clearcuts in lodgepole forests) have led to overstocked even-aged stands of suitable DBH that combined with environmental conditions (i.e., drought, lack of sufficiently low winter temperatures) have led and continue to lead to Mountain Pine Beetle infestations that spread to adjacent Whitebark Pine stands. Predation by raptors (e.g., Great Horned Owl, Swainson's Hawk, Red-tailed Hawk, Cooper's Hawk, Golden Eagle).

Evening Grosbeak Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct targeted outreach addressing the impacts of domestic cats on wildlife populations.	8.1 Invasive Non-Native/Alien Plants & Animals	Predation by domestic and feral cats.
3.1 Outreach & Communications	Conduct targeted outreach in forested developments about the impacts and risks of pathogens and pathogen spread facilitated by feeders on bird populations.	8.4 Pathogens & Microbes	Bacterial conjunctivitis, salmonellosis, and West Nile virus.
3.1 Outreach & Communications	Conduct targeted outreach in forested developments about the impacts of window collisions on bird populations and the importance of window markings near feeders, reducing vegetation near windows, and installing closely-spaced window decals or UV-reflecting windows.	1.1 Housing & Urban Areas	Vehicle and window collisions.

Golden Eagle Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat

A. Target Restoration/Stress Reduction Actions

1. Land/Water Protection

1.1 Site/Area Stewardship	Bury, burn, or dispose of chemically euthanized carcasses in a way that prevents scavenging. Use lead-free ammunition when euthanizing animals with firearms. Mitigate eagle depredation on lambs by using scarecrows, guard dogs, covering lambing pens, avoiding lambing on open range, and removing carcasses or moving them away from lambing pastures.	2.3 Livestock Farming & Ranching	Improper grazing can negatively impact habitat. Livestock related persecution. Poisoning by livestock euthanasia drugs, predator/rodent poison, or lead from rodent shooting.
1.1 Site/Area Stewardship	Cover oil pits to eliminate drowning risk. Follow the BLM standard stipulations for oil and gas development -- no surface occupancy or use allowed within 0.5 miles of Golden Eagle nests known to have been occupied at least once within the 7 previous years.	3.1 Oil & Gas Drilling	Oil and gas extraction negatively impacts golden eagles both directly and indirectly through avoidance of infrastructure, reducing area for available hunting.
1.1 Site/Area Stewardship	Easily and effectively mitigate vehicle strikes with roadkill carcass removal programs. Focus mitigation efforts in winter, along roads with infrequent carcass pickup, high eagle volume, higher vehicle volume (but not as high as major interstates), and high roadkill volume.	4.1 Roads & Railroads	Vehicle strikes, particularly when feeding on roadkill.
1.1 Site/Area Stewardship	Limit anthropogenic mosquito habitat near known nests.	8.4 Pathogens & Microbes	West Nile virus and highly pathogenic avian influenza (HPAI) can result in mortality.

B. Behavioral Change/Threat Reduction

3. Awareness Raising

3.1 Outreach & Communications	Collaborate with agencies, sportsman groups, and wildlife conservation groups to educate hunters on the impacts of lead on wildlife to promote a voluntary shift to non-lead ammunition. Model approaches from other states' agencies (e.g., Colorado Parks and Wildlife). Support trapper education and maintain good relationships with trappers to encourage reporting of incidental eagle by-catch.	5.1 Hunting & Collecting Terrestrial Animals	Illegal killing of eagles for sport or black market trade in parts. Lead poisoning from scavenging carcasses left by legal hunting, animal disposition, and varmint control with lead ammunition. Incidental capture in snares or traps leading to death or injury.
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Continue to investigate and enforce laws prohibiting unsanctioned killing or sale of Golden Eagle parts. Support and promote disposition of all eagles to the National Eagle repository and support expedited distribution of feathers to tribal members.	5.1 Hunting & Collecting Terrestrial Animals	Illegal killing of eagles for sport or black market trade in parts. Lead poisoning from scavenging carcasses left by legal hunting, animal disposition, and varmint control with lead ammunition. Incidental capture in snares or traps leading to death or injury.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Emphasize proper project siting and creation of new decision support tools for planning siting. Employ operational mitigation strategies for existing wind farms, including shutting down turbines when eagles are present, and removing attractants.	3.3 Renewable Energy	Wind farms are a direct cause of mortality to all life stages of residents and migrants due to collisions with turbines. They also fragment and eliminate habitat. Construction ground disturbance can lead prey populations to expand and attract eagles into dangerous areas. Increased roadways and traffic in and around installations can increase roadkill.
5.2 Better Products & Management Practices	Encourage application of buffers around Golden Eagle nest sites susceptible to disturbance from recreation or other activities during the breeding season.	6.3 Work & Other Activities	Anthropogenic activities near nest sites can be disruptive to breeding.
5.4 Direct Economic Incentives	Develop programs to gift or trade non-lead hunting ammunition to reduce the amount of lead in carcasses. Provide landowners and	5.1 Hunting & Collecting Terrestrial Animals	Illegal killing of eagles for sport or black market trade in parts. Lead poisoning from scavenging carcasses left by legal hunting, animal disposition, and varmint control with lead

	guides with financial incentives to require clients/access hunters to use lead-free ammunition.		ammunition. Incidental capture in snares or traps leading to death or injury.
5.5 Non-Monetary Values	Convey the link between lead poisoning in scavengers and health impacts in humans eating game shot with lead ammunition. Promote the conservation ethics and leave-no-trace principles of lead-free hunting.	5.1 Hunting & Collecting Terrestrial Animals	Illegal killing of eagles for sport or black market trade in parts. Lead poisoning from scavenging carcasses left by legal hunting, animal disposition, and varmint control with lead ammunition. Incidental capture in snares or traps leading to death or injury.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Place high importance on Phase 1 siting, because once turbines are established in problematic locations, mitigation is difficult. Do not locate new wind farms in high-risk areas with known or predicted high eagle use or known nesting activity. Use existing habitat models to assist with planning wind farm locations. Develop Montana-specific geospatial eagle risk assessment planning tools.	3.3 Renewable Energy	Wind farms are a direct cause of mortality to all life stages of residents and migrants due to collisions with turbines. They also fragment and eliminate habitat. Construction ground disturbance can lead prey populations to expand and attract eagles into dangerous areas. Increased roadways and traffic in and around installations can increase roadkill.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Discourage use of rodenticide and predator poisoning everywhere, especially in prime eagle habitat, and do not use on conservation properties, including FWP property.	2.3 Livestock Farming & Ranching	Improper grazing can negatively impact habitat. Livestock related persecution. Poisoning by livestock euthanasia drugs, predator/rodent poison, or lead from rodent shooting.
7.1 Laws, Regulations & Codes	Encourage the use of non-lead ammunition on conservation-oriented properties, such as Wildlife Management Areas and Refuges. Have local, states and federal employees (FWP, USFWS, law enforcement) use lead-free ammunition when dispatching wounded	5.1 Hunting & Collecting Terrestrial Animals	Illegal killing of eagles for sport or black market trade in parts. Lead poisoning from scavenging carcasses left by legal hunting, animal disposition, and varmint control with lead ammunition. Incidental capture in snares or traps leading to death or injury.

	animals, or bury animals dispatched with lead ammunition.		

Great Blue Heron Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct outreach to landowners with active breeding colonies to ensure they are aware of the colony and to encourage appreciation for the species.	2.1 Annual & Perennial Non-Timber Crops	Removal of riparian forest along rivers for row crop agriculture or hay production.
3.1 Outreach & Communications	Conduct targeted outreach to homeowners that live near suitable breeding habitat or active rookeries on how to minimize disturbance.	1.1 Housing & Urban Areas	Housing and subdivision development along major rivers could eliminate large cottonwoods or disturb heron rookeries.
3.1 Outreach & Communications	Post notices at fishing access sites with active colonies. Conduct outreach to boaters, fisherpersons, and other river recreationists on how to avoid disturbing birds at rookeries, to help prevent flushing adults when Bald Eagles may depredate nests.	8.2 Problematic Native Plants & Animals	Increasing Bald Eagle populations in turn increases depredation of heron nests.
3.1 Outreach & Communications	Post notices at fishing access sites with active colonies. Conduct outreach to boaters, fisherpersons, and other river recreationists on how to avoid disturbing birds at rookeries.	6.1 Recreational Activities	River recreationists may disturb rookeries and increase potential for nest abandonment or nest predation by Bald Eagles if adults flush.

5. Livelihood Economic & Moral Incentives			
5.3 Market-Based Incentives	Work with landowners on grazing management plans. Enroll willing landowners in grazing programs such as Audubon's Conservation Ranching Program.	2.3 Livestock Farming & Ranching	Overgrazing by cattle can degrade riparian habitat, limit recruitment of new cottonwood trees and other vegetation.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.3 Land/Water Use Zoning & Designation	Develop a map that identifies large, longer-term, and/or stable breeding colonies and highly suitable habitat where development should be avoided. Consider making the layer available in the Montana Natural Heritage Program Ecological Site Reviewer tool.	1.1 Housing & Urban Areas	Housing and subdivision development along major rivers could eliminate large cottonwoods or disturb heron rookeries.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Draft laws or regulations to regulate urban development along rivers, so that flood regimes could be restored without risking damage to houses and other infrastructure. E.g., codify riparian setbacks.	7.2 Dams & Water Management / Use	Ongoing impacts of dams on cottonwood recruitment and general riparian forest health leading to a loss of these forests.
7.1 Laws, Regulations & Codes	Update or create recommendations for housing developers on how to minimize impacts to the species (e.g., riparian setbacks).	1.1 Housing & Urban Areas	Housing and subdivision development along major rivers could eliminate large cottonwoods or disturb heron rookeries.
7.2 Policies & Guidelines	Promote open communication with airports and hatcheries, and work collaboratively on solutions (e.g., habitat modification at airports, hazing, covering raceways at hatcheries, laser deterrent systems).	5.1 Hunting & Collecting Terrestrial Animals	Legal, permitted take at airports and fish hatcheries is a source of direct mortality.
7.2 Policies & Guidelines	Update or create recommendations for industry and agencies that manage river flow	7.2 Dams & Water Management / Use	Ongoing impacts of dams on cottonwood recruitment and general riparian forest health leading to a loss of these forests.

	on how to enhance or maintain riparian habitat.		
10. Institutional Development			
10.3 Alliance & Partnership Development	Serve on boards or working groups, or form partnership alliances (e.g., river conservation district councils, watershed councils) that seek to improve water management, restore riparian habitat, and promote natural hydrologic flow regimes.	7.2 Dams & Water Management / Use	Ongoing impacts of dams on cottonwood recruitment and general riparian forest health leading to a loss of these forests.

Northern Hawk Owl Threats and Conservation Actions

Threats and actions for Northern Hawk Owl will be included in the final version of the 2025 SWAP.

Pacific Wren Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners and land managers about alternative options for pest and weed control (e.g., native predators, regenerative grazing, biocontrol, mechanical removal) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).
4. Law Enforcement & Prosecution			

4.1 Detection & Arrest	Strengthen and promote enforcement of county and state laws protecting streambanks to combat removal of important nest trees, logs, and other features in floodplains and other wet areas.	5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests results in fragmentation of habitat patches. This is especially impactful along riparian areas where inadequate buffers result in habitat fragmentation and loss of nesting sites near streams. Timber harvest in mature and old-growth forests results in loss of critical habitat features such as snags, downed wood, upturned root masses, and injured or dying trees, especially large-diameter sizes of these habitat features.
C. Enabling Conditions Actions			
9. Education & Training			
9.2 Training & Individual Capacity Development	Develop a document of best management practices for timber in mature and old-growth stands, with a focus on maintaining important patch sizes and habitat features for Species of Greatest Conservation Need dependent on old-growth stands. To facilitate communication on vegetation management between foresters and biologists, develop a document with common terms used in forest management and in descriptions of biological needs of forest-dependent Species of Greatest Conservation Need.	5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests results in fragmentation of habitat patches. This is especially impactful along riparian areas where inadequate buffers result in habitat fragmentation and loss of nesting sites near streams. Timber harvest in mature and old-growth forests results in loss of critical habitat features such as snags, downed wood, upturned root masses, and injured or dying trees, especially large-diameter sizes of these habitat features.
10. Institutional Development			
10.3 Alliance & Partnership Development	Encourage landowners with forested areas on their properties to engage with DNRC's Forest Stewardship Program to responsibly manage their forests.	5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests results in fragmentation of habitat patches. This is especially impactful along riparian areas where inadequate buffers result in habitat fragmentation and loss of nesting sites near streams. Timber harvest in mature and old-growth forests results in loss of critical habitat features such as snags, downed wood, upturned root masses, and injured or dying trees, especially large-diameter sizes of these habitat features.

		7.1 Fire & Fire Suppression	Lack of fire-related disturbance exacerbates the effects of abnormally severe fires by leaving valley-bottom forests vulnerable to fires outside the normal range of variation for the forest type. Severe fires (and fires that replace stands in nesting habitat with uncharacteristic forest types) result in loss of mature and old growth forests and associated important habitat features (snags, large woody debris, root masses, and injured or dying trees).
		7.3 Other Ecosystem Modifications	Lack of floodplain connection across large swaths of forested streams results in drying out of floodplains, which may allow fires to burn at high intensity in valley bottoms and through riparian areas. Causes of stream degradation include historical logging practices that have resulted in fewer older trees available to fall into stream channels, purposeful stream channel manipulation (e.g., ditching, re-routing), and loss of beavers from areas of their historical range.
		9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).

Pileated Woodpecker Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Avoid or minimize development around potential breeding sites, or maintain vegetated buffers between developed areas and potential breeding sites.	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead,

			and dying large-diameter trees on private properties in river bottoms and forested areas removes important nest trees and foraging resources.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Develop and distribute educational materials and best management practices when administering firewood permits, focused on discouraging cutting of trees >15 inches DBH and avoiding Western Larch, Black Cottonwood, and Ponderosa Pine.	5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests can remove large-diameter trees and canopy closure needed for nesting, and snags and downed woody debris needed for foraging. Timber harvest may result in patches that are too small to function as nesting territories.
		7.1 Fire & Fire Suppression	Lack of fire-related disturbance exacerbates the effects of abnormally severe fires by leaving valley-bottom forests vulnerable to fires outside the normal range of variation for the forest type. Lack of fire-related disturbance reduces or eliminates fire-hardened snags that last much longer on the landscape. Severe fires (and fires that replace stands in nesting habitat with uncharacteristic forest types) result in loss of mature and old growth forests and associated important habitat features (snags, large woody debris, root masses, and injured or dying trees).
3.1 Outreach & Communications	Develop and distribute educational materials to livestock producers in forested areas and river bottoms with large-diameter trees, about the importance of those trees to nesting and foraging woodpeckers and other species.	2.3 Livestock Farming & Ranching	Overgrazing of riparian areas can limit establishment and growth of cottonwood trees used for nesting and foraging. Removal of injured, dead, and dying large-diameter trees on private properties to maintain open rangelands removes important nesting and foraging trees.
3.1 Outreach & Communications	Develop and distribute educational materials to new and existing landowners in forested areas and river bottoms with large-diameter trees, about the importance of those trees to	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees on private properties in river

	nesting and foraging woodpeckers and other species.		bottoms and forested areas removes important nest trees and foraging resources.
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners and land managers about alternative options for pest and weed control (e.g., native predators, regenerative grazing, biocontrol, mechanical removal) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Strengthen and promote enforcement of state and county laws and regulations around removal and manipulation of riparian vegetation in floodplains by private landowners, and encourage reporting and remedy of violations.	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees on private properties in river bottoms and forested areas removes important nest trees and foraging resources.
4.1 Detection & Arrest	Strengthen and promote enforcement of state and county laws and regulations around removal and manipulation of riparian vegetation in floodplains.	2.3 Livestock Farming & Ranching	Overgrazing of riparian areas can limit establishment and growth of cottonwood trees used for nesting and foraging. Removal of injured, dead, and dying large-diameter trees on private properties to maintain open rangelands removes important nesting and foraging trees.
		4.1 Roads & Railroads	Roads used to access forested areas can increase snag and snag recruit removal for use as firewood. Roads, railroads, and other transportation infrastructure running along or through floodplains constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests.
5. Livelihood Economic & Moral Incentives			
5.5 Non-Monetary Values	Conduct education and outreach using various forms of media on Pileated	12.1 Other	Land managers, landowners, and the general public who are not aware of the role of Pileated Woodpeckers as a keystone

	Woodpeckers as a keystone species in Montana.		species. Little is known about the differences in habitat preferences and use between conifer and cottonwood forests for Pileated Woodpeckers.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Prohibit cutting of any live, dead, or dying trees >20 inches DBH for firewood.	5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests can remove large-diameter trees and canopy closure needed for nesting, and snags and downed woody debris needed for foraging. Timber harvest may result in patches that are too small to function as nesting territories.
		7.1 Fire & Fire Suppression	Lack of fire-related disturbance exacerbates the effects of abnormally severe fires by leaving valley-bottom forests vulnerable to fires outside the normal range of variation for the forest type. Lack of fire-related disturbance reduces or eliminates fire-hardened snags that last much longer on the landscape. Severe fires (and fires that replace stands in nesting habitat with uncharacteristic forest types) result in loss of mature and old growth forests and associated important habitat features (snags, large woody debris, root masses, and injured or dying trees).
7.1 Laws, Regulations & Codes	Promote increasing fines for violations of streamside protection laws so that fines do not become a 'fee' for vegetation removal/disturbance.	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees on private properties in river bottoms and forested areas removes important nest trees and foraging resources.
		2.3 Livestock Farming & Ranching	Overgrazing of riparian areas can limit establishment and growth of cottonwood trees used for nesting and foraging. Removal of injured, dead, and dying large-diameter trees on

			private properties to maintain open rangelands removes important nesting and foraging trees.
9. Education & Training			
9.2 Training & Individual Capacity Development	Develop a document of best management practices for timber in mature and old-growth stands, with a focus on maintaining important patch sizes and habitat features for Species of Greatest Conservation Need dependent on old-growth stands. To facilitate communication on vegetation management between foresters and biologists, develop a document with common terms used in forest management and in descriptions of biological needs of forest-dependent Species of Greatest Conservation Need.	5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests can remove large-diameter trees and canopy closure needed for nesting, and snags and downed woody debris needed for foraging. Timber harvest may result in patches that are too small to function as nesting territories.
		7.1 Fire & Fire Suppression	Lack of fire-related disturbance exacerbates the effects of abnormally severe fires by leaving valley-bottom forests vulnerable to fires outside the normal range of variation for the forest type. Lack of fire-related disturbance reduces or eliminates fire-hardened snags that last much longer on the landscape. Severe fires (and fires that replace stands in nesting habitat with uncharacteristic forest types) result in loss of mature and old growth forests and associated important habitat features (snags, large woody debris, root masses, and injured or dying trees).
10. Institutional Development			
10.3 Alliance & Partnership Development	Encourage landowners with forested areas on their properties to engage with DNRC's Forest Stewardship Program to responsibly manage their forests.	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees on private properties in river bottoms and forested areas removes important nest trees and foraging resources.
		5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests can remove large-diameter trees and canopy closure needed for nesting, and snags and downed woody debris needed for foraging. Timber harvest may result in patches that are too small to function as nesting territories.

Pinyon Jay Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Increase Limber Pine population size and maintain Limber Pine genetic diversity.	8.4 Pathogens & Microbes	West Nile virus, avian malaria, and other diseases. White Pine Blister Rust (<i>Cronartium ribicola</i>) destruction of Limber Pine.
1.1 Site/Area Stewardship	Remove infected stands and replace with mistletoe-free regeneration.	8.2 Problematic Native Plants & Animals	Dwarf-mistletoe. Nest predation by Common Ravens.
1.1 Site/Area Stewardship	When removing juniper trees to accomplish other management priorities, consider their importance for the conservation of Pinyon Jays. Consider buffering treatments from nesting habitat (~500 m of undisturbed habitat).	2.3 Livestock Farming & Ranching	Range improvement operations conducted in response to juniper encroachment.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Develop and revise management plans on public lands in core habitat areas where recreation may conflict with nesting habitat.	6.1 Recreational Activities	Increased motorized and OHV trail use may disturb or destroy habitat in core habitat areas.

Trumpeter Swan Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Remove perching posts in areas with high avian predator populations.	8.2 Problematic Native Plants & Animals	Invasion by aquatic invasive species. Predation of adults by mammalian predators such as foxes and coyotes, and nest predation by skunks and raccoons. Predation by avian predators (e.e., Bald Eagle).
1.2 Ecosystem & Natural Process (Re)Creation	Maintain and improve the quantity and quality of breeding, wintering, and stopover habitats. Implement wetland development, restoration, enhancement, and conservation projects for the Rocky Mountain Population of Trumpeter Swans, with emphasis on developing additional high-quality breeding and summer habitats.	1.1 Housing & Urban Areas	The rapid increase in human population and development leads to a loss of nesting and wintering habitats, including wetlands. Loss of wetlands results in loss of connectivity and staging areas.
		2.3 Livestock Farming & Ranching	Land conversion of wetlands to agriculture can lead to insufficient quality nesting habitat and loss of wintering habitat.
2. Species Management			
2.1 Species Stewardship	Consider placement of artificial nesting platforms in areas of high mammalian predator populations.	8.2 Problematic Native Plants & Animals	Invasion by aquatic invasive species. Predation of adults by mammalian predators such as foxes and coyotes, and nest predation by skunks and raccoons. Predation by avian predators (e.e., Bald Eagle).
2.1 Species Stewardship	Consider use of non-toxic fishing tackle where there is potential for swans to ingest tackle lost by anglers.	1.3 Tourism & Recreation	Lead poisoning.
2.1 Species Stewardship	Consider using non-toxic fishing tackle. Re-route or apply seasonal closures of trails around critical habitat or nesting areas during sensitive times (nesting and fledging periods). Buffer occupied or potential nesting	6.1 Recreational Activities	Illegal shooting/poaching. Increased human disturbance and recreation activities, including trails, river use, recreational fishing, and motorized and non-motorized recreation (boating).

	sites using buoys to prevent encroachment from boaters.		
2.1 Species Stewardship	Cull non-native competitors.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition from invasive Mute Swans.
2.1 Species Stewardship	Establish partnerships with power companies to implement powerline mitigation initiatives at key sites to reduce swan mortality, including burying or marking sections of powerlines that are in vulnerable flight paths.	4.2 Utility & Service Lines	Collisions with powerlines.
2.1 Species Stewardship	Manage state hunting season to ensure Trumpeter Swan conservation is considered, to maintain compatibility with Tundra Swan hunting in the Pacific Flyway. Modify seasons temporally or spatially (i.e., use later start dates or establish area closures) to reduce the take of Trumpeter Swans.	5.1 Hunting & Collecting Terrestrial Animals	General swan hunting season.
2.1 Species Stewardship	Work with local ranches and private landowners to remove or relocate fences, particularly in areas with high frequency of bird passage and/or during the fall when cygnets are starting to fly. Visibly mark fences (top wires) with flagging or sections of 2-inch PVC pipe.	2.3 Livestock Farming & Ranching	Collisions with fences. Water use, diversion, or management can reduce water level and water quality in wetlands and affect food sources, availability of open water on the winter range, availability of food in the spring, and water levels in nesting habitat. Channelization and trenching of irrigation ditches (straightening) can make swans more vulnerable to predation. Water use, diversion, or management can result in reduction of water or complete dewatering of wetland habitats used by Trumpeter Swans.
2.1 Species Stewardship	Work with wildlife rehabilitators to salvage eggs from potentially flooded nests, and incubate and reintroduce fledglings back to the site.	11.3 Changes in Temperature Regimes	Warmer water temperatures enable invasive plants to outcompete native aquatic food sources. Expansion of emergent sedge habitats results in loss of open water habitat. Changes in winter severity, deeper snow, freeze-thaw cycles,

			or rain on snow can create ice crusting and temporary loss of habitat or loss of winter food sources.
		11.5 Severe/Extreme Weather Events	Excessive spring flooding can result in flooded nests. Spring hail can or excessive spring precipitation can impact nesting success, eggs, and nestling survival. Expansion of emergent sedge habitats can lead to loss of open water habitat.
2.2 Species Re-Introduction & Translocation	Develop a banding program for the Rocky Mountain Population of Trumpeter Swans. Maintain a resight database to help assess management programs. Develop spatial models to identify wetlands used as stopover and release sites. Fit released and wild swans with tracking devices to evaluate survival and habitat use. Identify potential restoration areas to expand breeding and wintering habitats.	1.1 Housing & Urban Areas	The rapid increase in human population and development leads to a loss of nesting and wintering habitats, including wetlands. Loss of wetlands results in loss of connectivity and staging areas.
		2.3 Livestock Farming & Ranching	Land conversion of wetlands to agriculture can lead to insufficient quality nesting habitat and loss of wintering habitat.
2.2 Species Re-Introduction & Translocation	Through state wildlife agencies, continue to support effective management of furbearers, predators, and non-game wildlife to ensure predator-prey balance.	8.2 Problematic Native Plants & Animals	Invasion by aquatic invasive species. Predation of adults by mammalian predators such as foxes and coyotes, and nest predation by skunks and raccoons. Predation by avian predators (e.e., Bald Eagle).
2.3 Ex-Situ Conservation	Rehabilitate injured swans off-site. Work with non-profit waterfowl rehabilitators to house rehabilitated birds and integrate Trumpeter Swans into their breeding program.	2.3 Livestock Farming & Ranching	Collisions with fences. Water use, diversion, or management can reduce water level and water quality in wetlands and affect food sources, availability of open water on the winter range, availability of food in the spring, and water levels in nesting habitat. Channelization and trenching of irrigation ditches (straightening) can make swans more vulnerable to predation. Water use, diversion, or management can result in reduction of water or complete dewatering of wetland habitats used by Trumpeter Swans.
		4.1 Roads & Railroads	Collisions with vehicles.
		4.2 Utility & Service Lines	Collisions with powerlines.

B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Pursue education opportunities for hunters through interpretive signs to discourage the take of Trumpeter Swans. Develop an online swan identification program educating hunters on the differences between Trumpeter and Tundra Swans.	5.1 Hunting & Collecting Terrestrial Animals	General swan hunting season.
3.1 Outreach & Communications	Raise awareness about the risks associated with using lead ammunition for target practice near waterways (e.g., private ponds, rivers). Create educational exhibits or pamphlets about the risks of lead tackle ingestion to waterfowl.	1.3 Tourism & Recreation	Lead poisoning.
3.1 Outreach & Communications	Raise awareness about the risks associated with using lead ammunition for target practice near waterways (e.g., private ponds, rivers). Create educational exhibits or pamphlets about the risks of lead tackle ingestion to waterfowl. Place educational signs around critical habitat and nesting areas.	6.1 Recreational Activities	Illegal shooting/poaching. Increased human disturbance and recreation activities, including trails, river use, recreational fishing, and motorized and non-motorized recreation (boating).
4. Law Enforcement & Prosecution			
4.2 Criminal Prosecution & Conviction	Ensure appropriate application of sanctions for violations of existing laws and policies.	6.1 Recreational Activities	Illegal shooting/poaching. Increased human disturbance and recreation activities, including trails, river use, recreational fishing, and motorized and non-motorized recreation (boating).
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			

6.4 Conservation Planning	Form partnerships through federal, state/provincial, and non-governmental organizations to prioritize conservation actions and revise the 2017 Pacific Flyway Rocky Mountain Trumpeter Swan Plan.	7.4 Removing / Reducing Human Maintenance	Reduced USFWS/Refuge funds results in the loss of human resources or funds to manage refuge system wetlands. Changes in water level management can result in reductions of water or complete dewatering of wetlands used by Trumpeter Swans. Expansion of emergent sedge habitats results in loss of open water habitat. Decreasing wetland connectivity results in habitat loss.
6.4 Conservation Planning	Form partnerships through federal, state/provincial, and non-governmental organizations to prioritize conservation actions.	5.3 Logging & Wood Harvesting	Current management of the boreal forest and associated activities may result in wetland loss, wetland degradation, or overall changes in the hydrology of the boreal forest.
6.4 Conservation Planning	Form partnerships with federal, state/provincial, and non-governmental organizations to prioritize conservation actions.	3.1 Oil & Gas Drilling	Land use, development, and management are linked to conservation issues for the Rocky Mountain population of Trumpeter Swans across the Canadian breeding range (Alberta, British Columbia, Northwest Territories, and the Yukon), including large exploration and development projects, pipelines, forestry practices, and road expansion, but data are lacking on the impacts of these activities.
		4.1 Roads & Railroads	Collisions with vehicles.
9. Education & Training			
9.2 Training & Individual Capacity Development	Work with landowners to remove concentrations of moldy crops to reduce the risk of aspergillosis.	8.4 Pathogens & Microbes	Cygnets parasites. Highly pathogenic avian influenza (HPAI). Aspergillosis (fungal disease from moldy crops).
10. Institutional Development			
10.3 Alliance & Partnership Development	Partner with local land trusts to protect river corridors and nesting habitat through acquisition of conservation easements. Through government agencies, work with land trusts to secure funding to expand protection of important wintering and transitional habitats. Partner with NGOs and	7.4 Removing / Reducing Human Maintenance	Reduced USFWS/Refuge funds results in the loss of human resources or funds to manage refuge system wetlands. Changes in water level management can result in reductions of water or complete dewatering of wetlands used by Trumpeter Swans. Expansion of emergent sedge habitats results in loss of open water habitat. Decreasing wetland connectivity results in habitat loss.

	the private sector to protect, enhance, and increase summer and wintering areas.		
10.3 Alliance & Partnership Development	Partner with local land trusts to protect river corridors and nesting habitat through acquisition of conservation easements. Through government agencies, work with land trusts to secure funding to expand protection of important wintering and transitional habitats. Partner with NGOs and the private sector to protect, enhance, and increase summer and wintering areas. Convene meetings with local stakeholders.	1.1 Housing & Urban Areas	The rapid increase in human population and development leads to a loss of nesting and wintering habitats, including wetlands. Loss of wetlands results in loss of connectivity and staging areas.
		2.3 Livestock Farming & Ranching	Land conversion of wetlands to agriculture can lead to insufficient quality nesting habitat and loss of wintering habitat.
10.4 Financing Conservation	Seek funds to address priority research and information needs, as well as habitat improvement and range expansion efforts. Engage local land trusts, and conservation groups.	1.1 Housing & Urban Areas	The rapid increase in human population and development leads to a loss of nesting and wintering habitats, including wetlands. Loss of wetlands results in loss of connectivity and staging areas.
10.4 Financing Conservation	Seek funds to address priority research needs, information needs, habitat improvement efforts, and range expansion efforts. Engage local land trusts and conservation groups.	2.3 Livestock Farming & Ranching	Land conversion of wetlands to agriculture can lead to insufficient quality nesting habitat and loss of wintering habitat.

White-tailed Ptarmigan Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			

6.4 Conservation Planning	If important breeding or wintering areas are identified, consider managing recreational use to decrease disturbance.	6.1 Recreational Activities	Disturbance from recreation during sensitive times of year.

Alder Flycatcher Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Control deer populations through managed hunting opportunities or culling in floodplain areas impacted by over-browsing.	8.2 Problematic Native Plants & Animals	High densities of White-tailed Deer and other ungulate browsers in floodplains reduce or eliminate understory and midstory shrubs that are important for this species.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Implement education and outreach campaigns about the importance of beavers to ecosystem services and natural stream processes and ways landowners and land managers can mitigate beaver conflicts.	11.4 Changes in Precipitation & Hydrological Regimes	Changes in the timing of spring runoff can cause flashier spring flooding, leading to more damaging flood flows over shorter time periods than historical conditions, leading to channel incision/overwidening and reduction of floodplain processes. Reduced snowpack and spring/summer precipitation leads to diminished flows, which lead to less water available within stream systems to cause erosion and deposition that leads to recruitment of woody riparian vegetation important for this species.
3.1 Outreach & Communications	Implement education and outreach campaigns in agricultural communities about state laws that protect streambanks and riparian habitat (SMZ Law and 310 Law), the	2.3 Livestock Farming & Ranching	Draining of wetlands to improve agricultural production removes or degrades habitat. Overgrazing of riparian areas causes geomorphic changes to the stream system, which degrades habitat in the long-term (e.g., stream incision or

	importance of beavers to streams and ecosystem services, techniques for mitigating beaver-human conflicts, and alternative pest and weed control options to reduce reliance on pesticides and herbicides (e.g., native predators, regenerative grazing, biocontrol, mechanical removal).		over-widening). Overgrazing of riparian areas degrades foraging and breeding habitat through loss of streamside vegetation in the short-term.
3.1 Outreach & Communications	Implement education and outreach campaigns in fire-prone communities about the importance of beavers to ecosystem services and fire mitigation.	7.1 Fire & Fire Suppression	Lack of fire-related disturbance in valley bottoms and around aspen stands results in shift away from woody riparian vegetation important for this species. Lack of floodplain connection and beaver activity leaves suitable floodplain areas vulnerable to negative impacts from severe wildfires. Severe wildfires outside the normal range of variation driven by long-term fire suppression and a drier climate directly destroy habitat in valley bottoms and along streams.
3.1 Outreach & Communications	Implement education and outreach campaigns to local, county, and state roads crews about the importance of beavers and about techniques for mitigating beaver-human conflicts. Implement education and outreach campaigns to water users about the importance of natural stream processes like channel migration.	7.3 Other Ecosystem Modifications	Loss of beavers from vast areas has reduced available habitat and maintained stream systems in a degraded state, with a loss or severe reduction of floodplain processes important for establishment and maintenance of streamside and floodplain shrub communities. Maintenance/protection of human infrastructure in floodplains can result in direct loss of streamside vegetation. The removal of beavers to prevent conflict with the maintenance of irrigation infrastructure decreases suitable habitat created and maintained by beavers. Rip-rapping and other bank-hardening measures diminish important processes for establishment and maintenance of woody riparian vegetation (e.g., lateral channel migration) and/or lead to stream channel degradation (e.g., channel incision or overwidening).
3.1 Outreach & Communications	Implement education and outreach campaigns to local, county, and state roads crews about the importance of beavers and	4.1 Roads & Railroads	Road construction and maintenance in floodplains degrades foraging and breeding habitat through geomorphic changes to stream systems in the long-term (e.g., incision, over-widening)

	techniques for mitigating beaver-human conflicts.		and through loss of vegetation in the short-term. The removal of beavers to prevent conflict with the maintenance of roads decreases suitable habitat created and maintained by beavers.
3.1 Outreach & Communications	Implement education and outreach campaigns to water users about the importance of beavers to ecosystem services and of natural stream processes like channel migration, and appropriate tools for mitigating beaver-human conflicts.	7.2 Dams & Water Management / Use	The removal of beavers to prevent conflict with the maintenance of irrigation infrastructure decreases suitable habitat created and maintained by beavers. Reduced stream flows from dams and/or irrigation withdrawals diminish important floodplain processes for establishment and maintenance of woody riparian vegetation (e.g., lateral channel migration).
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners and land managers about alternative options for pest and weed control (e.g., native predators, regenerative grazing, biocontrol, mechanical removal) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Strengthen and promote enforcement of state and county laws protecting streambanks, and encourage reporting and remedy of violations.	2.3 Livestock Farming & Ranching	Draining of wetlands to improve agricultural production removes or degrades habitat. Overgrazing of riparian areas causes geomorphic changes to the stream system, which degrades habitat in the long-term (e.g., stream incision or over-widening). Overgrazing of riparian areas degrades foraging and breeding habitat through loss of streamside vegetation in the short-term.
		4.1 Roads & Railroads	Road construction and maintenance in floodplains degrades foraging and breeding habitat through geomorphic changes to stream systems in the long-term (e.g., incision, over-widening) and through loss of vegetation in the short-term. The removal of beavers to prevent conflict with the maintenance of roads

			decreases suitable habitat created and maintained by beavers.
		7.3 Other Ecosystem Modifications	Loss of beavers from vast areas has reduced available habitat and maintained stream systems in a degraded state, with a loss or severe reduction of floodplain processes important for establishment and maintenance of streamside and floodplain shrub communities. Maintenance/protection of human infrastructure in floodplains can result in direct loss of streamside vegetation. The removal of beavers to prevent conflict with the maintenance of irrigation infrastructure decreases suitable habitat created and maintained by beavers. Rip-rapping and other bank-hardening measures diminish important processes for establishment and maintenance of woody riparian vegetation (e.g., lateral channel migration) and/or lead to stream channel degradation (e.g., channel incision or overwidening).
C. Enabling Conditions Actions			
10. Institutional Development			
10.3 Alliance & Partnership Development	Encourage landowners with forested areas on their properties to engage with DNRC's Forest Stewardship Program to responsibly manage their forests.	11.1 Ecosystem Encroachment	Widespread stream incision and over-widening results in shifts to upland vegetation communities in perched floodplains that diminish important processes for creating and maintaining streamside woody vegetation, out-compete woody riparian vegetation that can get established, and/or allow for disturbances to function outside of their normal range of variation in the floodplain (e.g., wildfires).
		7.1 Fire & Fire Suppression	Lack of fire-related disturbance in valley bottoms and around aspen stands results in shift away from woody riparian vegetation important for this species. Lack of floodplain connection and beaver activity leaves suitable floodplain areas vulnerable to negative impacts from severe wildfires. Severe wildfires outside the normal range of variation driven

			by long-term fire suppression and a drier climate directly destroy habitat in valley bottoms and along streams.
		7.3 Other Ecosystem Modifications	Loss of beavers from vast areas has reduced available habitat and maintained stream systems in a degraded state, with a loss or severe reduction of floodplain processes important for establishment and maintenance of streamside and floodplain shrub communities. Maintenance/protection of human infrastructure in floodplains can result in direct loss of streamside vegetation. The removal of beavers to prevent conflict with the maintenance of irrigation infrastructure decreases suitable habitat created and maintained by beavers. Rip-rapping and other bank-hardening measures diminish important processes for establishment and maintenance of woody riparian vegetation (e.g., lateral channel migration) and/or lead to stream channel degradation (e.g., channel incision or overwidening).
		9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).

American Bittern Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Restore wetlands in breeding and stopover sites, focusing on larger wetlands (>10 ha), which support large portions of regional nesting populations, but also including	7.3 Other Ecosystem Modifications	Wetland eutrophication and pollution degrades habitat and food resources.

	smaller wetlands (<5 ha), which may serve as important feeding sites and "stepping stones" during movements between larger wetlands but receive no legal protection in most states.		
B. Behavioral Change/Threat Reduction			
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	During FWP review of projects, recommend the maintenance of buffer zones to block siltation, pesticide, and fertilizer run-off.	7.3 Other Ecosystem Modifications	Wetland eutrophication and pollution degrades habitat and food resources.
4.3 Non-Criminal Legal Action	Through the agency review process of projects, identify opportunities to protect wetlands.	7.2 Dams & Water Management / Use	Altered hydrology through wetland drainage and wetland loss.

American White Pelican Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Restrict access to breeding sites and protect nesting islands.	6.3 Work & Other Activities	Human disturbance can disrupt breeding, especially early in breeding season.
1.1 Site/Area Stewardship	Through coordinated management of water levels, protect pelican nesting islands from low water levels that would allow access to predators.	7.2 Dams & Water Management / Use	Altered hydrology through dam operation activities impacts food availability and nesting habitat.

1.2 Ecosystem & Natural Process (Re)Creation	Manage (reduce) vegetation at breeding sites to increase habitat availability.	8.4 Pathogens & Microbes	Avian influenza, botulism, and West Nile Virus can result in mortality.
2. Species Management			
2.1 Species Stewardship	Create artificial sites for nesting.	11.1 Ecosystem Encroachment	Reduction in breeding habitat through drought. Shift in breeding or winter range.
2.1 Species Stewardship	Implement non-lethal control or deterrent measures.	5.1 Hunting & Collecting Terrestrial Animals	American White Pelicans can be perceived by fisherman, hatchery owners/operations as a pest or as competition for fish. Lethal control by permit removes birds from the population.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Install educational signs to convey the sensitivity of nest sites.	6.3 Work & Other Activities	Human disturbance can disrupt breeding, especially early in breeding season.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Through the agency review process of projects, identify opportunities to protect nest sites.	6.3 Work & Other Activities	Human disturbance can disrupt breeding, especially early in breeding season.
5. Livelihood Economic & Moral Incentives			
5.1 Linked Enterprises & Alternative Livelihoods	Promote awareness of the value of pelicans and the composition of their diet compared to common perceptions.	5.1 Hunting & Collecting Terrestrial Animals	American White Pelicans can be perceived by fisherman, hatchery owners/operations as a pest or as competition for fish. Lethal control by permit removes birds from the population.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.2 Easements & Resource Rights	Establish easements with private landowners to restore or retain nesting locations (note: most nest sites are currently on federal or state lands).	11.1 Ecosystem Encroachment	Reduction in breeding habitat through drought. Shift in breeding or winter range.

Baird's Sparrow Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Limit construction and disturbance during grassland bird breeding, nesting, and brood-rearing season (April 1- July 15), keep noise levels < 49 dBA during the breeding season, and ensure sites and surroundings are reclaimed back to native grassland habitat post-construction.	3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Provide signage on public lands indicating no off-road travel. Conduct outreach campaigns to clean and dry recreational machines before and after use to minimize the spread of non-native species. Increase enforcement on public lands to ensure signage and recreational rules are being met.	6.1 Recreational Activities	ATV/UTV recreational use causes degradation of grassland habitats by impacting vegetation and soil, spreading non-native vegetation, potentially driving over nests. Human activities and noise may interfere with nesting, foraging, and brood-rearing.
4. Law Enforcement & Prosecution			

4.3 Non-Criminal Legal Action	Provide agency comments and review of potential new transmission line builds to mitigate pre/post construction effects and ensure species and habitats of concern are considered.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.
4.3 Non-Criminal Legal Action	Reduce permitting of new dams, reservoirs, and other water impoundments in important grassland bird habitat, except where livestock cannot access water from other sources (e.g., groundwater, rural water systems).	7.2 Dams & Water Management / Use	Disruption of natural hydrological processes (e.g., artificial dam construction, loss of beavers) that impact function of ephemeral or perennial prairie streams and floodplains can degrade habitat.
4.3 Non-Criminal Legal Action	Through the agency review process of new road and railroad construction, provide recommendations to mitigate effects and ensure species and habitats of concern are considered.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
4.3 Non-Criminal Legal Action	Through the agency, provide project-specific comments and recommendations to companies to mitigate pre- and post-construction effects and ensure that species of concern are considered.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
4.3 Non-Criminal Legal Action	Through the agency, provide project-specific comments and recommendations to development companies to mitigate pre- and post-construction effects and ensure species	1.1 Housing & Urban Areas	Housing development in core grassland habitat will decrease breeding habitat via fragmentation and conversion, including destruction of native vegetation, installation of vertical structures avoided by grassland birds, introduction or

	and habitats of concern are considered. Consult FWP's Crucial Areas Planning System (CAPS) and other sites such as Montana Natural Heritage Program for indications of species of concern.		expansion of meso-predators and human commensal species (e.g., cats, crows, raccoons), noise disturbance, and increase of non-native plant species.
5. Livelihood Economic & Moral Incentives			
5.1 Linked Enterprises & Alternative Livelihoods	Incentivize ranching over farming.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.2 Better Products & Management Practices	Manage wireless technology by constructing shorter cellular towers or reducing reliance on cell towers (i.e., move towards satellite or other alternatives).	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.
5.2 Better Products & Management Practices	Provide information to landowners about management practices that minimize negative effects on grassland bird nesting success. Mow fields after July 15 so nestlings can fledge. Seed fields early, before May 10 to limit nest destruction by machinery. Minimize tillage and use of pesticides and herbicides.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.3 Market-Based Incentives	Incentivize meat and fiber produced on properties with a grazing management plan compatible with grassland bird habitat.	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.
5.3 Market-Based Incentives	Promote the value of agriculture products produced while stewarding grassland, such as beef, bison and fiber.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.4 Direct Economic Incentives	Compensate livestock producers when production goals and wildlife habitat goals do not align (e.g., resting and heavy grazing).	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.

5.4 Direct Economic Incentives	Incentivize ranching over farming.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.5 Non-Monetary Values	Convey the link between conservation and the effects of a changing climate on human health and populations.	11.3 Changes in Temperature Regimes	Changes in temperature can lengthen growing seasons, increase non-native vegetation monocultures, and impact the timing of the breeding season of grassland birds and cause their range to expand or contract. Hotter/drier summers can lead to droughts. Cooler temperatures can promote additional biomass growth throughout grasslands.
		11.4 Changes in Precipitation & Hydrological Regimes	Increased precipitation in the spring could increase non-native vegetation monocultures (Cheatgrass, Sweetclover, Kentucky Bluegrass, Smooth Brome) and woody vegetation expansion. Low moisture could impact prey populations for grassland birds. High moisture could promote cropland expansion.
		11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
5.5 Non-Monetary Values	Educating the public on the importance of minimal disturbance and the impacts of habitat destruction on grassland birds.	6.1 Recreational Activities	ATV/UTV recreational use causes degradation of grassland habitats by impacting vegetation and soil, spreading non-native vegetation, potentially driving over nests. Human activities and noise may interfere with nesting, foraging, and brood-rearing.

C. Enabling Conditions Actions

6. Conservation Designation & Planning

6.4 Conservation Planning	Identify areas of highest population densities and quality habitat for focused conservation attention. Prioritize conservation needs as projects/development are proposed.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation

			structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Maintain strong adherence to the Montana Environmental Policy Act (MEPA).	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
7.1 Laws, Regulations & Codes	Pass laws/bills to minimize the use of pesticides, particularly insecticides including neonicotinoid seed treatments. Make highly toxic pesticides illegal.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
7.1 Laws, Regulations & Codes	Promote native vegetation seeding and prohibit persistent non-native species seeding during reclamation or restoration (e.g., along roadsides, energy production).	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
7.1 Laws, Regulations & Codes	Re-seed with native species only, without persistent non-native species. Restrict the construction of new roads and railroads	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-

	(especially elevated roads) in grassland bird habitat. Apply Migratory Bird Treaty Act timing restrictions for construction in core habitat of ground-nesting bird species.		native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
7.1 Laws, Regulations & Codes	Reduce disparity in subsidies between annual cropland and grass-based agriculture. Implement policies that better mitigate risk for ranching operations.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
7.1 Laws, Regulations & Codes	Restrict construction of new utility and service lines. Require seeding of native vegetation, without persistent non-native species, at all utility installation sites, including waterlines.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.
7.1 Laws, Regulations & Codes	Support science-based laws and bills to address climate change.	11.3 Changes in Temperature Regimes	Changes in temperature can lengthen growing seasons, increase non-native vegetation monocultures, and impact the timing of the breeding season of grassland birds and cause their range to expand or contract. Hotter/drier summers can lead to droughts. Cooler temperatures can promote additional biomass growth throughout grasslands.
		11.4 Changes in Precipitation & Hydrological Regimes	Increased precipitation in the spring could increase non-native vegetation monocultures (Cheatgrass, Sweetclover, Kentucky Bluegrass, Smooth Brome) and woody vegetation expansion. Low moisture could impact prey populations for grassland birds. High moisture could promote cropland expansion.
		11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
7.2 Policies & Guidelines	Reduce disparity in subsidies between annual cropland and grass-based	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.

	agriculture. Implement policies that better mitigate risk for ranching operations.		
9. Education & Training			
9.2 Training & Individual Capacity Development	Increase agencies' and public awareness of the threat posed by non-native vegetation to grassland species and habitats.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
9.2 Training & Individual Capacity Development	Provide technical assistance and information to landowners about woody vegetation encroachment and management guides.	8.2 Problematic Native Plants & Animals	Encroachment of native woody vegetation (Rocky Mountain Juniper, Ponderosa Pine) results in a complete loss of habitat for most grassland songbirds.
9.2 Training & Individual Capacity Development	Provide technical assistance to landowners through incentive programs and workshops. Support rancher-led organizations such as the Ranchers Stewardship Alliance.	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.
9.2 Training & Individual Capacity Development	Provide trainings and information to stakeholders and agencies on pesticide use and effects on grassland birds.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
9.2 Training & Individual Capacity Development	Providing office and in-field trainings for agency personnel and workshops to landowners about prescribed fire management.	7.1 Fire & Fire Suppression	Altered fire regimes and fire suppression leading to high intensity fires reduces local breeding densities and leads to encroachment of woody vegetation in grassland habitat.
10. Institutional Development			
10.3 Alliance & Partnership Development	Proactively improve and increase partnerships with pesticide applicators to ensure that the methods and products used are the best available for wildlife and habitats.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
10.3 Alliance & Partnership Development	Work proactively with oil and gas contractors and companies to ensure best methods for wildlife and habitats are incorporated.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.

10.3 Alliance & Partnership Development	Work proactively with renewable energy contractors and companies to ensure best methods for wildlife and habitats are incorporated.	3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
10.3 Alliance & Partnership Development	Work proactively with road and railroad contractors and companies to ensure best methods for wildlife and habitats are incorporated.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
10.3 Alliance & Partnership Development	Work proactively with utility and service line contractors and companies to ensure best methods for wildlife and habitats are incorporated.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.
10.3 Alliance & Partnership Development	Work with ranching communities, agricultural extensions, and universities to find and share common solutions.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
10.4 Financing Conservation	Promote incentive programs for landowners to manage non-native species. Create available funding for district/city weed managers.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.

Black Tern Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat

A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Work to quickly detect and remove non-native emergent vegetation at sites with existing Black Tern colonies in order to retain those colonies.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive plants degrade freshwater wetland habitats by blocking access to open water essential for nesting and foraging, and reducing suitable nesting sites.
B. Behavioral Change/Threat Reduction			
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	During FWP review of projects, recommend the maintenance of buffer zones to block siltation, pesticide, and fertilizer run-off.	7.3 Other Ecosystem Modifications	Wetland eutrophication and pollution degrades habitat and food resources.

Black-billed Cuckoo Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct outreach on the importance of insect populations, the impacts of both small and large scale use of pesticides, and alternative options.	9.3 Agricultural & Forestry Effluents	Insecticides can cause direct and indirect mortality.
3.1 Outreach & Communications	Conduct outreach to private landowners on alternatives to bank armoring and the consequences of channel simplification.	7.3 Other Ecosystem Modifications	Loss of riparian habitat due to channel simplification (e.g., bank stabilization using riprap and side-channel isolation).
3.1 Outreach & Communications	Raise awareness on the challenges birds face with building collisions. Promote solutions	1.2 Commercial & Industrial Areas	Collisions with buildings and other commercial structures.

	from the Bird Collision Prevention Alliance and 'lights out' campaigns targeting migration events.		
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Work with landowners and natural resources agencies to implement FWP guidelines (Fish and Wildlife Recommendations for Subdivision Development). Recommend a preferred setback distance of 500 m (minimum 90 m) for structures from a river, based on cuckoo home range size and foraging requirements. Avoid removal of understory and maintain diversity of riparian species. Minimize ground disturbance during the breeding season (May 15-September 30).	1.1 Housing & Urban Areas	Loss of riparian habitat from conversion to housing.
		4.1 Roads & Railroads	The frequent placement of roads and railroads along rivers causes loss and degradation of riparian habitat.
		7.2 Dams & Water Management / Use	Loss of riparian forest due to channelization, dewatering for irrigation, and hydrological changes on dammed rivers.
5. Livelihood Economic & Moral Incentives			
5.3 Market-Based Incentives	Provide monetary incentive to support regenerative agricultural practices on private lands.	11.3 Changes in Temperature Regimes	Increased temperatures may lead to declines in prey abundance (e.g., lepidopteran larvae).
		11.4 Changes in Precipitation & Hydrological Regimes	Loss of habitat and changes in riparian community due to changes in precipitation.
		11.5 Severe/Extreme Weather Events	Extreme weather events (e.g., hail, wind, rain) can cause direct and indirect mortality.
5.4 Direct Economic Incentives	Create a tax incentive for companies to employ solutions to reduce collisions.	1.2 Commercial & Industrial Areas	Collisions with buildings and other commercial structures.
5.4 Direct Economic Incentives	Incentivize instream flow.	7.2 Dams & Water Management / Use	Loss of riparian forest due to channelization, dewatering for irrigation, and hydrological changes on dammed rivers.
5.4 Direct Economic Incentives	Provide compensation or tax incentives to reduce use of herbicides and pesticides or use environmentally-friendly products.	9.3 Agricultural & Forestry Effluents	Insecticides can cause direct and indirect mortality.

5.4 Direct Economic Incentives	Provide economic incentives to deter conversion of riparian habitat and offset financial impacts to landowners.	2.1 Annual & Perennial Non-Timber Crops	Conversion of riparian forests adjacent to rivers into agricultural areas.
5.4 Direct Economic Incentives	Provide monetary incentives to exclude livestock from riparian habitats (e.g., virtual fencing) and implement practices that reduce impacts of grazing. Work with NRCS on cost-share programs to build sustainable alternative water sources for livestock.	2.3 Livestock Farming & Ranching	Grazing can result in habitat loss and degradation.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.5 Site Infrastructure	Work with natural resource agencies to incorporate solutions from the Bird Collision Prevention Alliance into new building plans or maintenance of existing buildings.	1.2 Commercial & Industrial Areas	Collisions with buildings and other commercial structures.
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Change policy to allow bison grazing on state lands when requested by the lessee.	2.3 Livestock Farming & Ranching	Grazing can result in habitat loss and degradation.
7.2 Policies & Guidelines	Reduce regulatory burden on returning water rights to in-stream flow to restore natural hydrological regimes.	7.2 Dams & Water Management / Use	Loss of riparian forest due to channelization, dewatering for irrigation, and hydrological changes on dammed rivers.
7.2 Policies & Guidelines	Restrict permitting for gravel pits in areas identified as important breeding habitat for the species.	3.2 Mining & Quarrying	Loss of riparian habitat from mining (e.g., gold, gravel pits) along river corridors.
9. Education & Training			
9.2 Training & Individual Capacity Development	Provide guidance or training to permitted mining/quarrying operators on the importance of riparian species and how to avoid impacting important breeding habitat.	3.2 Mining & Quarrying	Loss of riparian habitat from mining (e.g., gold, gravel pits) along river corridors.

9.2 Training & Individual Capacity Development	Provide workshops for landowners on native revegetation and removal of invasive species along riparian habitat.	8.1 Invasive Non-Native/Alien Plants & Animals	Loss of riparian habitat from encroachment of non-native plants.
9.2 Training & Individual Capacity Development	Provide workshops for landowners on the benefits of keeping livestock out of riparian habitat, how to minimize livestock impacts on riparian areas, and how to sustainably provide alternative water sources for livestock.	2.3 Livestock Farming & Ranching	Grazing can result in habitat loss and degradation.

Black-crowned Night Heron Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Implement non-lethal measures to control or deter nuisance colonies (e.g., habitat alteration, noise harassment, shooting, nest destruction). If necessary, use distress signals, explosives, or lights to deter Black-crowned Night Herons from aquaculture facilities.	5.1 Hunting & Collecting Terrestrial Animals	Black-crowned Night Herons can be perceived by hatchery owners/operations as a pest. Lethal control by permit removes birds from the population.
B. Behavioral Change/Threat Reduction			
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	During FWP review of projects, recommend the maintenance of buffer zones to block siltation, pesticide, and fertilizer run-off.	9.3 Agricultural & Forestry Effluents	Pesticide run-off, including dichlorodiphenyl dichloroethene (DDE) and polychlorinated biphenyl (PCB) contamination, degrades habitat and food resources.

4.3 Non-Criminal Legal Action	Through the agency review process of projects, identify opportunities to protect wetlands.	7.2 Dams & Water Management / Use	Altered hydrology through wetland drainage and wetland loss impacts food availability and nesting habitat.

Black-necked Stilt Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.2 Ecosystem & Natural Process (Re)Creation	Protect wetland complexes supporting large portions of nesting populations.	7.3 Other Ecosystem Modifications	Wetland eutrophication and pollution degrades habitat and food resources.
2. Species Management			
2.1 Species Stewardship	Create artificial sites for nesting.	11.1 Ecosystem Encroachment	Reduction in breeding habitat through drought. Shift in breeding or winter range.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Install educational signs to convey the sensitivity of nest sites.	6.3 Work & Other Activities	Human disturbance can disrupt breeding, especially early in breeding season.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	During FWP review of projects, recommend the maintenance of buffer zones to block siltation, pesticide, and fertilizer run-off.	7.3 Other Ecosystem Modifications	Wetland eutrophication and pollution degrades habitat and food resources.
4.3 Non-Criminal Legal Action	Through the agency review process of projects, identify opportunities to protect wetlands.	7.2 Dams & Water Management / Use	Altered hydrology through wetland drainage and wetland loss impacts food availability and nesting habitat.

Blue-gray Gnatcatcher Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate and engage the public in preventing the spread of invasive species, and encourage reporting to facilitate early detection.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive annual grasses degrade habitat quality and increase potential for wildfires that cause habitat loss.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Consider employing curtailments during intense migration periods to reduce risk of mortality.	3.3 Renewable Energy	Development and maintenance of wind and solar farms can lead to habitat loss and fragmentation. Established infrastructure degrades the quality of the surrounding habitat.
5.2 Better Products & Management Practices	Restrict the timing of surface-disturbing activities during breeding and nesting.	3.1 Oil & Gas Drilling	Development and maintenance of oil and gas infrastructure can lead to habitat loss and fragmentation. Established infrastructure can degrade the habitat quality of the surrounding habitat.
		3.2 Mining & Quarrying	Development and maintenance of mines and quarries leads to habitat loss and fragmentation. Established infrastructure degrades the habitat quality of the surrounding habitat.
5.4 Direct Economic Incentives	Engage with partner agencies and NGOs in conservation stewardship programs.	2.3 Livestock Farming & Ranching	Habitat degradation and loss from range improvement projects. Improper livestock grazing intensities can degrade breeding habitat and attract nest parasites.
C. Enabling Conditions Actions			
10. Institutional Development			

10.3 Alliance & Partnership Development	Collaborate with the local weed districts, partner agencies, and NGOs to coordinate weed management efforts.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive annual grasses degrade habitat quality and increase potential for wildfires that cause habitat loss.

Bobolink Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Develop and promote economically viable mowing practices that allow young to fledge before hay fields are disturbed (e.g., identify and promote grassland-friendly hay species that do not require mowing before mid-July, and offset decreased quality with targeted programs). Support and promote initiatives like 'Kicking the hay habitat' where outreach may convince landowners to reduce haying costs and switch to winter grazing on native lands.	2.1 Annual & Perennial Non-Timber Crops	Non-native crops (e.g., alfalfa) can function as ecological traps, due to incompatible mowing schedules of hay fields and grassy nesting areas causing reproductive failure during nesting seasons.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate consumers on products and management practices (e.g., regenerative agriculture) to support healthy grasslands and people.	2.3 Livestock Farming & Ranching	Disturbance or destruction of breeding habitat by intensive or overgrazing practices.

3.1 Outreach & Communications	Implement community programs targeted at local farmers and ranchers to increase awareness of ecosystem services provided by grasslands and economic tradeoffs of grassland conversion. Collaborate and ensure open communication with universities and rangeland educators to promote awareness of ecosystem services provided by grasslands. Partner with private landowner programs to promote better management practices that favor grassland birds.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Non-native crops (e.g., alfalfa) can function as ecological traps, due to incompatible mowing schedules of hay fields and grassy nesting areas causing reproductive failure during nesting seasons.
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners and land managers about alternative options for pest and weed control (e.g., native predators, regenerative grazing) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Pesticide use on grassland bird food resources and habitat sites.
3.1 Outreach & Communications	Initiate programs to educate the public on the impact of feral and domestic cats to grassland birds, and the impact of Russian Olives on grassland birds.	8.1 Invasive Non-Native/Alien Plants & Animals	Domestic and feral outdoor cats. Invasive and non-native grasses and plants (e.g., Russian Olives and non-native wind-breaks) can replace or degrade native grasslands and agricultural lands beneficial to Bobolinks.
3.1 Outreach & Communications	Raise local awareness of the importance of migratory birds and migratory habitat.	5.1 Hunting & Collecting Terrestrial Animals	The increase in mesopredator populations due to the removal of large predators leads to an increase in nest predations. Persecution in migratory/wintering habitats.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Comment on Environmental Assessments requesting consideration of grassland birds in action, mitigation and reclamation plans.	3.1 Oil & Gas Drilling	Noise and other disturbances from roads, construction, and laydown yards can decrease habitat connectivity and suitability for grassland bird species.
		3.3 Renewable Energy	Wind and solar farm sites can cause direct and indirect fatalities, disturbance, and loss of native habitat.

5. Livelihood Economic & Moral Incentives			
5.1 Linked Enterprises & Alternative Livelihoods	Develop programs that subsidize sunk and transitional costs (e.g., machinery) to corn and soy growers wishing to adopt more grassland friendly agricultural practices and revenue streams.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops.
5.2 Better Products & Management Practices	Develop a program to promote the use of Russian Olives for heating public buildings. Develop and support programs that offset wind breaks and pay for artificial windbreaks instead of planting Russian Olives.	8.1 Invasive Non-Native/Alien Plants & Animals	Domestic and feral outdoor cats. Invasive and non-native grasses and plants (e.g., Russian Olives and non-native wind-breaks) can replace or degrade native grasslands and agricultural lands beneficial to Bobolinks.
5.2 Better Products & Management Practices	Develop an incentive program that identifies overgrazed habitat and works with ranchers to decrease overgrazing, educate, and incentivize healthier rangeland management.	2.3 Livestock Farming & Ranching	Disturbance or destruction of breeding habitat by intensive or overgrazing practices.
5.2 Better Products & Management Practices	In years with extreme weather, incentivize farmers to not cut hay, providing protection for nesting birds (e.g., from hail storms).	11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
5.2 Better Products & Management Practices	Use multi-bore pads and clustering wells to minimize impact. Apply additional restrictions during the breeding season (May to mid-July), like reducing noise levels, disturbances, and drilling.	3.1 Oil & Gas Drilling	Noise and other disturbances from roads, construction, and laydown yards can decrease habitat connectivity and suitability for grassland bird species.
5.3 Market-Based Incentives	Develop economic incentives for bird-friendly rice production and consumption.	5.1 Hunting & Collecting Terrestrial Animals	The increase in mesopredator populations due to the removal of large predators leads to an increase in nest predations. Persecution in migratory/wintering habitats.
5.3 Market-Based Incentives	Develop or strengthen incentives and markets for grazing practices that benefit grassland birds. Incentivize farming and ranching that employs best management practices that support grasslands and	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Non-native crops (e.g., alfalfa) can function as ecological traps, due to incompatible mowing schedules of hay fields and grassy nesting areas causing reproductive failure during nesting seasons.

	grassland bird habitat. Develop markets for late-cut hay and provide incentives to farmers and buyers. Develop a 'grassland friendly hay' marketing tag or certification (e.g., Audubon beef certification) that allows consumers to choose the most environmentally friendly products.		
5.4 Direct Economic Incentives	Create subsidiary or compensation programs to reimburse farmers for declines in hay value related to delayed mowing, or for taking sub-optimal land out of hay production.	2.1 Annual & Perennial Non-Timber Crops	Non-native crops (e.g., alfalfa) can function as ecological traps, due to incompatible mowing schedules of hay fields and grassy nesting areas causing reproductive failure during nesting seasons.
5.4 Direct Economic Incentives	Reward farmers employing best management practices.	2.3 Livestock Farming & Ranching	Disturbance or destruction of breeding habitat by intensive or overgrazing practices.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Increase effectiveness of grassland lobbying groups by developing guidance on ecosystem services that could be used to support new and expanding programs, like the U.S. Farm Bill.	5.1 Hunting & Collecting Terrestrial Animals	The increase in mesopredator populations due to the removal of large predators leads to an increase in nest predations. Persecution in migratory/wintering habitats.
7.1 Laws, Regulations & Codes	Increase effectiveness of grassland lobbying groups.	3.1 Oil & Gas Drilling	Noise and other disturbances from roads, construction, and laydown yards can decrease habitat connectivity and suitability for grassland bird species.
7.1 Laws, Regulations & Codes	Increase the effectiveness of grassland lobbying groups to implement climate legislation that protects grasslands.	11.3 Changes in Temperature Regimes	Changes in precipitation patterns and loss of wet grasslands caused by climate change.
7.1 Laws, Regulations & Codes	Use U.S. Farm Bill conservation programs to strengthen, profile, improve, and enhance quality grassland habitat. Promote and support programs like CRP and support development of additional programs.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops.

9. Education & Training			
9.2 Training & Individual Capacity Development	Educate stakeholders and relevant individuals of the effects of pesticides in birds, humans, and the environment.	9.3 Agricultural & Forestry Effluents	Pesticide use on grassland bird food resources and habitat sites.
10. Institutional Development			
10.2 External Organizational Development & Support	Work with wildlife services in areas without predator control guidelines and provide incentives to landowners to leave larger predators.	5.1 Hunting & Collecting Terrestrial Animals	The increase in mesopredator populations due to the removal of large predators leads to an increase in nest predations. Persecution in migratory/wintering habitats.
10.3 Alliance & Partnership Development	Build partnerships with agricultural interests and beef producers to advocate for and incentivize lands kept in grazing.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops.
10.3 Alliance & Partnership Development	Foster relationships and exchanges between grassland conservation entities and agricultural stakeholders.	2.3 Livestock Farming & Ranching	Disturbance or destruction of breeding habitat by intensive or overgrazing practices.
		9.3 Agricultural & Forestry Effluents	Pesticide use on grassland bird food resources and habitat sites.
10.3 Alliance & Partnership Development	Partner with vet clinics and non-profits to initiate trap-spay-release programs.	8.1 Invasive Non-Native/Alien Plants & Animals	Domestic and feral outdoor cats. Invasive and non-native grasses and plants (e.g., Russian Olives and non-native wind-breaks) can replace or degrade native grasslands and agricultural lands beneficial to Bobolinks.

Brewer's Sparrow Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			

1.1 Site/Area Stewardship	Reduce lighting at night during migratory periods.	3.1 Oil & Gas Drilling	Development and maintenance of oil and gas infrastructure can lead to habitat loss and fragmentation. Established infrastructure can degrade the habitat quality of the surrounding habitat.
		3.3 Renewable Energy	Development and maintenance of wind and solar farms can lead to habitat loss and fragmentation. Established infrastructure degrades the quality of the surrounding habitat.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate and engage the public in preventing the spread of invasive species, and encourage reporting to facilitate early detection.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive annual grass species degrade habitat quality, increase fire frequency, and cause habitat loss.
3.1 Outreach & Communications	In areas with intense recreation pressure, install information signs and collaborate with partner agencies to provide programming about responsible recreation.	6.1 Recreational Activities	Increased motorized and non-motorized recreational traffic causes disturbances that impact breeding songbirds.
3.1 Outreach & Communications	Inform landowners of the benefits of conifer removal and engage the public in active conifer management efforts.	7.1 Fire & Fire Suppression	Fire suppression has allowed for conifer encroachment into higher-elevation sagebrush habitat. Fire suppression has resulted in a current fire regime characterized by intense fires that cause loss of low-elevation sagebrush habitat.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Consider employing curtailments during intense migration periods to reduce risk of mortality.	3.3 Renewable Energy	Development and maintenance of wind and solar farms can lead to habitat loss and fragmentation. Established infrastructure degrades the quality of the surrounding habitat.
5.2 Better Products & Management Practices	Employ horizontal drilling to reduce the number of roads required.	3.1 Oil & Gas Drilling	Development and maintenance of oil and gas infrastructure can lead to habitat loss and fragmentation. Established infrastructure can degrade the habitat quality of the surrounding habitat.
5.2 Better Products & Management Practices	Implement mitigation strategies, such as perch deterrents and buried lines, to reduce	4.2 Utility & Service Lines	Utility and service lines lead to habitat loss, fragmentation, and habitat degradation in the surrounding area.

	suitability of perching habitat created by service lines.		
5.2 Better Products & Management Practices	Recommend restrictions on lighting at night during migration, and restrictions on the timing of surface-disturbing actions during breeding and nesting.	3.2 Mining & Quarrying	Development and maintenance of mines and quarry infrastructure leads to habitat loss and fragmentation. Established infrastructure degrades the habitat quality of the surrounding habitat.
C. Enabling Conditions Actions			
10. Institutional Development			
10.3 Alliance & Partnership Development	Collaborate with partner agencies and organizations to promote conservation stewardship programs and conservation-minded grazing programs and practices on private and public lands. Continue to collaborate with partner agencies and organizations to mitigate conifer encroachment.	2.3 Livestock Farming & Ranching	Over-utilization from improper grazing management degrades habitat quality. Rangeland improvement projects removing sagebrush causes habitat degradation and loss.
10.3 Alliance & Partnership Development	Collaborate with the local weed districts, partner agencies, and NGOs to coordinate invasive species management efforts.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive annual grass species degrade habitat quality, increase fire frequency, and cause habitat loss.
10.3 Alliance & Partnership Development	Engage and support partner agencies and NGOs in conservation stewardship programs.	11.3 Changes in Temperature Regimes	Increased temperatures exacerbate fire and invasive species issues and reduce suitable habitat.
		11.4 Changes in Precipitation & Hydrological Regimes	Declines in annual precipitation and increased frequency of large precipitation events can reduce reproductive success.
		2.1 Annual & Perennial Non-Timber Crops	Conversion of sagebrush steppe habitat to cropland, causing habitat loss.

Burrowing Owl Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Avoid granting road access through prairie dog towns on public lands, and buffer the area around known prairie dog towns.	4.1 Roads & Railroads	Vehicle strikes along roadways. Increase in right-of-way requests for roads across public lands.
1.1 Site/Area Stewardship	Protect habitat for Burrowing Owls through conservation of Prairie Dog habitat. Consider conservation easements/leases or other habitat protections. Encourage land managers to use best management practices to benefit Burrowing Owl habitat.	8.4 Pathogens & Microbes	Avian influenza can result in mortality. Sylvatic plague in prairie dog colonies may decrease prairie dog densities, eradicate colonies, and decrease available Burrowing Owl habitat.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Design outreach programs highlighting the importance of regular dam maintenance and potential consequences of dam failure.	7.2 Dams & Water Management / Use	Possibility of dam failure and flooding in the spring when Burrowing Owls are establishing nests.
3.1 Outreach & Communications	Post educational signs in areas popular with recreational prairie dog shooters. Use media campaigns and outreach events to increase statewide knowledge of Burrowing Owls, their use of prairie dog burrows for nesting, and their benefits to the ecosystem.	5.1 Hunting & Collecting Terrestrial Animals	Shooting of prairie dogs and ground squirrels for recreation decreases Burrowing Owl fecundity. Recreational shooters may misidentify Burrowing Owls as prairie dogs or ground squirrels while shooting.
3.1 Outreach & Communications	Provide information to landowners on the utility of prairie dogs to ecosystems and use of burrows by Burrowing Owls.	2.3 Livestock Farming & Ranching	Active poisoning of prairie dog colonies for perceived impacts to livestock. Herbicide and insecticide application on crops.
3.1 Outreach & Communications	Use media campaigns and outreach events to increase statewide knowledge of Burrowing Owls, their use of prairie dog	1.1 Housing & Urban Areas	Control or removal of prairie dog colonies reduces nesting habitat for Burrowing Owls. Modification of native ecosystems with non-native plantings may change prey base available to

	burrows for nesting, and their benefits to the ecosystem.		Burrowing Owls. The increase in domestic cats and dogs increases predation on Burrowing Owls. An increase in corvids may increase nest predation.
5. Livelihood Economic & Moral Incentives			
5.3 Market-Based Incentives	Creating a market for ecosystem-friendly beef. Promote responsible agricultural practices.	2.3 Livestock Farming & Ranching	Active poisoning of prairie dog colonies for perceived impacts to livestock. Herbicide and insecticide application on crops.
5.4 Direct Economic Incentives	Award prizes and provide tax incentives for maintaining prairie dog populations on private lands and adopting conservation measures.	2.3 Livestock Farming & Ranching	Active poisoning of prairie dog colonies for perceived impacts to livestock. Herbicide and insecticide application on crops.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Designate important habitat areas in Montana for Burrowing Owls (without formal protection).	1.1 Housing & Urban Areas	Control or removal of prairie dog colonies reduces nesting habitat for Burrowing Owls. Modification of native ecosystems with non-native plantings may change prey base available to Burrowing Owls. The increase in domestic cats and dogs increases predation on Burrowing Owls. An increase in corvids may increase nest predation.
		2.3 Livestock Farming & Ranching	Active poisoning of prairie dog colonies for perceived impacts to livestock. Herbicide and insecticide application on crops.
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Limit energy development activity in and around prairie dog colonies. Minimize disturbance around prairie dog towns during Burrowing Owl breeding season. Consider prairie dog distribution when siting wind turbines. Consider operational practices such as curtailment when Burrowing Owls are present. Design turbines to minimize collision risk.	3.3 Renewable Energy	Collisions with wind turbines. Disturbance during nesting.

7.2 Policies & Guidelines	Recommend limiting energy development activity in areas within prairie dog colonies. Minimize disturbance inside a buffer surrounding prairie dog towns during Burrowing Owl breeding season.	3.1 Oil & Gas Drilling	Burrowing Owls may avoid areas with oil and gas development and associated infrastructure and be affected by alterations to native vegetation.
9. Education & Training			
9.2 Training & Individual Capacity Development	Provide technical assistance to landowners on how to conduct regular dam inspections, clean debris from spillways and conduits, and address any deterioration or damage to avoid flooding and dam failure.	7.2 Dams & Water Management / Use	Possibility of dam failure and flooding in the spring when Burrowing Owls are establishing nests.
10. Institutional Development			
10.3 Alliance & Partnership Development	Partner with other agencies and NGOs to ensure there is a maintenance plan for any dam installed.	7.2 Dams & Water Management / Use	Possibility of dam failure and flooding in the spring when Burrowing Owls are establishing nests.
10.3 Alliance & Partnership Development	Reinvigorate interagency collaboration on prairie dog management and monitoring across Montana. Establish repeatable monitoring methods for Burrowing Owls across Montana.	8.4 Pathogens & Microbes	Avian influenza can result in mortality. Sylvatic plague in prairie dog colonies may decrease prairie dog densities, eradicate colonies, and decrease available Burrowing Owl habitat.

Clark's Grebe Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			

3.1 Outreach & Communications	Install educational signs to convey the sensitivity of nest sites.	6.3 Work & Other Activities	Human disturbance can disrupt breeding, especially early in breeding season.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Through the agency review process of projects, identify opportunities to protect wetlands.	7.2 Dams & Water Management / Use	Altered hydrology through wetland drainage and wetland loss impacts food availability and nesting habitat.

Common Loon Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Install floating signs and shore signage to seasonally close off nesting and nursery areas from intrusion by recreationists.	6.1 Recreational Activities	Disturbance to nest sites and nursery areas from boaters, floaters, anglers, hikers, campers, bird watchers, photographers, and other recreationists causes nest abandonment or failure. Boat strikes cause direct mortalities of loons.
1.1 Site/Area Stewardship	Locate garbage dumps and carcass disposal sites away from areas with loon lakes to avoid attracting eagles and corvids.	8.2 Problematic Native Plants & Animals	Increasing bald eagle numbers and proximity to loon nesting areas increases predation on loon adults and chicks and eggs. These increases can be driven by garbage dumps and carcass disposal sites near waterbodies with loons.
1.1 Site/Area Stewardship	Refrain from stocking fish in fishless lakes that are occupied by loons or have suitable loon habitat.	8.1 Invasive Non-Native/Alien Plants & Animals	Introduction of aquatic invasive species (e.g., invasive mussels) and plants can reduce or eliminate prey base for loons and increase the risk of botulism outbreaks that cause loon mortalities. Introduction of non-native fish species in lakes used by loons or planting of fish in formerly fishless lakes can reduce or eliminate prey base for loons (e.g.,

			Northern Pike reducing silver salmon in Salmon Lake). Efforts to remove non-native fish for native fish restoration can cause loon mortalities or stress (e.g., gill-netting, piscicides reducing prey base) in the short term, but are generally positive for loon conservation in the long term.
1.1 Site/Area Stewardship	Work with dam operators on occupied lakes to minimize water level fluctuations during loon nesting season.	7.2 Dams & Water Management / Use	Low water levels can result in increased water temperatures and make previously accessible shoreline nest sites inaccessible. Water-level fluctuations in reservoirs controlled by dams can flood loon nests (water too high) or leave them vulnerable to predation (water too low).
2. Species Management			
2.1 Species Stewardship	Install floating nest platforms on lakes where water level fluctuations affect nesting success, and consider including a cover to provide protection from sunlight and insects.	11.4 Changes in Precipitation & Hydrological Regimes	Multi-peak spring runoff events result in nests being flooded or made more accessible to predators.
2.1 Species Stewardship	Install floating nest platforms on lakes where water levels fluctuate due to dams and negatively affect loon nesting success.	7.2 Dams & Water Management / Use	Low water levels can make previously accessible shoreline nest sites inaccessible and result in increased water temperatures. Water-level fluctuations in reservoirs controlled by dams can flood loon nests (water too high) or leave them vulnerable to predation (water too low).
2.1 Species Stewardship	When installing nest platforms, include a cover to provide additional protection for nesting loons from attacks by eagles and corvids.	8.2 Problematic Native Plants & Animals	Garbage dumps and carcass disposal sites artificially increase numbers of corvids and eagles that may then prey on adult and juvenile loons and eggs. Increasing Bald Eagle numbers and proximity to loon nesting areas increases predation on loon adults and chicks.
2.1 Species Stewardship	When installing nesting platforms, consider including a cover to provide protection from sunlight and insects.	11.3 Changes in Temperature Regimes	Abnormally high temperatures can make incubation difficult for loons due to overheating and increased presence of black flies, mosquitoes, and other biting insects. Lower lake levels due to drought conditions can strand nesting loons or result in a cascade of other impacts (e.g., warm temperatures). Cyanotoxins resulting from abnormally high water temperatures combined with nutrient loading from lakeside

			developments and developments in feeder streams/rivers may lead to direct deaths of loons and/or reduce their prey base. Increased plant and algae growth and longer growing seasons may make some emergent/submergent plant species and algal blooms problematic for loons through reduced water clarity, changes to prey base, or reduced swimming ability/efficiency.
2.1 Species Stewardship	Where natural nesting habitat is not available or is subject to frequent disturbance, install floating nest platforms to encourage loons to nest away from developed areas.	1.1 Housing & Urban Areas	Housing and other development along lake shores reduces habitat through destruction of streamside vegetation and bank stabilization/modification, increases disturbance to nesting and foraging loons, and increases the introduction of pollutants and trash into lakes from yards, roads, waste storage areas, and access points.
		1.2 Commercial & Industrial Areas	Commercial development along lake shores reduces habitat through bank stabilization/modification and destruction of streamside vegetation, increases disturbance to nesting and foraging loons, and introduces pollutants and trash into lakes from yards, roads, waste storage areas, and access points.
		1.3 Tourism & Recreation	Development of recreation sites along lake shores reduces habitat through bank stabilization/modification and destruction of streamside vegetation, increases disturbance to nesting and foraging loons, and increases the introduction of pollutants and trash into lakes from campgrounds, boat ramps, roads, waste storage areas, and associated recreational activities.
		6.1 Recreational Activities	Disturbance to nest sites and nursery areas from boaters, floaters, anglers, hikers, campers, bird watchers, photographers, and other recreationists can cause nest abandonment or failure. Boat strikes can cause direct mortalities of loons.
B. Behavioral Change/Threat Reduction			

3. Awareness Raising

3.1 Outreach & Communications	Conduct education and outreach with lakeside landowners on the dangers of nutrient loading in lakes for a variety of wildlife species, including loons and their prey base.	11.3 Changes in Temperature Regimes	Abnormally high temperatures can make incubation difficult for loons due to overheating and increased presence of black flies, mosquitoes, and other biting insects. Lower lake levels due to drought conditions can strand nesting loons or result in a cascade of other impacts (e.g., warm temperatures). Cyanotoxins resulting from abnormally high water temperatures combined with nutrient loading from lakeside developments and developments in feeder streams/rivers may lead to direct deaths of loons and/or reduce their prey base. Increased plant and algae growth and longer growing seasons may make some emergent/submergent plant species and algal blooms problematic for loons through reduced water clarity, changes to prey base, or reduced swimming ability/efficiency.
3.1 Outreach & Communications	Create and maintain public awareness about the issues with mercury contamination, PFAS chemicals, and herbicides/pesticides. Implement outreach and education campaigns targeted towards landowners and land managers about alternative options for pest and weed control (e.g., native predators, regenerative grazing) to reduce reliance on pesticides and herbicides.	9.5 Air-Borne Pollutants	Fire retardants that are dropped on lakes accidentally or that make their way to lakes through runoff can be toxic to loons and their prey base. Runoff of herbicides and pesticides into lakes may be toxic to loons and affect their prey base. Mercury contamination of breeding lakes, largely from airborne sources, can decrease breeding success through bioaccumulation in loons, causing a variety of behavioral and physiological effects. PFAS chemicals can be toxic to loons and their prey base.
3.1 Outreach & Communications	Develop and pursue education and outreach opportunities targeting lake recreationists on the dangers of illegal introductions of aquatic invasive species (e.g., 'Don't Let it Loose' and 'Clean, Drain, Dry' messaging). Maintain funding and support for USFS, NPS, and FWP Loon Ranger internship and technician positions to conduct outreach with	8.1 Invasive Non-Native/Alien Plants & Animals	Introduction of aquatic invasive species (e.g., invasive mussels) and plants can reduce or eliminate prey base for loons and increase the risk of botulism outbreaks that cause loon mortalities. Introduction of non-native fish species in lakes used by loons or planting of fish in formerly fishless lakes can reduce or eliminate prey base for loons (e.g., Northern Pike reducing silver salmon in Salmon Lake). Efforts to remove non-native fish for native fish restoration can cause

	landowners at occupied and potential loon lakes.		loon mortalities or stress (e.g., gill-netting, piscicides reducing prey base) in the short term, but are generally positive for loon conservation in the long term.
3.1 Outreach & Communications	Develop site-specific management plans and foster community engagement in loon conservation. Maintain funding for USFS, NPS, and FWP Loon Ranger internship and technician positions to conduct outreach. Pursue education opportunities at campgrounds, boat launches, and other recreation sites on the Migratory Bird Treaty Act and ways recreationists can help with loon conservation.	1.3 Tourism & Recreation	Development of recreation sites along lake shores reduces habitat through bank stabilization/modification and destruction of streamside vegetation, increases disturbance to nesting and foraging loons, and increases the introduction of pollutants and trash into lakes from campgrounds, boat ramps, roads, waste storage areas, and associated recreational activities.
3.1 Outreach & Communications	Develop site-specific management plans and foster community engagement in loon conservation. Maintain funding for USFS, NPS, and FWP Loon Ranger internship and technician positions to conduct outreach. Pursue education opportunities with lakeside landowners and communities on the Migratory Bird Treaty Act and ways homeowners, businesses, and agencies can protect loons and their habitat.	1.1 Housing & Urban Areas	Housing and other development along lake shores reduces habitat through destruction of streamside vegetation and bank stabilization/modification, increases disturbance to nesting and foraging loons, and increases the introduction of pollutants and trash into lakes from yards, roads, waste storage areas, and access points.
		1.2 Commercial & Industrial Areas	Commercial development along lake shores reduces habitat through bank stabilization/modification and destruction of streamside vegetation, increases disturbance to nesting and foraging loons, and introduces pollutants and trash into lakes from yards, roads, waste storage areas, and access points.
3.1 Outreach & Communications	Develop site-specific management plans and foster community engagement in loon conservation. Maintain funding for USFS, NPS, and FWP Loon Ranger positions to conduct outreach with recreationists and monitor loon nesting and manage closure signs. Pursue education opportunities at campgrounds and boat launches on the	6.1 Recreational Activities	Disturbance to nest sites and nursery areas from boaters, floaters, anglers, hikers, campers, bird watchers, photographers, and other recreationists can cause nest abandonment or failure. Boat strikes can cause direct mortalities of loons.

	Migratory Bird Treaty Act and ways recreationists can help loons.		
3.1 Outreach & Communications	Develop site-specific management plans and foster community engagement. Maintain funding for USFS, NPS, and FWP Loon Ranger positions. Pursue education opportunities with lake recreationists and associations on the dangers of discarded fishing tackle and lead sinkers. Use social media and news releases to get the word out about the dangers of lead sinkers. Work with non-lead ammunition groups on effective messaging.	5.4 Fishing & Harvesting Aquatic Resources	Ingestion of lead from fishing tackle causes direct mortality and is believed to be the top source of mortality for adult loons in Montana. Ingestion of fishing hooks and entanglement in discarded fishing line kills individual loons or diminishes their ability to hunt and raise young effectively. Opening day for fishing on many lakes coincides with arrival of loons and/or nest initiation leading to sudden and major influx of disturbance (e.g., boats, shore anglers) and discarded or lost fishing tackle (e.g., lead sinkers).
3.1 Outreach & Communications	Develop site-specific management plans that address local risk factors and foster community engagement in loon conservation. Maintain connection with dam operators, especially when ownership changes to ensure that plans implemented to protect loons are carried over.	7.2 Dams & Water Management / Use	Low water levels can result in increased water temperatures and make previously accessible shoreline nest sites inaccessible. Water-level fluctuations in reservoirs controlled by dams can flood loon nests (water too high) or leave them vulnerable to predation (water too low).
3.1 Outreach & Communications	Develop site-specific management plans that address local risk factors and foster community engagement in loon conservation. Maintain funding and support for USFS, NPS, and FWP Loon Ranger positions to conduct outreach. Pursue education opportunities with lake recreationists and lakeside homeowners on the dangers of entanglement, particularly from discarded netting and fishing tackle.	9.4 Garbage & Solid Waste	Discarded fishing line, nets, ropes, plastic containers, and other waste can cause fatal entanglement, can reduce foraging and brood-rearing abilities, and if ingested can cause plastic toxicity or reduced nutrition uptake.
3.1 Outreach & Communications	When issues are identified or suspected, work with the appropriate agency or group to educate staff about the sensitivity of loons,	6.3 Work & Other Activities	Natural resource professionals working in loon lakes may accidentally disturb, injure, or kill loons while conducting other work (e.g., shoreline surveys, gill-netting for fish surveys)

	how to identify nesting activity, and how to prevent disturbance.		or to remove invasive species, water quality monitoring, bird surveys, etc.).
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Fully enforce the Migratory Bird Treaty Act when recreationists purposefully violate closure signs or purposefully harass nesting loons. Install wildlife cameras at loon nest sites to detect and identify individuals who are violating closure areas or purposefully harassing nesting loons.	6.1 Recreational Activities	Disturbance to nest sites and nursery areas from boaters, floaters, anglers, hikers, campers, bird watchers, photographers, and other recreationists can cause nest abandonment or failure. Boat strikes can cause direct mortalities of loons.
4.1 Detection & Arrest	Install game cameras at popular access points with seasonal closures or closures for certain types of recreation to monitor illegal access and use and pursue penalties for violations.	1.3 Tourism & Recreation	Development of recreation sites along lake shores reduces habitat through bank stabilization/modification and destruction of streamside vegetation, increases disturbance to nesting and foraging loons, and increases the introduction of pollutants and trash into lakes from campgrounds, boat ramps, roads, waste storage areas, and associated recreational activities.
4.1 Detection & Arrest	Strengthen and promote enforcement of state and local laws and ordinances around lakeside environmental protections, and encourage reporting of violations.	1.2 Commercial & Industrial Areas	Commercial development along lake shores reduces habitat through bank stabilization/modification and destruction of streamside vegetation, increases disturbance to nesting and foraging loons, and introduces pollutants and trash into lakes from yards, roads, waste storage areas, and access points.
		9.4 Garbage & Solid Waste	Discarded fishing line, nets, ropes, plastic containers, and other waste can cause fatal entanglement, can reduce foraging and brood-rearing abilities, and if ingested can cause plastic toxicity or reduced nutrition uptake.
4.1 Detection & Arrest	Strengthen and promote enforcement of state and local wetland protection laws and encourage reporting and remedy of violations.	1.1 Housing & Urban Areas	Housing and other development along lake shores reduces habitat through destruction of streamside vegetation and bank stabilization/modification, increases disturbance to nesting and foraging loons, and increases the introduction of pollutants and trash into lakes from yards, roads, waste storage areas, and access points.

4.3 Non-Criminal Legal Action	Promote the formation of lakeside community groups to encourage best management practices for lake shore protection and community policing.	1.1 Housing & Urban Areas	Housing and other development along lake shores reduces habitat through destruction of streamside vegetation and bank stabilization/modification, increases disturbance to nesting and foraging loons, and increases the introduction of pollutants and trash into lakes from yards, roads, waste storage areas, and access points.
		1.2 Commercial & Industrial Areas	Commercial development along lake shores reduces habitat through bank stabilization/modification and destruction of streamside vegetation, increases disturbance to nesting and foraging loons, and introduces pollutants and trash into lakes from yards, roads, waste storage areas, and access points.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Develop and distribute an updated guide for lakeside landowners on ways they can be responsible stewards of the resource in their backyards.	1.1 Housing & Urban Areas	Housing and other development along lake shores reduces habitat through destruction of streamside vegetation and bank stabilization/modification, increases disturbance to nesting and foraging loons, and increases the introduction of pollutants and trash into lakes from yards, roads, waste storage areas, and access points.
5.2 Better Products & Management Practices	Encourage administrators of major social media accounts (e.g., Montana Birding) to stop allowing posts that show loons during breeding stages or identify locations. Work with companies like eBird and iNaturalist to put buffers on nesting locations and remove from public view entries that identify reproductive stages (e.g., chicks have hatched and birders/photographers want to see loonlets riding on parents' backs).	6.1 Recreational Activities	Disturbance to nest sites and nursery areas from boaters, floaters, anglers, hikers, campers, bird watchers, photographers, and other recreationists can cause nest abandonment or failure. Boat strikes can cause direct mortalities of loons.
5.2 Better Products & Management Practices	Encourage sporting goods retailers, especially those in towns near loon lakes, to discontinue marketing sinkers that are made of lead, provide alternative products, and/or	5.4 Fishing & Harvesting Aquatic Resources	Ingestion of lead from fishing tackle causes direct mortality and is believed to be the top source of mortality for adult loons in Montana. Ingestion of fishing hooks and entanglement in discarded fishing line kills individual loons or diminishes their

	provide educational materials in the aisle where lead sinkers are sold. Provide free or discounted non-lead fishing tackle through educational programs and other public outreach events.		ability to hunt and raise young effectively. Disturbance from opening day for fishing on many lakes coincides with arrival and/or nest initiation.
5.3 Market-Based Incentives	Create a voucher program with major sporting goods retailers so they can be labeled as waterfowl-friendly. Provide anglers with coupons for non-lead sinkers so they are competitively priced with lead sinkers.	5.4 Fishing & Harvesting Aquatic Resources	Ingestion of lead from fishing tackle causes direct mortality and is believed to be the top source of mortality for adult loons in Montana. Ingestion of fishing hooks and entanglement in discarded fishing line kills individual loons or diminishes their ability to hunt and raise young effectively. Disturbance from opening day for fishing on many lakes coincides with arrival and/or nest initiation.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Work with USFS and NPS on fire suppression planning efforts to identify lakes with nesting loons that should be avoided for water scooping if possible.	7.1 Fire & Fire Suppression	Water scooping off lakes to fight fires can result in nest abandonment due to disturbance.
6.4 Conservation Planning	Work with USFS, NPS, FWP, Common Loon Working Group, Montana Loon Society, and others to review and update the Montana Loon Conservation Plan.	12.1 Other	Lack of consistent, statewide monitoring to track loon populations and identify declines. Lack of monitoring in areas with low nest success and lack of data on the causes of nest abandonment, nest failure, and chick loss.
6.5 Site Infrastructure	Install fishing tackle disposal stations at popular fishing access locations and boat ramps, and signage to encourage their use. Provide educational signage at campground and boat ramp kiosks on the sensitivity of loons and the dangers of discarded fishing materials and trash to loons.	9.4 Garbage & Solid Waste	Discarded fishing line, nets, ropes, plastic containers, and other waste can cause fatal entanglement, can reduce foraging and brood-rearing abilities, and if ingested can cause plastic toxicity or reduced nutrition uptake.

6.5 Site Infrastructure	Install fishing tackle disposal stations at popular fishing access locations and boat ramps, and signage to encourage their use. Provide educational signage at campground and boat ramp kiosks on the sensitivity of loons and the dangers of fishing tackle to loons.	5.4 Fishing & Harvesting Aquatic Resources	Ingestion of lead from fishing tackle causes direct mortality and is believed to be the top source of mortality for adult loons in Montana. Ingestion of fishing hooks and entanglement in discarded fishing line kills individual loons or diminishes their ability to hunt and raise young effectively. Disturbance from opening day for fishing on many lakes coincides with arrival and/or nest initiation.
6.5 Site Infrastructure	Provide educational signage at campground and boat ramp kiosks on the sensitivity of loons, the Migratory Bird Treaty Act, and ways recreationists can help with loon conservation.	1.3 Tourism & Recreation	Development of recreation sites along lake shores reduces habitat through bank stabilization/modification and destruction of streamside vegetation, increases disturbance to nesting and foraging loons, and increases the introduction of pollutants and trash into lakes from campgrounds, boat ramps, roads, waste storage areas, and associated recreational activities.
		6.1 Recreational Activities	Disturbance to nest sites and nursery areas from boaters, floaters, anglers, hikers, campers, bird watchers, photographers, and other recreationists can cause nest abandonment or failure. Boat strikes can cause direct mortalities of loons.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Advocate for increased fines and other punishments for violations of laws around illegal species introductions and the transport of Aquatic Invasive Species.	8.1 Invasive Non-Native/Alien Plants & Animals	Introduction of aquatic invasive species (e.g., invasive mussels) and plants can reduce or eliminate prey base for loons and increase the risk of botulism outbreaks that cause loon mortalities. Introduction of non-native fish species in lakes used by loons or planting of fish in formerly fishless lakes can reduce or eliminate prey base for loons (e.g., Northern Pike reducing silver salmon in Salmon Lake). Efforts to remove non-native fish for native fish restoration can cause loon mortalities or stress (e.g., gill-netting, piscicides reducing prey base) in the short term, but are generally positive for loon conservation in the long term.

7.1 Laws, Regulations & Codes	Work with relevant agencies to adjust opening dates for fishing seasons at specific locations to avoid key periods for loon nest establishment.	5.4 Fishing & Harvesting Aquatic Resources	Ingestion of lead from fishing tackle causes direct mortality and is believed to be the top source of mortality for adult loons in Montana. Ingestion of fishing hooks and entanglement in discarded fishing line kills individual loons or diminishes their ability to hunt and raise young effectively. Disturbance from opening day for fishing on many lakes coincides with arrival and/or nest initiation.
10. Institutional Development			
10.3 Alliance & Partnership Development	Develop and maintain a network of rescuers and rehabbers that can respond to reports of stranded loons and get them to suitable water bodies, or to rehab centers if they are injured or sick.	11.5 Severe/Extreme Weather Events	Severe weather events can cause migrating loons to crash-land and become stranded in parking lots, open fields, and waterbodies that are too small for them to take off.
10.3 Alliance & Partnership Development	Maintain participation and engagement in loon conservation with agencies and private partners through the Common Loon Working Group and the Montana Loon Society to address concerns around development pressure on loons and their habitats.	1.1 Housing & Urban Areas	Housing and other development along lake shores reduces habitat through destruction of streamside vegetation and bank stabilization/modification, increases disturbance to nesting and foraging loons, and increases the introduction of pollutants and trash into lakes from yards, roads, waste storage areas, and access points.
		1.2 Commercial & Industrial Areas	Commercial development along lake shores reduces habitat through bank stabilization/modification and destruction of streamside vegetation, increases disturbance to nesting and foraging loons, and introduces pollutants and trash into lakes from yards, roads, waste storage areas, and access points.
		1.3 Tourism & Recreation	Development of recreation sites along lake shores reduces habitat through bank stabilization/modification and destruction of streamside vegetation, increases disturbance to nesting and foraging loons, and increases the introduction of pollutants and trash into lakes from campgrounds, boat ramps, roads, waste storage areas, and associated recreational activities.

		5.4 Fishing & Harvesting Aquatic Resources	Ingestion of lead from fishing tackle causes direct mortality and is believed to be the top source of mortality for adult loons in Montana. Ingestion of fishing hooks and entanglement in discarded fishing line kills individual loons or diminishes their ability to hunt and raise young effectively. Disturbance from opening day for fishing on many lakes coincides with arrival and/or nest initiation.
		6.1 Recreational Activities	Disturbance to nest sites and nursery areas from boaters, floaters, anglers, hikers, campers, bird watchers, photographers, and other recreationists causes nest abandonment or failure. Boat strikes cause direct mortalities of loons.
		8.1 Invasive Non-Native/Alien Plants & Animals	Introduction of aquatic invasive species (e.g., invasive mussels) and plants can reduce or eliminate prey base for loons and increase the risk of botulism outbreaks that cause loon mortalities. Introduction of non-native fish species in lakes used by loons or planting of fish in formerly fishless lakes can reduce or eliminate prey base for loons (e.g., Northern Pike reducing silver salmon in Salmon Lake). Efforts to remove non-native fish for native fish restoration can cause loon mortalities or stress (e.g., gill-netting, piscicides reducing prey base) in the short term, but are generally positive for loon conservation in the long term.
10.4 Financing Conservation	Secure funding to purchase and distribute Avian Influenza test kits across the Common Loon range in Montana, and to pay for testing at the National Wildlife Health Center.	8.4 Pathogens & Microbes	Avian influenza can result in mortality.

Common Tern Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.2 Ecosystem & Natural Process (Re)Creation	Manage (reduce) vegetation at breeding sites to increase habitat availability.	7.2 Dams & Water Management / Use	Altered hydrological regime, and loss of nesting habitat.
2. Species Management			
2.1 Species Stewardship	Create artificial sites for nesting. Exclude predators (night herons and gulls) and displace gulls from breeding sites. Refrain from recommending or using lethal gull control, as it has shown mixed results.	7.2 Dams & Water Management / Use	Altered hydrological regime, and loss of nesting habitat.
2.1 Species Stewardship	Exclude gulls (native species) from nesting areas, but do not recommend gull/predator control.	8.2 Problematic Native Plants & Animals	Displacement of Caspian Terns at breeding sites by more common gulls can reduce reproduction.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Install educational signs to convey the sensitivity of nest sites.	7.2 Dams & Water Management / Use	Altered hydrological regime, and loss of nesting habitat.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	During FWP review of projects, recommend the maintenance of buffer zones to block siltation, pesticide, and fertilizer run-off.	7.3 Other Ecosystem Modifications	Wetland pollution (organochlorines, metals, selenium) degrades habitat and food resources.
4.3 Non-Criminal Legal Action	Through the agency review process of projects, identify opportunities to protect wetlands.	7.2 Dams & Water Management / Use	Altered hydrological regime, and loss of nesting habitat.
C. Enabling Conditions Actions			

7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Propose or implement regulations on pollutants such as organochlorines, and selenium.	7.3 Other Ecosystem Modifications	Wetland pollution (organochlorines, metals, selenium) degrades habitat and food resources.

Ferruginous Hawk Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Create an incentive program and work with power companies to bury powerlines.	4.2 Utility & Service Lines	Collision with power lines and cellphone towers which are increasing across the landscape due to an influx of development.
1.1 Site/Area Stewardship	Implement restrictions during breeding seasons (June 1 to July 15, or March 1 to July 15 to encompass all migratory birds, grouse, etc.).	3.1 Oil & Gas Drilling	Reduction in quantity and quality of connected habitat for grassland bird species.
2. Species Management			
2.1 Species Stewardship	Replace felled nesting trees with nesting platforms.	11.1 Ecosystem Encroachment	Loss of cottonwoods due to climate change and active removal reduced available habitat.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Implement outreach and education campaigns directed at small mammal and mesocarnivore hunters, as exposure in Montana is likely a result of ingesting these	5.1 Hunting & Collecting Terrestrial Animals	The increase in mesopredator populations due to the removal of large predators leads to an increase in nest predations. Persecution by landowners and secondary poisoning (anticoagulants, lead). Young being fed poisoned food

	lead bullets rather than bullets from big-game season. Implement a lead bullet trade-in or offset program.		sources. Possible bioaccumulation with hawks eating meadowlarks.
3.1 Outreach & Communications	Implement outreach, education, and incentive programs to encourage landowners to keep prairie dogs on the landscape. Collaborate with the FWP Prairie Dog Conservation Lease Program and state and federal agencies.	7.3 Other Ecosystem Modifications	Loss of prairie dog colonies due to sylvatic plague and targeted removal. Loss of general prey species like jackrabbits. Possible impacts from rabbit hemorrhagic disease in jackrabbits.
3.1 Outreach & Communications	Increase awareness of ecosystem services provided by grasslands and economic tradeoffs of grassland conversion. Educate consumers on products that support healthy grasslands and people.	2.1 Annual & Perennial Non-Timber Crops	Conversion of grassland and native steppe habitats to row crops decreases the availability of suitable breeding habitat and prey.
3.1 Outreach & Communications	Raise awareness of the ecosystem services grasslands provide and the economic impact of their conversion.	11.3 Changes in Temperature Regimes	Audubon's Survival by Degrees project predicts minor loss of breeding habitat across various warming scenarios (1.5-3C) (MNHP, 2025).
3.1 Outreach & Communications	Work with realtors and developers to provide educational material to new landowners that promote native habitat friendly actions and reduce negative impacts. Work with developers and planning/zoning to consolidate development and allow for large intact areas of native open habitat. Block up development instead of gridding it out.	1.1 Housing & Urban Areas	Land use conversion from traditional rangeland to subdivision and urban development.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Comment on Environmental Assessments requesting consideration of grassland birds in action, mitigation and reclamation plans.	3.2 Mining & Quarrying	Disturbance from construction and daily operations causes localized extirpation and reduces the quantity and quality of continuous habitat.
		3.3 Renewable Energy	Collision with wind turbines and avoidance of disturbed areas, reducing productivity (North Dakota SWAP). This would also apply to habitat loss due to solar development.

5. Livelihood Economic & Moral Incentives			
5.1 Linked Enterprises & Alternative Livelihoods	Develop programs that subsidize sunk and transitional costs (e.g., machinery) to corn and soy growers.	2.1 Annual & Perennial Non-Timber Crops	Conversion of grassland and native steppe habitats to row crops decreases the availability of suitable breeding habitat and prey.
5.2 Better Products & Management Practices	Ensure that operations are undertaken in ways that minimize flaring and avoid unnecessary environmental degradation and conflict. Use multi-bore pads and clustering wells to minimize impact.	3.1 Oil & Gas Drilling	Reduction in quantity and quality of connected habitat for grassland bird species.
5.2 Better Products & Management Practices	Use multi-bore pads and clustering wells to minimize impact.	3.2 Mining & Quarrying	Disturbance from construction and daily operations causes localized extirpation and reduces the quantity and quality of continuous habitat.
5.3 Market-Based Incentives	Develop and/or strengthen incentives and markets for grazing practices that benefit grassland birds. Incentivize farming and ranching that employs best management practices that support grasslands and grassland bird habitat.	2.1 Annual & Perennial Non-Timber Crops	Conversion of grassland and native steppe habitats to row crops decreases the availability of suitable breeding habitat and prey.
5.4 Direct Economic Incentives	Incentivize homeowners and power companies to collocate solar development and promote, endorse, incentivize, and mandate solar roofs on state subsidized buildings.	3.3 Renewable Energy	Collision with wind turbines and avoidance of disturbed areas, reducing productivity (North Dakota SWAP). This would also apply to habitat loss due to solar development.
5.4 Direct Economic Incentives	Use grasslands to sequester carbon and earn carbon credits for land owners.	11.3 Changes in Temperature Regimes	Audubon's Survival by Degrees project predicts minor loss of breeding habitat across various warming scenarios (1.5-3C) (MNHP, 2025).
5.5 Non-Monetary Values	Develop moral and educational outreach emphasizing the negative impacts of lead bullets.	5.1 Hunting & Collecting Terrestrial Animals	The increase in mesopredator populations due to the removal of large predators leads to an increase in nest predations. Persecution by landowners and secondary poisoning (anticoagulants, lead). Young being fed poisoned food sources. Possible bioaccumulation with hawks eating meadowlarks.

C. Enabling Conditions Actions

6. Conservation Designation & Planning

6.4 Conservation Planning	Implement bird or hawk deterrents on powerlines and towers with high mortality rates.	4.2 Utility & Service Lines	Collision with power lines and cellphone towers which are increasing across the landscape due to an influx of development.
6.4 Conservation Planning	Support and implement plague mitigation via vaccination.	7.3 Other Ecosystem Modifications	Loss of prairie dog colonies due to sylvatic plague and targeted removal. Loss of general prey species like jackrabbits. Possible impacts from rabbit hemorrhagic disease in jackrabbits.
6.5 Site Infrastructure	If hawks are present, place artificial nesting platforms surrounding disturbed habitat, providing the option for hawks to remain in the area if prey remains sufficient. Place perching and nesting deterrents on structures to limit human-hawk conflict.	3.2 Mining & Quarrying	Disturbance from construction and daily operations causes localized extirpation and reduces the quantity and quality of continuous habitat.
6.5 Site Infrastructure	Place perching and nesting deterrents on structures to limit human-hawk conflict.	3.1 Oil & Gas Drilling	Reduction in quantity and quality of connected habitat for grassland bird species.

7. Legal & Policy Frameworks

7.1 Laws, Regulations & Codes	Increase effectiveness of grassland lobbying groups.	3.2 Mining & Quarrying	Disturbance from construction and daily operations causes localized extirpation and reduces the quantity and quality of continuous habitat.
		3.3 Renewable Energy	Collision with wind turbines and avoidance of disturbed areas, reducing productivity (North Dakota SWAP). This would also apply to habitat loss due to solar development.
7.1 Laws, Regulations & Codes	Increase the effectiveness of grassland lobbying groups to implement climate legislation that protects grasslands.	11.3 Changes in Temperature Regimes	Audubon's Survival by Degrees project predicts minor loss of breeding habitat across various warming scenarios (1.5-3C) (MNHP, 2025).
7.1 Laws, Regulations & Codes	Use U.S. Farm Bill conservation programs to strengthen, profile, improve, and enhance quality grassland habitat.	2.1 Annual & Perennial Non-Timber Crops	Conversion of grassland and native steppe habitats to row crops decreases the availability of suitable breeding habitat and prey.

10. Institutional Development			
10.2 External Organizational Development & Support	Work with wildlife services to provide incentives to landowners to leave larger predators. Work with APHIS/wildlife damage management to ensure contaminated carcasses are removed so hawks cannot eat them.	5.1 Hunting & Collecting Terrestrial Animals	The increase in mesopredator populations due to the removal of large predators leads to an increase in nest predations.
10.3 Alliance & Partnership Development	Build partnerships with agricultural interests and beef producers to advocate for and incentivize lands kept in grazing.	2.1 Annual & Perennial Non-Timber Crops	Conversion of grassland and native steppe habitats to row crops decreases the availability of suitable breeding habitat and prey.

Flammulated Owl Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Avoid logging operations during the breeding season (May through August).	5.3 Logging & Wood Harvesting	Salvage logging after fires and firewood cutting removes snags used for nesting. New and existing roads concentrate these activities in foothill habitats and more open forested areas. Timber harvest and vegetation management to restore mature and old-growth conditions and/or reduce fuel loads removes potential roost site features and escape cover (e.g., small patches of dense young conifers, trees with mistletoe growths, dense crowns, etc.). Vegetation management and timber harvest in dry Ponderosa Pine and Douglas-fir forest types can remove large-diameter trees, snags, and downed woody debris critical for nesting and foraging.

2. Species Management

2.1 Species Stewardship	Construct nest boxes in rangelands where significant snag removal has occurred and is limiting suitable nest sites. Work on conservation actions for Pileated Woodpeckers, an important nest cavity excavator for Flammulated Owls.	2.3 Livestock Farming & Ranching	Overgrazing in foothill Ponderosa Pine and Douglas-fir forest types introduces or favors invasive plant species that can reduce prey base, require more herbicide use, or result in shifting fire regimes. Removal of dead, dying, and downed trees in foothill rangelands to improve grazing ground removes critical habitat elements for nesting and roosting.
2.1 Species Stewardship	Construct nest boxes on lands where suitable snags and deformed trees for nesting are limited, due to extreme fire events or shifting fire regimes, as a temporary solution until suitable habitat conditions are restored.	7.1 Fire & Fire Suppression	Lack of fire disturbance leads to loss of dry Ponderosa Pine and Douglas-fir forests that consist of widely spaced, large-diameter trees, an open understory, and aspen stands. More frequent fire due to invasive plant species (e.g., Cheatgrass) removes understory shrubs and favors invasive species dominance, degrading habitat. Severely burned foothill forests may not recover to pre-fire conditions in the long-term, with compounding effects of climate change and invasive plant species.
2.1 Species Stewardship	Construct nest boxes on lands where suitable snags and injured trees for nesting are limited, as a temporary solution until suitable habitat conditions are restored. Work on conservation actions for Pileated Woodpeckers to promote robust populations of this keystone species which is an important next cavity excavator for Flammulated Owls.	5.3 Logging & Wood Harvesting	Salvage logging after fires and firewood cutting removes snags used for nesting. New and existing roads concentrate these activities in foothill habitats and more open forested areas. Timber harvest and vegetation management to restore mature and old-growth conditions and/or reduce fuel loads removes potential roost site features and escape cover (e.g., small patches of dense young conifers, trees with mistletoe growths, dense crowns, etc.). Vegetation management and timber harvest in dry Ponderosa Pine and Douglas-fir forest types can remove large-diameter trees, snags, and downed woody debris critical for nesting and foraging.
2.1 Species Stewardship	Work on conservation actions for Pileated Woodpeckers to promote robust populations of this keystone species which is an important next cavity excavator for Flammulated Owls.	8.1 Invasive Non-Native/Alien Plants & Animals	European Starlings compete with owls for nest cavities or compete with primary cavity excavators. Invasion of open, dry Ponderosa Pine and Douglas-fir forests by invasive plants (e.g., Cheatgrass, knapweed, toadflax) degrades habitat for

			prey species and leads to changing fire regimes that can reduce or eliminate habitat in the long-term.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Develop and distribute outreach materials for landowners in developments in or near suitable habitat about the importance of key habitat elements (e.g., snags) and effects of development on favoring invasive species and increasing the presence of corvids.	1.1 Housing & Urban Areas	Encroachment of development into dry Ponderosa Pine and Douglas-fir forest types and removal of dead, downed, and dying trees to “clean up” private property destroys or degrades habitat. Encroachment of development into dry Ponderosa Pine and Douglas-fir forest types increases human-caused sources of mortality (e.g., outdoor cats, European Starlings, corvids, window strikes, vehicle collisions).
3.1 Outreach & Communications	Develop and distribute outreach materials to livestock producers on the importance of dead, dying, and downed trees with an emphasis on dry forest types with large-diameter trees below 5,000 ft elevation.	2.3 Livestock Farming & Ranching	Overgrazing in foothill Ponderosa Pine and Douglas-fir forest types introduces or favors invasive plant species that can reduce prey base, require more herbicide use, or result in shifting fire regimes. Removal of dead, dying, and downed trees in foothill rangelands to improve grazing ground removes critical habitat elements for nesting and roosting.
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners and land managers about alternative options for pest and weed control (e.g., native predators, pheromones, regenerative grazing) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Promote education and enforcement around county and state-level firewood cutting laws to combat removal of important nest trees in dry Ponderosa Pine and Douglas-fir forest types below 5,000 ft elevation.	5.3 Logging & Wood Harvesting	Salvage logging after fires and firewood cutting removes snags used for nesting. New and existing roads concentrate these activities in foothill habitats and more open forested areas. Timber harvest and vegetation management to restore mature and old-growth conditions and/or reduce fuel loads removes potential roost site features and escape cover (e.g., small patches of dense young conifers, trees with mistletoe growths,

			dense crowns, etc.). Vegetation management and timber harvest in dry Ponderosa Pine and Douglas-fir forest types can remove large-diameter trees, snags, and downed woody debris critical for nesting and foraging.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Work with USFS, DNRC, and private landowners on incorporating habitat considerations for this species into their forest planning and vegetation management efforts.	7.1 Fire & Fire Suppression	Lack of fire disturbance leads to loss of dry Ponderosa Pine and Douglas-fir forests that consist of widely spaced, large-diameter trees, an open understory, and aspen stands. More frequent fire due to invasive plant species (e.g., Cheatgrass) removes understory shrubs and favors invasive species dominance, degrading habitat. Severely burned foothill forests may not recover to pre-fire conditions in the long-term, with compounding effects of climate change and invasive plant species.

Forster's Tern Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	During FWP review of projects, recommend the maintenance of buffer zones to block siltation, pesticide, and fertilizer run-off.	7.3 Other Ecosystem Modifications	Wetland eutrophication and pollution degrades habitat and food resources.
4.3 Non-Criminal Legal Action	Through the agency review process of projects, identify opportunities to protect wetlands.	7.2 Dams & Water Management / Use	Altered hydrology through wetland drainage and wetland loss.

Franklin's Gull Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.2 Ecosystem & Natural Process (Re)Creation	Maintain water levels suitable for Franklin Gull nests in large marshes, instead of managing for waterfowl production.	7.2 Dams & Water Management / Use	Altered hydrology through wetland drainage and wetland loss.
B. Behavioral Change/Threat Reduction			
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	During FWP review of projects, recommend the maintenance of buffer zones to block pesticide and fertilizer run-off.	7.3 Other Ecosystem Modifications	Wetland eutrophication and pollution degrades habitat and food resources.
4.3 Non-Criminal Legal Action	Through the agency review process of projects, identify opportunities to protect wetlands.	6.3 Work & Other Activities	Human disturbance from agricultural operations and recreation can cause nest abandonment.
		7.2 Dams & Water Management / Use	Altered hydrology through wetland drainage and wetland loss.

Green-tailed Towhee Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat

A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Reduce lighting at night during migratory periods.	3.1 Oil & Gas Drilling	Development and maintenance of oil and gas infrastructure can lead to habitat loss and fragmentation. Established infrastructure can degrade the habitat quality of the surrounding habitat.
		3.3 Renewable Energy	Development and maintenance of wind and solar farms can lead to habitat loss and fragmentation. Established infrastructure degrades the quality of the surrounding habitat.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate and engage the public in preventing the spread of invasive annual grass species, and encourage reporting to facilitate early detection.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive annual grass species degrade habitat quality, increase fire frequency, and cause habitat loss.
3.1 Outreach & Communications	In areas with intense recreation pressure, install information signs and collaborate with partner agencies to provide programming about responsible recreation.	6.1 Recreational Activities	Increased motorized and non-motorized recreational traffic causes disturbances that impact breeding songbirds.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Consider employing curtailments during intense migration periods to reduce risk of mortality.	3.3 Renewable Energy	Development and maintenance of wind and solar farms can lead to habitat loss and fragmentation. Established infrastructure degrades the quality of the surrounding habitat.
5.2 Better Products & Management Practices	Employ horizontal drilling to reduce the number of roads required.	3.1 Oil & Gas Drilling	Development and maintenance of oil and gas infrastructure can lead to habitat loss and fragmentation. Established infrastructure can degrade the habitat quality of the surrounding habitat.
5.2 Better Products & Management Practices	Implement mitigation strategies, such as perch deterrents and buried lines, to reduce	4.2 Utility & Service Lines	Utility and service lines lead to habitat loss, fragmentation, and habitat degradation in the surrounding area.

	suitability of perching habitat created by service lines.		
5.2 Better Products & Management Practices	Suggest timing restrictions of surface-disturbing actions during sensitive periods such as breeding and nesting, and minimizing disturbance from lights.	3.2 Mining & Quarrying	Development and maintenance of mines and quarry infrastructure leads to habitat loss and fragmentation. Established infrastructure degrades the habitat quality of the surrounding habitat.
C. Enabling Conditions Actions			
10. Institutional Development			
10.3 Alliance & Partnership Development	Collaborate with partner agencies and organizations to promote conservation stewardship programs and conservation-minded grazing programs and practices on private and public lands.	2.3 Livestock Farming & Ranching	Over-utilization from improper grazing management degrades habitat quality. Rangeland improvement projects removing sagebrush and shrub cover causes habitat degradation and loss.
10.3 Alliance & Partnership Development	Collaborate with the local weed districts, partner agencies, and NGOs to coordinate invasive annual grass species management efforts.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive annual grass species degrade habitat quality, increase fire frequency, and cause habitat loss.
10.3 Alliance & Partnership Development	Engage and support partner agencies and NGOs in conservation stewardship programs.	11.3 Changes in Temperature Regimes	Increased temperatures exacerbate fire and invasive species issues and reduce suitable habitat.
		11.4 Changes in Precipitation & Hydrological Regimes	Declines in annual precipitation and increased frequency of large precipitation events can reduce reproductive success.
		2.1 Annual & Perennial Non-Timber Crops	Conversion of sagebrush steppe and shrubland habitats to cropland, causing habitat loss.

Horned Grebe Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Install educational signs to convey the sensitivity of nest sites.	6.3 Work & Other Activities	Sensitive to human disturbance, especially early in breeding.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Through the agency review process of projects, identify opportunities to protect wetlands.	7.2 Dams & Water Management / Use	Altered hydrology through wetland drainage and wetland loss.

LeConte's Sparrow Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Develop and promote economically viable mowing practices that allow young to fledge before hay fields are disturbed (e.g., identify and promote grassland-friendly hay that does not require mowing before mid-July).	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Intensification of hay agriculture and mowing operations during nesting season decreases survivorship, increases nest mortality, predation, and nest abandonment, and decreases site fidelity.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate consumers on products to support healthy grasslands and people.	2.3 Livestock Farming & Ranching	Disturbance of breeding habitat by intensive or overgrazing practices.

		8.1 Invasive Non-Native/Alien Plants & Animals	Invasive and exotic grasses (e.g., Crested Wheatgrass) can replace natural grasslands.
3.1 Outreach & Communications	Increase awareness of ecosystem services provided by grasslands and economic tradeoffs of grassland conversion. Educate consumers on products that support healthy grasslands and people.	3.1 Oil & Gas Drilling	Reduction in quantity and quality of connected habitat for grassland bird species.
		7.1 Fire & Fire Suppression	Suppression of natural fire patterns leads to encroachment of woody vegetation in grassland habitat.
3.1 Outreach & Communications	Raise awareness of the ecosystem services grasslands provide and the economic impact of their conversion.	11.3 Changes in Temperature Regimes	Climate change can lead to a reduction in precipitation and loss of wet grassland habitats. Shifts in bioclimatic envelopes need to be considered in the context of land cover to determine if suitable habitat will be available in the future. Changes in rainfall and storm surge height can cause nest loss and mortality.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Comment on Environmental Assessments requesting consideration of grassland birds in action, mitigation and reclamation plans.	3.1 Oil & Gas Drilling	Reduction in quantity and quality of connected habitat for grassland bird species.
		3.3 Renewable Energy	Wind and solar farm sites can cause direct and indirect fatalities and disturbance.
5. Livelihood Economic & Moral Incentives			
5.1 Linked Enterprises & Alternative Livelihoods	Develop programs that subsidize sunk and transitional costs (e.g., machinery) to corn and soy growers.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Intensification of hay agriculture and mowing operations during nesting season decreases survivorship, increases nest mortality, predation, and nest abandonment, and decreases site fidelity.
5.2 Better Products & Management Practices	Use multi-bore pads and clustering wells to minimize impact. Apply additional restrictions during the breeding season (May to mid-July), like reducing noise levels, disturbances, and drilling.	3.1 Oil & Gas Drilling	Reduction in quantity and quality of connected habitat for grassland bird species.

5.3 Market-Based Incentives	Develop or strengthen incentives and markets for grazing practices that benefit grassland birds. Incentivize farming and ranching that employs best management practices that support grassland birds and their habitat. Develop markets for late-cut hay and provide incentives to farmers and buyers.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Intensification of hay agriculture and mowing operations during nesting season decreases survivorship, increases nest mortality, predation, and nest abandonment, and decreases site fidelity.
5.4 Direct Economic Incentives	Create subsidiary or compensation programs to reimburse farmers for declines in hay value related to delayed mowing, or for taking sub-optimal land out of hay production.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Intensification of hay agriculture and mowing operations during nesting season decreases survivorship, increases nest mortality, predation, and nest abandonment, and decreases site fidelity.
5.4 Direct Economic Incentives	Provide incentives and support to landowners to reduce shrub growth, focusing on the benefit to beef production.	7.1 Fire & Fire Suppression	Suppression of natural fire patterns leads to encroachment of woody vegetation in grassland habitat.
5.4 Direct Economic Incentives	Reward farmers employing best management practices.	2.3 Livestock Farming & Ranching	Disturbance of breeding habitat by intensive or overgrazing practices.
5.4 Direct Economic Incentives	Use conservation lease or habitat lease programs to protect, restore, or improve wetland habitats.	7.2 Dams & Water Management / Use	Farmland conversion and climate change can lead to habitat degradation and drainage/destruction of inland grasslands, marshes, wetlands, and freshwater shorelines.
5.4 Direct Economic Incentives	Use grasslands to sequester carbon and earn carbon credits for land owners.	11.3 Changes in Temperature Regimes	Climate change can lead to a reduction in precipitation and loss of wet grassland habitats. Shifts in bioclimatic envelopes need to be considered in the context of land cover to determine if suitable habitat will be available in the future. Changes in rainfall and storm surge height can cause nest loss and mortality.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Increase effectiveness of grassland lobbying groups.	3.1 Oil & Gas Drilling	Reduction in quantity and quality of connected habitat for grassland bird species.

		3.3 Renewable Energy	Wind and solar farm sites can cause direct and indirect fatalities and disturbance.
		8.1 Invasive Non-Native/Alien Plants & Animals	Invasive and exotic grasses (e.g., Crested Wheatgrass) can replace natural grasslands.
7.1 Laws, Regulations & Codes	Increase the effectiveness of grassland lobbying groups to implement climate legislation that protects grasslands.	11.3 Changes in Temperature Regimes	Climate change can lead to a reduction in precipitation and loss of wet grassland habitats. Shifts in bioclimatic envelopes need to be considered in the context of land cover to determine if suitable habitat will be available in the future. Changes in rainfall and storm surge height can cause nest loss and mortality.
		11.4 Changes in Precipitation & Hydrological Regimes	Changes in annual flooding, periods of drought and precipitation impact the availability of suitable habitat for grassland birds. These effects extend beyond water retaining areas and into upland grasslands.
7.1 Laws, Regulations & Codes	Use U.S. Farm Bill conservation programs to strengthen, profile, improve, and enhance quality grassland habitat.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Intensification of hay agriculture and mowing operations during nesting season decreases survivorship, increases nest mortality, predation, and nest abandonment, and decreases site fidelity.
9. Education & Training			
9.2 Training & Individual Capacity Development	Educate stakeholders and relevant individuals of the effects of pesticides in birds, humans, and the environment.	9.3 Agricultural & Forestry Effluents	Pesticides can impact grassland birds through prey loss or exposure of birds nesting near treated crops. Neonicotinoid pesticides especially may have far reaching effects due to their accumulating properties.
9.2 Training & Individual Capacity Development	Generate awareness among ranching and agricultural stakeholders on the importance of early detection and containment of invasive grasses. Implement citizen science monitoring programs for early identification of invasive grasses. Educate relevant individuals on replacing Crested Wheatgrass	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive and exotic grasses (e.g., Crested Wheatgrass) can replace natural grasslands.

	with better, native alternatives. Communicate across entities about the benefits of native seeds over invasives.		
10. Institutional Development			
10.2 External Organizational Development & Support	Work with wildlife services in areas without predator control guidelines and provide incentives to landowners to leave larger predators.	5.1 Hunting & Collecting Terrestrial Animals	The increase in mesopredator populations due to the removal of large predators leads to an increase in nest predations.
10.3 Alliance & Partnership Development	Build partnerships with agricultural interests and beef producers to advocate for and incentivize lands kept in grazing.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Intensification of hay agriculture and mowing operations during nesting season decreases survivorship, increases nest mortality, predation, and nest abandonment, and decreases site fidelity.
10.3 Alliance & Partnership Development	Foster relationships and exchanges between grassland conservation entities and agricultural stakeholders.	2.3 Livestock Farming & Ranching	Disturbance of breeding habitat by intensive or overgrazing practices.
		9.3 Agricultural & Forestry Effluents	Pesticides can impact grassland birds through prey loss or exposure of birds nesting near treated crops. Neonicotinoid pesticides especially may have far reaching effects due to their accumulating properties.
10.3 Alliance & Partnership Development	Raise awareness and promote economic incentives, easements, and lease options associated with preservation of grassland habitat.	7.2 Dams & Water Management / Use	Farmland conversion and climate change can lead to habitat degradation and drainage/destruction of inland grasslands, marshes, wetlands, and freshwater shorelines.

Loggerhead Shrike Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			

1. Land/Water Protection			
1.1 Site/Area Stewardship	Limit construction and disturbance during grassland bird breeding, nesting, and brood-rearing season (April 1- July 15), keep noise levels < 49 dBA during the breeding season, and ensure sites and surroundings are reclaimed back to native grassland habitat post-construction.	3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Provide signage on public lands indicating no off-road travel. Conduct outreach campaigns to clean and dry recreational machines before and after use to minimize the spread of non-native species. Increase enforcement on public lands to ensure signage and recreational rules are being met.	6.1 Recreational Activities	ATV/UTV recreational use causes degradation of grassland habitats by impacting vegetation and soil, spreading non-native vegetation, potentially driving over nests. Human activities and noise may interfere with nesting, foraging, and brood-rearing.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Provide agency comments and review of potential new transmission line builds to mitigate pre/post construction effects and ensure species and habitats of concern are considered.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.
4.3 Non-Criminal Legal Action	Reduce permitting of new dams, reservoirs, and other water impoundments in important grassland bird habitat, except where livestock cannot access water from other sources (e.g., groundwater, rural water systems).	7.2 Dams & Water Management / Use	Disruption of natural hydrological processes (e.g., artificial dam construction, loss of beavers) that impact function of ephemeral or perennial prairie streams and floodplains can degrade habitat.

4.3 Non-Criminal Legal Action	Through the agency review process of new road and railroad construction, provide recommendations to mitigate effects and ensure species and habitats of concern are considered.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
4.3 Non-Criminal Legal Action	Through the agency, provide project-specific comments and recommendations to companies to mitigate pre- and post-construction effects and ensure that species of concern are considered.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
4.3 Non-Criminal Legal Action	Through the agency, provide project-specific comments and recommendations to development companies to mitigate pre- and post-construction effects and ensure species and habitats of concern are considered. Consult FWP's Crucial Areas Planning System (CAPS) and other sites such as Montana Natural Heritage Program for indications of species of concern.	1.1 Housing & Urban Areas	Housing development in core grassland habitat will decrease breeding habitat via fragmentation and conversion, including destruction of native vegetation, installation of vertical structures avoided by grassland birds, introduction or expansion of meso-predators and human commensal species (e.g., cats, crows, raccoons), noise disturbance, and increase of non-native plant species.
5. Livelihood Economic & Moral Incentives			
5.1 Linked Enterprises & Alternative Livelihoods	Incentivize ranching over farming.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.2 Better Products & Management Practices	Manage wireless technology by constructing shorter cellular towers or reducing reliance	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and

	on cell towers (i.e., move towards satellite or other alternatives).		loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.
5.2 Better Products & Management Practices	Provide information to landowners about management practices that minimize negative effects on grassland bird nesting success. Mow fields after July 15 so nestlings can fledge. Seed fields early, before May 10 to limit nest destruction by machinery. Minimize tillage and use of pesticides and herbicides.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.3 Market-Based Incentives	Incentivize meat and fiber produced on properties with a grazing management plan compatible with grassland bird habitat.	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.
5.3 Market-Based Incentives	Promote the value of agriculture products produced while stewarding grassland, such as beef, bison and fiber.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.4 Direct Economic Incentives	Compensate livestock producers when production goals and wildlife habitat goals do not align (e.g., resting and heavy grazing).	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.
5.4 Direct Economic Incentives	Incentivize ranching over farming.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.5 Non-Monetary Values	Convey the link between conservation and the effects of a changing climate on human health and populations.	11.3 Changes in Temperature Regimes	Changes in temperature can lengthen growing seasons, increase non-native vegetation monocultures, and impact the timing of the breeding season of grassland birds and cause their range to expand or contract. Hotter/drier summers can lead to droughts. Cooler temperatures can promote additional biomass growth throughout grasslands.
		11.4 Changes in Precipitation & Hydrological Regimes	Increased precipitation in the spring could increase non-native vegetation monocultures (Cheatgrass, Sweetclover, Kentucky Bluegrass, Smooth Brome) and woody vegetation

			expansion. Low moisture could impact prey populations for grassland birds. High moisture could promote cropland expansion.
		11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
5.5 Non-Monetary Values	Educating the public on the importance of minimal disturbance and the impacts of habitat destruction on grassland birds.	6.1 Recreational Activities	ATV/UTV recreational use causes degradation of grassland habitats by impacting vegetation and soil, spreading non-native vegetation, potentially driving over nests. Human activities and noise may interfere with nesting, foraging, and brood-rearing.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Identify areas of highest population densities and quality habitat for focused conservation attention. Prioritize conservation needs as projects/development are proposed.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Maintain strong adherence to the Montana Environmental Policy Act (MEPA).	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.

		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
7.1 Laws, Regulations & Codes	Pass laws/bills to minimize the use of pesticides, particularly insecticides including neonicotinoid seed treatments. Make highly toxic pesticides illegal.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
7.1 Laws, Regulations & Codes	Promote native vegetation seeding and prohibit persistent non-native species seeding during reclamation or restoration (e.g., along roadsides, energy production).	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
7.1 Laws, Regulations & Codes	Re-seed with native species only, without persistent non-native species. Restrict the construction of new roads and railroads (especially elevated roads) in grassland bird habitat. Apply Migratory Bird Treaty Act timing restrictions for construction in core habitat of ground-nesting bird species.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
7.1 Laws, Regulations & Codes	Reduce disparity in subsidies between annual cropland and grass-based agriculture. Implement policies that better mitigate risk for ranching operations.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
7.1 Laws, Regulations & Codes	Restrict construction of new utility and service lines. Require seeding of native vegetation, without persistent non-native	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines

	species, at all utility installation sites, including waterlines.		affects survival due to collisions during migration and by increasing predator perching sites.
7.1 Laws, Regulations & Codes	Support science-based laws and bills to address climate change.	11.3 Changes in Temperature Regimes	Changes in temperature can lengthen growing seasons, increase non-native vegetation monocultures, and impact the timing of the breeding season of grassland birds and cause their range to expand or contract. Hotter/drier summers can lead to droughts. Cooler temperatures can promote additional biomass growth throughout grasslands.
		11.4 Changes in Precipitation & Hydrological Regimes	Increased precipitation in the spring could increase non-native vegetation monocultures (Cheatgrass, Sweetclover, Kentucky Bluegrass, Smooth Brome) and woody vegetation expansion. Low moisture could impact prey populations for grassland birds. High moisture could promote cropland expansion.
		11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
7.2 Policies & Guidelines	Reduce disparity in subsidies between annual cropland and grass-based agriculture. Implement policies that better mitigate risk for ranching operations.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
9. Education & Training			
9.2 Training & Individual Capacity Development	Increase agencies' and public awareness of the threat posed by non-native vegetation to grassland species and habitats.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
9.2 Training & Individual Capacity Development	Provide technical assistance and information to landowners about woody vegetation encroachment and management guides.	8.2 Problematic Native Plants & Animals	Encroachment of native woody vegetation (Rocky Mountain Juniper, Ponderosa Pine) results in a complete loss of habitat for most grassland songbirds.

9.2 Training & Individual Capacity Development	Provide technical assistance to landowners through incentive programs and workshops. Support rancher-led organizations such as the Ranchers Stewardship Alliance.	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.
9.2 Training & Individual Capacity Development	Provide trainings and information to stakeholders and agencies on pesticide use and effects on grassland birds.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
9.2 Training & Individual Capacity Development	Providing office and in-field trainings for agency personnel and workshops to landowners about prescribed fire management.	7.1 Fire & Fire Suppression	Altered fire regimes and fire suppression leading to high intensity fires reduces local breeding densities and leads to encroachment of woody vegetation in grassland habitat.
10. Institutional Development			
10.3 Alliance & Partnership Development	Proactively improve and increase partnerships with pesticide applicators to ensure that the methods and products used are the best available for wildlife and habitats.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
10.3 Alliance & Partnership Development	Work proactively with oil and gas contractors and companies to ensure best methods for wildlife and habitats are incorporated.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
10.3 Alliance & Partnership Development	Work proactively with renewable energy contractors and companies to ensure best methods for wildlife and habitats are incorporated.	3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
10.3 Alliance & Partnership Development	Work proactively with road and railroad contractors and companies to ensure best methods for wildlife and habitats are incorporated.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
10.3 Alliance & Partnership Development	Work proactively with utility and service line contractors and companies to ensure best	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines

	methods for wildlife and habitats are incorporated.		affects survival due to collisions during migration and by increasing predator perching sites.
10.3 Alliance & Partnership Development	Work with ranching communities, agricultural extensions, and universities to find and share common solutions.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
10.4 Financing Conservation	Promote incentive programs for landowners to manage non-native species. Create available funding for district/city weed managers.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.

Long-billed Curlew Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Prioritize decommissioning nonessential roads on state and federal property wherever possible, as this minimizes access to opportunistic or intentional illegal shooting. Restrict/redirect/reduce access to target shooting, including shooting of rodents and mesocarnivores, on public lands in spring and summer to reduce opportunistic illegal shooting.	5.1 Hunting & Collecting Terrestrial Animals	Illegal shooting.

1.1 Site/Area Stewardship	Work with farmers and ranchers to reduce herbicide and pesticide use on grasslands and near water where application results in reduction of invertebrates (either terrestrial, marine, or freshwater) or berries used for food. Avoid widespread pesticide applications aimed at controlling grasshopper outbreaks.	9.3 Agricultural & Forestry Effluents	Pesticide and herbicide use.
1.1 Site/Area Stewardship	Work with farmers to complete haying, harvest, tilling, and other field crop activities in a timely manner to minimize nest destruction (April-May) and minimize stress for brooding adults.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland. Early or frequent pasture and hayfield cutting (nest destruction). Intensive agricultural operations. Loss of compatible CRP lands. Poor quality CRP lands. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.
1.1 Site/Area Stewardship	Work with ranchers on rotational burning, mowing, grazing, and maintaining prairie dogs and prairie dog habitat as appropriate, to create and maintain vegetative diversity in grasslands, meadows, and prairies.	2.3 Livestock Farming & Ranching	Incompatible timing, intensity, or duration of grazing. Alterations to native vegetation. Reduced grass and forb diversity. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.
1.2 Ecosystem & Natural Process (Re)Creation	Work with landowners to graze or move cattle between pastures in a biologically and seasonally appropriate manner to provide short vegetation, minimize stress to brooding adults, and minimize nest destruction from April to early June.	2.3 Livestock Farming & Ranching	Incompatible timing, intensity, or duration of grazing. Alterations to native vegetation. Reduced grass and forb diversity. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Through conservation organizations and social, print, and televised media, educate agricultural producers on the species' basic	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland. Early or frequent pasture and hayfield cutting (nest destruction). Intensive agricultural operations. Loss of compatible CRP lands. Poor quality CRP lands. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.

	ecology, nesting behaviors, and breeding behaviors.	2.3 Livestock Farming & Ranching	Incompatible timing, intensity, or duration of grazing. Alterations to native vegetation. Reduced grass and forb diversity. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.
		5.1 Hunting & Collecting Terrestrial Animals	Illegal shooting.
5. Livelihood Economic & Moral Incentives			
5.3 Market-Based Incentives	Continue to support the market for bird-friendly beef, focusing on maintaining extensive areas of unplowed prairie grasslands while also including crops tied to beef agriculture, such as alfalfa and other hay crops.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland. Early or frequent pasture and hayfield cutting (nest destruction). Intensive agricultural operations. Loss of compatible CRP lands. Poor quality CRP lands. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.
		2.3 Livestock Farming & Ranching	Incompatible timing, intensity, or duration of grazing. Alterations to native vegetation. Reduced grass and forb diversity. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.
5.4 Direct Economic Incentives	Create tax incentives to promote conservation actions for livestock raised in bird friendly conditions, such as NRCS cost share programs and CRP. Encourage landowners to work with programs that provide technical and financial assistance to develop fish and wildlife habitat on private lands.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland. Early or frequent pasture and hayfield cutting (nest destruction). Intensive agricultural operations. Loss of compatible CRP lands. Poor quality CRP lands. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.
		2.3 Livestock Farming & Ranching	Incompatible timing, intensity, or duration of grazing. Alterations to native vegetation. Reduced grass and forb diversity. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Support ballot initiatives to fund conservation programs and establish native prairie protection by supporting 'country of origin' labeling legislation.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland. Early or frequent pasture and hayfield cutting (nest destruction). Intensive agricultural operations. Loss of compatible CRP lands. Poor quality CRP lands. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.

		2.3 Livestock Farming & Ranching	Incompatible timing, intensity, or duration of grazing. Alterations to native vegetation. Reduced grass and forb diversity. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.
7.2 Policies & Guidelines	Create stipulations for public lands, and potentially with local/state governments and the private sector, to bury existing electrical transmission lines, require future lines to be buried, minimize construction of new roads, decommission unneeded roads, and perform work outside of the breeding season (April 1- July 15).	1.1 Housing & Urban Areas	Housing, urban, and ex-urban development, hospitals, and schools. Hobby livestock and domestic sheep and goats associated with exurban development.
		3.1 Oil & Gas Drilling	Alterations to native vegetation. Alterations to animal communities (predator/prey relationships). Fragmentation of native habitat due to energy infrastructure.
		3.3 Renewable Energy	Renewable energy operations and associated impacts degrade habitat through direct destruction (e.g., sagebrush clearing) and through disturbance (e.g., lights and traffic near nests and leks, need for towers and powerlines, fencing).
9. Education & Training			
9.1 Formal Education	Work with universities to establish a curriculum of required credits in conservation for college students seeking a degree in agriculture. Introduce conservation stewardship importance to future generations of agricultural producers and foster greater cooperation with wildlife managers/researchers.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland. Early or frequent pasture and hayfield cutting (nest destruction). Intensive agricultural operations. Loss of compatible CRP lands. Poor quality CRP lands. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.
		2.3 Livestock Farming & Ranching	Incompatible timing, intensity, or duration of grazing. Alterations to native vegetation. Reduced grass and forb diversity. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.
9.2 Training & Individual Capacity Development	Host workshops on the use of conservation tools for interested agriculture producers.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland. Early or frequent pasture and hayfield cutting (nest destruction). Intensive agricultural operations. Loss of compatible CRP lands. Poor quality CRP lands. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.
		2.3 Livestock Farming & Ranching	Incompatible timing, intensity, or duration of grazing. Alterations to native vegetation. Reduced grass and forb diversity. Loss of prairie dogs and prairie dog habitat. Pesticide/herbicide use.

10. Institutional Development			
10.1 Internal Organizational Management & Administration	Hire additional enforcement personnel for conservation agencies (e.g., FWP, BLM, USFS).	5.1 Hunting & Collecting Terrestrial Animals	Illegal shooting.

Nelson's Sparrow Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Develop and promote economically viable mowing practices that allow young to fledge before hay fields are disturbed (e.g., identify and promote grassland-friendly hay that does not require mowing before mid-July).	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Intensification of hay agriculture and mowing operations during nesting season decreases survivorship, increases nest mortality, predation, and nest abandonment, and decreases site fidelity.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate consumers on products to support healthy grasslands and people.	11.4 Changes in Precipitation & Hydrological Regimes	Changes in annual flooding, periods of drought and precipitation impact the availability of suitable habitat for grassland birds. These effects extend beyond water retaining areas and into upland grasslands.
		2.3 Livestock Farming & Ranching	Disturbance of breeding habitat by intensive or overgrazing practices.
3.1 Outreach & Communications	Increase awareness of ecosystem services provided by grasslands and economic	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Intensification of hay agriculture and mowing operations

	tradeoffs of grassland conversion. Educate consumers on products that support healthy grasslands and people.		during nesting season decreases survivorship, increases nest mortality, predation, and nest abandonment, and decreases site fidelity.
3.1 Outreach & Communications	Raise awareness of the ecosystem services grasslands provide and the economic impact of their conversion.	11.3 Changes in Temperature Regimes	Climate change can lead to a reduction in precipitation and loss of wet grassland habitats. Shifts in bioclimatic envelopes need to be considered in the context of land cover to determine if suitable habitat will be available in the future. Changes in rainfall and storm surge height can cause nest loss and mortality.
4. Law Enforcement & Prosecution			
4.3 Non-criminal Legal Action	Comment on Environmental Assessments requesting consideration of grassland birds in action, mitigation and reclamation plans.	3.1 Oil & Gas Drilling	Noise and other disturbances from infrastructure can decrease habitat connectivity and suitability for grassland bird species.
4.3 Non-Criminal Legal Action	Comment on Environmental Assessments requesting consideration of grassland birds in action, mitigation and reclamation plans.	3.3 Renewable Energy	Wind and solar farm sites can cause direct and indirect fatalities and disturbance, including collisions, construction noise and disturbance, lay down yards, and roads.
5. Livelihood Economic & Moral Incentives			
5.1 Linked Enterprises & Alternative Livelihoods	Develop programs that subsidize sunk and transitional costs (e.g., machinery) to corn and soy growers.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Intensification of hay agriculture and mowing operations during nesting season decreases survivorship, increases nest mortality, predation, and nest abandonment, and decreases site fidelity.
5.2 Better Products & Management Practices	Use multi-bore pads and clustering wells to minimize impact. Apply additional restrictions during the breeding season (May to mid-July), like reducing noise levels, disturbances, and drilling.	3.1 Oil & Gas Drilling	Noise and other disturbances from infrastructure can decrease habitat connectivity and suitability for grassland bird species.
5.3 Market-Based Incentives	Develop or strengthen incentives and markets for grazing practices that benefit grassland birds. Incentivize farming and ranching that employs best management	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Intensification of hay agriculture and mowing operations during nesting season decreases survivorship, increases nest

	practices that support grassland birds and their habitat. Develop markets for late-cut hay and provide incentives to farmers and buyers.		mortality, predation, and nest abandonment, and decreases site fidelity.
5.4 Direct Economic Incentives	Create subsidiary or compensation programs to reimburse farmers for declines in hay value related to delayed mowing, or for taking sub-optimal land out of hay production.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Intensification of hay agriculture and mowing operations during nesting season decreases survivorship, increases nest mortality, predation, and nest abandonment, and decreases site fidelity.
5.4 Direct Economic Incentives	Provide incentives and support to landowners to reduce shrub growth, focusing on the benefit to beef production.	7.1 Fire & Fire Suppression	Altered fire regimes and fire suppression leading to high intensity fires reduces local breeding densities and leads to encroachment of woody vegetation in grassland habitat.
5.4 Direct Economic Incentives	Reward farmers employing best management practices.	2.3 Livestock Farming & Ranching	Disturbance of breeding habitat by intensive or overgrazing practices.
5.4 Direct Economic Incentives	Use conservation lease or habitat lease programs to protect, restore, or improve wetland habitats.	7.2 Dams & Water Management / Use	Farmland conversion can lead to habitat degradation and drainage/destruction of inland grasslands, marshes, wetlands, and freshwater shorelines.
5.4 Direct Economic Incentives	Use grasslands to sequester carbon and earn carbon credits for land owners.	11.3 Changes in Temperature Regimes	Climate change can lead to a reduction in precipitation and loss of wet grassland habitats. Shifts in bioclimatic envelopes need to be considered in the context of land cover to determine if suitable habitat will be available in the future. Changes in rainfall and storm surge height can cause nest loss and mortality.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Increase effectiveness of grassland lobbying groups.	3.1 Oil & Gas Drilling	Noise and other disturbances from infrastructure can decrease habitat connectivity and suitability for grassland bird species.
		3.3 Renewable Energy	Wind and solar farm sites can cause direct and indirect fatalities and disturbance, including collisions, construction noise and disturbance, lay down yards, and roads.

7.1 Laws, Regulations & Codes	Increase the effectiveness of grassland lobbying groups to implement climate legislation that protects grasslands.	11.3 Changes in Temperature Regimes	Climate change can lead to a reduction in precipitation and loss of wet grassland habitats. Shifts in bioclimatic envelopes need to be considered in the context of land cover to determine if suitable habitat will be available in the future. Changes in rainfall and storm surge height can cause nest loss and mortality.
		11.4 Changes in Precipitation & Hydrological Regimes	Changes in annual flooding, periods of drought and precipitation impact the availability of suitable habitat for grassland birds. These effects extend beyond water retaining areas and into upland grasslands.
7.1 Laws, Regulations & Codes	Use U.S. Farm Bill conservation programs to strengthen, profile, improve, and enhance quality grassland habitat.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Intensification of hay agriculture and mowing operations during nesting season decreases survivorship, increases nest mortality, predation, and nest abandonment, and decreases site fidelity.
9. Education & Training			
9.2 Training & Individual Capacity Development	Educate stakeholders and relevant individuals of the effects of pesticides in birds, humans, and the environment.	9.3 Agricultural & Forestry Effluents	Pesticides can impact grassland birds through prey loss or exposure of birds nesting near treated crops. Neonicotinoid pesticides especially may have far reaching effects due to their accumulating properties.
9.2 Training & Individual Capacity Development	Generate awareness among ranching and agricultural stakeholders on the importance of early detection and containment of invasive grasses. Implement citizen science monitoring programs for early identification of invasive grasses. Educate relevant individuals on replacing Crested Wheatgrass with better, native alternatives. Communicate across entities about the benefits of native seeds over invasives.	11.4 Changes in Precipitation & Hydrological Regimes	Changes in annual flooding, periods of drought and precipitation impact the availability of suitable habitat for grassland birds. These effects extend beyond water retaining areas and into upland grasslands.
10. Institutional Development			

10.2 External Organizational Development & Support	Work with wildlife services in areas without predator control guidelines and provide incentives to landowners to leave larger predators.	5.1 Hunting & Collecting Terrestrial Animals	The increase in mesopredator populations due to the removal of large predators leads to an increase in nest predations.
10.3 Alliance & Partnership Development	Build partnerships with agricultural interests and beef producers to advocate for and incentivize lands kept in grazing.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Intensification of hay agriculture and mowing operations during nesting season decreases survivorship and increases nest mortality, predation, nest abandonment, and decreased site fidelity.
10.3 Alliance & Partnership Development	Foster relationships and exchanges between grassland conservation entities and agricultural stakeholders.	2.3 Livestock Farming & Ranching	Disturbance of breeding habitat by intensive or overgrazing practices.
		9.3 Agricultural & Forestry Effluents	Pesticides can impact grassland birds through prey loss or exposure of birds nesting near treated crops. Neonicotinoid pesticides especially may have far reaching effects due to their accumulating properties.
10.3 Alliance & Partnership Development	Raise awareness and promote economic incentives, easements, and lease options.	7.2 Dams & Water Management / Use	Farmland conversion can lead to habitat degradation and drainage/destruction of inland grasslands, marshes, wetlands, and freshwater shorelines.

Red-headed Woodpecker Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Develop and distribute educational materials and best management practices when administering firewood permits, focused on	4.1 Roads & Railroads	Roads, railroads, and other transportation infrastructure running along or through floodplains constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests. Roads used to access forested

	discouraging cutting of burned, dead, and dying large-diameter trees.		areas can increase snag and snag recruit removal for use as firewood.
3.1 Outreach & Communications	Develop and distribute educational materials and best management practices when administering firewood permits, focused on discouraging cutting of trees >9 inches DBH and avoiding Western Larch, Black Cottonwood, Aspen, and Ponderosa Pine.	5.3 Logging & Wood Harvesting	Post-fire salvage logging removes nesting and forage trees. Encroachment of trees into open savannah habitat may reduce habitat quality. Removal of dead and dying cottonwood trees in riparian habitats eliminates nest structures.
3.1 Outreach & Communications	Develop and distribute educational materials to livestock producers in forested areas and river bottoms with large-diameter trees, about the importance of those trees to nesting and foraging woodpeckers and other species.	2.3 Livestock Farming & Ranching	Removal of injured, dead, and dying large-diameter trees on private properties to maintain open rangelands removes important nesting and foraging trees. Overgrazing of riparian areas can limit establishment and growth of cottonwood trees used for nesting and foraging.
3.1 Outreach & Communications	Develop and distribute educational materials to new and existing landowners in forested areas and river bottoms with large-diameter trees, about the importance of those trees to nesting and foraging woodpeckers and other species.	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees and dead branches on private properties in river bottoms and in forested areas removes important nest trees and foraging resources.
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners and land managers about alternative options for pest and weed control (e.g., native predators, regenerative grazing, biocontrol, mechanical removal) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Strengthen and promote enforcement of state and county laws and regulations around removal and manipulation of riparian	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood

	vegetation in floodplains by private landowners, and encourage reporting and remedy of violations.		forests important for this species. Removal of injured, dead, and dying large-diameter trees and dead branches on private properties in river bottoms and in forested areas removes important nest trees and foraging resources.
4.1 Detection & Arrest	Strengthen and promote enforcement of state and county laws and regulations around removal and manipulation of riparian vegetation in floodplains.	2.3 Livestock Farming & Ranching	Removal of injured, dead, and dying large-diameter trees on private properties to maintain open rangelands removes important nesting and foraging trees. Overgrazing of riparian areas can limit establishment and growth of cottonwood trees used for nesting and foraging.
		4.1 Roads & Railroads	Roads, railroads, and other transportation infrastructure running along or through floodplains constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests. Roads used to access forested areas can increase snag and snag recruit removal for use as firewood.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Promote increasing fines for violations of streamside protection laws so that fines do not become a 'fee' for vegetation removal/disturbance.	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees and dead branches on private properties in river bottoms and in forested areas removes important nest trees and foraging resources.
		2.3 Livestock Farming & Ranching	Removal of injured, dead, and dying large-diameter trees on private properties to maintain open rangelands removes important nesting and foraging trees. Overgrazing of riparian areas can limit establishment and growth of cottonwood trees used for nesting and foraging.
9. Education & Training			

9.2 Training & Individual Capacity Development	Develop a document that provides best management practices for timber in mature and old-growth stands, with a focus on maintaining important patch sizes and habitat features for Species of Greatest Conservation Need dependent on old-growth stands. Facilitate communication on vegetation management between foresters and biologists by developing a document with common terms used in forest management and in descriptions of biological needs of forest-dependent Species of Greatest Conservation Need.	5.3 Logging & Wood Harvesting	Post-fire salvage logging removes nesting and forage trees. Encroachment of trees into open savanna habitat may reduce habitat quality. Removal of dead and dying cottonwood trees in riparian habitats eliminates nest structures.
10. Institutional Development			
10.3 Alliance & Partnership Development	Encourage landowners with forested areas on their properties to engage with DNRC's Forest Stewardship Program to responsibly manage their forests.	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees and dead branches on private properties in river bottoms and in forested areas removes important nest trees and foraging resources.
		5.3 Logging & Wood Harvesting	Post-fire salvage logging removes nesting and forage trees. Encroachment of trees into open savannah habitat may reduce habitat quality. Removal of dead and dying cottonwood trees in riparian habitats eliminates nest structures.

Sage Thrasher Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Reduce lighting at night during migratory periods.	3.1 Oil & Gas Drilling	Development and maintenance of oil and gas infrastructure can lead to habitat loss and fragmentation. Established infrastructure can degrade the habitat quality of the surrounding habitat.
		3.3 Renewable Energy	Development and maintenance of wind and solar farms can lead to habitat loss and fragmentation. Established infrastructure degrades the quality of the surrounding habitat.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate and engage the public in preventing the spread of invasive species, and encourage reporting to facilitate early detection.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive annual grass species degrade habitat quality, increase fire frequency, and cause habitat loss.
3.1 Outreach & Communications	In areas with intense recreation pressure, install information signs and collaborate with partner agencies to provide programming about responsible recreation.	6.1 Recreational Activities	Increased motorized and non-motorized recreational traffic causes disturbances that impact breeding songbirds.
3.1 Outreach & Communications	Inform landowners of the benefits of conifer removal and engage the public in active conifer management efforts.	7.1 Fire & Fire Suppression	Fire suppression has allowed for conifer encroachment into higher-elevation sagebrush habitat. Fire suppression has resulted in a current fire regime characterized by intense fires that cause loss of low-elevation sagebrush habitat.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Consider employing curtailments during intense migration periods to reduce risk of mortality.	3.3 Renewable Energy	Development and maintenance of wind and solar farms can lead to habitat loss and fragmentation. Established infrastructure degrades the quality of the surrounding habitat.

5.2 Better Products & Management Practices	Employ horizontal drilling to reduce the number of roads required.	3.1 Oil & Gas Drilling	Development and maintenance of oil and gas infrastructure can lead to habitat loss and fragmentation. Established infrastructure can degrade the habitat quality of the surrounding habitat.
5.2 Better Products & Management Practices	Implement mitigation strategies, such as perch deterrents and buried lines, to reduce suitability of perching habitat created by service lines.	4.2 Utility & Service Lines	Utility and service lines lead to habitat loss, fragmentation, and habitat degradation in the surrounding area.
5.2 Better Products & Management Practices	Suggest timing restrictions of surface-disturbing actions during sensitive periods such as breeding and nesting, and minimizing disturbance from lights.	3.2 Mining & Quarrying	Development and maintenance of mines and quarry infrastructure leads to habitat loss and fragmentation. Established infrastructure degrades the habitat quality of the surrounding habitat.
C. Enabling Conditions Actions			
10. Institutional Development			
10.3 Alliance & Partnership Development	Collaborate with partner agencies and organizations to promote conservation stewardship programs and conservation-minded grazing programs and practices on private and public lands.	2.3 Livestock Farming & Ranching	Over-utilization from improper grazing management degrades habitat quality. Rangeland improvement projects removing sagebrush causes habitat degradation and loss.
10.3 Alliance & Partnership Development	Collaborate with the local weed districts, partner agencies, and NGOs to coordinate invasive species management efforts.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive annual grass species degrade habitat quality, increase fire frequency, and cause habitat loss.
10.3 Alliance & Partnership Development	Continue to support and participate in collaborative efforts with partner agencies and organizations to employ conifer encroachment mitigation efforts.	7.1 Fire & Fire Suppression	Fire suppression has allowed for conifer encroachment into higher-elevation sagebrush habitat. Fire suppression has resulted in a current fire regime characterized by intense fires that cause loss of low-elevation sagebrush habitat.
10.3 Alliance & Partnership Development	Engage and support partner agencies and NGOs in conservation stewardship programs.	11.3 Changes in Temperature Regimes	Increased temperatures exacerbate fire and invasive species issues and reduce suitable habitat.
		11.4 Changes in Precipitation & Hydrological Regimes	Declines in annual precipitation and increased frequency of large precipitation events can reduce reproductive success.

		2.1 Annual & Perennial Non-Timber Crops	Conversion of sagebrush steppe habitat to cropland, causing habitat loss.

Sagebrush Sparrow Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Reduce lighting at night during migratory periods.	3.1 Oil & Gas Drilling	Development and maintenance of oil and gas infrastructure can lead to habitat loss and fragmentation. Established infrastructure can degrade the habitat quality of the surrounding habitat.
		3.3 Renewable Energy	Development and maintenance of wind and solar farms can lead to habitat loss and fragmentation. Established infrastructure degrades the quality of the surrounding habitat.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate and engage the public in preventing the spread of invasive species, and encourage reporting to facilitate early detection.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive annual grass species degrade habitat quality, increase fire frequency, and cause habitat loss.
3.1 Outreach & Communications	In areas with intense recreation pressure, install information signs and collaborate with partner agencies to provide programming about responsible recreation.	6.1 Recreational Activities	Increased motorized and non-motorized recreational traffic causes disturbances that impact breeding songbirds.

3.1 Outreach & Communications	Inform landowners of the benefits of conifer removal and engage the public in active conifer management efforts.	7.1 Fire & Fire Suppression	Fire suppression has allowed for conifer encroachment into higher-elevation sagebrush habitat. Fire suppression has resulted in a current fire regime characterized by intense fires that cause loss of low-elevation sagebrush habitat.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Consider employing curtailments during intense migration periods to reduce risk of mortality.	3.3 Renewable Energy	Development and maintenance of wind and solar farms can lead to habitat loss and fragmentation. Established infrastructure degrades the quality of the surrounding habitat.
5.2 Better Products & Management Practices	Employ horizontal drilling to reduce the number of roads required.	3.1 Oil & Gas Drilling	Development and maintenance of oil and gas infrastructure can lead to habitat loss and fragmentation. Established infrastructure can degrade the habitat quality of the surrounding habitat.
5.2 Better Products & Management Practices	Implement mitigation strategies, such as perch deterrents and buried lines, to reduce suitability of perching habitat created by service lines.	4.2 Utility & Service Lines	Utility and service lines lead to habitat loss, fragmentation, and habitat degradation in the surrounding area.
5.2 Better Products & Management Practices	Suggest timing restrictions of surface-disturbing actions during sensitive periods such as breeding and nesting, and minimizing disturbance from lights.	3.2 Mining & Quarrying	Development and maintenance of mines and quarry infrastructure leads to habitat loss and fragmentation. Established infrastructure degrades the habitat quality of the surrounding habitat.
C. Enabling Conditions Actions			
10. Institutional Development			
10.3 Alliance & Partnership Development	Collaborate with partner agencies and organizations to promote conservation stewardship programs and conservation-minded grazing programs and practices on private and public lands.	2.3 Livestock Farming & Ranching	Rangeland improvement projects removing sagebrush causes habitat degradation and loss.
10.3 Alliance & Partnership Development	Collaborate with partner agencies and organizations to promote conservation-minded grazing programs and practices on private and public lands. Collaborate with	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive annual grass species degrade habitat quality, increase fire frequency, and cause habitat loss.

	local weed districts, partner agencies, and NGOs to coordinate invasive species management efforts.		
10.3 Alliance & Partnership Development	Continue to support and participate in collaborative efforts with partner agencies and organizations to employ conifer encroachment mitigation efforts.	7.1 Fire & Fire Suppression	Fire suppression has allowed for conifer encroachment into higher-elevation sagebrush habitat. Fire suppression has resulted in a current fire regime characterized by intense fires that cause loss of low-elevation sagebrush habitat.
10.3 Alliance & Partnership Development	Engage and support partner agencies and NGOs in conservation stewardship programs.	11.3 Changes in Temperature Regimes	Increased temperatures exacerbate fire and invasive species issues and reduce suitable habitat.
		11.4 Changes in Precipitation & Hydrological Regimes	Declines in annual precipitation and increased frequency of large precipitation events can reduce reproductive success.
		2.1 Annual & Perennial Non-Timber Crops	Conversion of sagebrush steppe habitat to cropland, causing habitat loss.

Sedge Wren Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Develop and promote economically viable mowing practices that allow young to fledge before hay fields are disturbed (e.g., identify and promote grassland-friendly hay that does not require mowing before mid-July).	2.1 Annual & Perennial Non-Timber Crops	Intensification of hay agriculture and mowing operations.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			

3.1 Outreach & Communications	Educate consumers on products to support healthy grasslands and people.	2.3 Livestock Farming & Ranching	Intensified grazing and overgrazing affects Sedge Wren's ability to find appropriate habitat and decreases nesting density. The loss and draining of wetlands and wet-grass habitats and subsequent conversion to agriculture leads to local population declines.
3.1 Outreach & Communications	Initiate programs to educate the public on the impact of feral and domestic cats to grassland birds.	8.1 Invasive Non-Native/Alien Plants & Animals	Domestic and feral outdoor cats.
3.1 Outreach & Communications	Raise awareness of the ecosystem services grasslands provide and the economic impact of their conversion.	11.3 Changes in Temperature Regimes	Audubon's Survival by Degrees project predicts minor loss of breeding habitat across various warming scenarios (1.5-3C) (MNHP, 2025).
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	In years with extreme weather, incentivize farmers to not cut hay, providing protection for nesting birds (e.g., from hail storms).	11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
5.3 Market-Based Incentives	Develop markets for late-cut hay and provide incentives to farmers and buyers.	2.1 Annual & Perennial Non-Timber Crops	Intensification of hay agriculture and mowing operations.
5.4 Direct Economic Incentives	Create subsidiary or compensation programs to reimburse farmers for declines in hay value related to delayed mowing, or for taking sub-optimal land out of hay production.	2.1 Annual & Perennial Non-Timber Crops	Intensification of hay agriculture and mowing operations.
5.4 Direct Economic Incentives	Reward farmers employing best management practices.	2.3 Livestock Farming & Ranching	Intensified grazing and overgrazing affects Sedge Wren's ability to find appropriate habitat and decreases nesting density. The loss and draining of wetlands and wet-grass habitats and subsequent conversion to agriculture leads to local population declines.
5.4 Direct Economic Incentives	Use grasslands to sequester carbon and earn carbon credits for land owners.	11.3 Changes in Temperature Regimes	Audubon's Survival by Degrees project predicts minor loss of breeding habitat across various warming scenarios (1.5-3C) (MNHP, 2025).
C. Enabling Conditions Actions			

6. Conservation Designation & Planning			
6.4 Conservation Planning	Protect wetlands, particularly sedge meadows and wet meadow habitats, as they support high densities of Sedge Wrens, are particularly vulnerable to urban and agricultural development, and have poor recovery post degradation.	2.3 Livestock Farming & Ranching	Intensified grazing and overgrazing affects Sedge Wren's ability to find appropriate habitat and decreases nesting density. The loss and draining of wetlands and wet-grass habitats and subsequent conversion to agriculture leads to local population declines.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Increase the effectiveness of grassland lobbying groups to implement climate legislation that protects grasslands.	11.3 Changes in Temperature Regimes	Audubon's Survival by Degrees project predicts minor loss of breeding habitat across various warming scenarios (1.5-3C) (MNHP, 2025).
8. Research & Monitoring			
8.1 Basic Research and Status Monitoring	Identify target areas and guidelines for sustainable hay and pasture management.	2.3 Livestock Farming & Ranching	Intensified grazing and overgrazing affects Sedge Wren's ability to find appropriate habitat and decreases nesting density. The loss and draining of wetlands and wet-grass habitats and subsequent conversion to agriculture leads to local population declines.
9. Education & Training			
9.2 Training & Individual Capacity Development	Educate stakeholders and relevant individuals of the effects of pesticides in birds, humans, and the environment.	9.3 Agricultural & Forestry Effluents	Herbicides and pesticides impact insects and insect food in upland habitats.
10. Institutional Development			
10.2 External Organizational Development & Support	Work with wildlife services in areas without predator control guidelines and provide incentives to landowners to leave larger predators.	5.1 Hunting & Collecting Terrestrial Animals	The increase in mesopredator populations due to the removal of large predators leads to an increase in nest predations.
10.3 Alliance & Partnership Development	Foster relationships and exchanges between grassland conservation entities and agricultural stakeholders.	2.3 Livestock Farming & Ranching	Intensified grazing and overgrazing affects Sedge Wren's ability to find appropriate habitat and decreases nesting density. The loss and draining of wetlands and wet-grass

			habitats and subsequent conversion to agriculture leads to local population declines.
		9.3 Agricultural & Forestry Effluents	Herbicides and pesticides impact insects and insect food in upland habitats.
10.3 Alliance & Partnership Development	Partner with vet clinics and non-profits to initiate trap-spay-release programs.	8.1 Invasive Non-Native/Alien Plants & Animals	Domestic and feral outdoor cats.

Sprague's Pipit Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Limit construction and disturbance during grassland bird breeding, nesting, and brood-rearing season (April 1- July 15), keep noise levels < 49 dBA during the breeding season, and ensure sites and surroundings are reclaimed back to native grassland habitat post-construction.	3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
1.1 Site/Area Stewardship	See Black-tailed/White-tailed Prairie Dog Threats and Actions.	5.1 Hunting & Collecting Terrestrial Animals	Loss of Black-tailed Prairie Dogs due to recreational shooting and direct and indirect mortality from poisoning can alter vegetation compositions and degrade habitat for grassland birds.

		8.4 Pathogens & Microbes	Loss of Black-tailed Prairie Dogs due to sylvatic plague can alter vegetation compositions and degrade habitat for grassland birds.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Provide signage on public lands indicating no off-road travel. Conduct outreach campaigns to clean and dry recreational machines before and after use to minimize the spread of non-native species. Increase enforcement on public lands to ensure signage and recreational rules are being met.	6.1 Recreational Activities	ATV/UTV recreational use causes degradation of grassland habitats by impacting vegetation and soil, spreading non-native vegetation, potentially driving over nests. Human activities and noise may interfere with nesting, foraging, and brood-rearing.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Provide agency comments and review of potential new transmission line builds to mitigate pre/post construction effects and ensure species and habitats of concern are considered.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.
4.3 Non-Criminal Legal Action	Reduce permitting of new dams, reservoirs, and other water impoundments in important grassland bird habitat, except where livestock cannot access water from other sources (e.g., groundwater, rural water systems).	7.2 Dams & Water Management / Use	Disruption of natural hydrological processes (e.g., artificial dam construction, loss of beavers) that impact function of ephemeral or perennial prairie streams and floodplains can degrade habitat.
4.3 Non-Criminal Legal Action	Through the agency review process of new road and railroad construction, provide recommendations to mitigate effects and ensure species and habitats of concern are considered.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.

4.3 Non-Criminal Legal Action	Through the agency, provide project-specific comments and recommendations to companies to mitigate pre- and post-construction effects and ensure that species of concern are considered.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
4.3 Non-Criminal Legal Action	Through the agency, provide project-specific comments and recommendations to development companies to mitigate pre- and post-construction effects and ensure species and habitats of concern are considered. Consult FWP's Crucial Areas Planning System (CAPS) and other sites such as Montana Natural Heritage Program for indications of species of concern.	1.1 Housing & Urban Areas	Housing development in core grassland habitat will decrease breeding habitat via fragmentation and conversion, including destruction of native vegetation, installation of vertical structures avoided by grassland birds, introduction or expansion of meso-predators and human commensal species (e.g., cats, crows, raccoons), noise disturbance, and increase of non-native plant species.
5. Livelihood Economic & Moral Incentives			
5.1 Linked Enterprises & Alternative Livelihoods	Incentivize ranching over farming.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.2 Better Products & Management Practices	Manage wireless technology by constructing shorter cellular towers or reducing reliance on cell towers (i.e., move towards satellite or other alternatives).	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.

5.2 Better Products & Management Practices	Provide information to landowners about management practices that minimize negative effects on grassland bird nesting success. Mow fields after July 15 so nestlings can fledge. Seed fields early, before May 10 to limit nest destruction by machinery. Minimize tillage and use of pesticides and herbicides.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.3 Market-Based Incentives	Incentivize meat and fiber produced on properties with a grazing management plan compatible with grassland bird habitat.	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.
5.3 Market-Based Incentives	Promote the value of agriculture products produced while stewarding grassland, such as beef, bison and fiber.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.4 Direct Economic Incentives	Compensate livestock producers when production goals and wildlife habitat goals do not align (e.g., resting and heavy grazing).	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.
5.5 Non-Monetary Values	Convey the link between conservation and the effects of a changing climate on human health and populations.	11.3 Changes in Temperature Regimes	Changes in temperature can lengthen growing seasons, increase non-native vegetation monocultures, and impact the timing of the breeding season of grassland birds and cause their range to expand or contract. Hotter/drier summers can lead to droughts. Cooler temperatures can promote additional biomass growth throughout grasslands.
		11.4 Changes in Precipitation & Hydrological Regimes	Increased precipitation in the spring could increase non-native vegetation monocultures (Cheatgrass, Sweetclover, Kentucky Bluegrass, Smooth Brome) and woody vegetation expansion. Low moisture could impact prey populations for grassland birds. High moisture could promote cropland expansion.
		11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds

			during nesting and brood rearing and can affect adult and fledging survival.
5.5 Non-Monetary Values	Educating the public on the importance of minimal disturbance and the impacts of habitat destruction on grassland birds.	6.1 Recreational Activities	ATV/UTV recreational use causes degradation of grassland habitats by impacting vegetation and soil, spreading non-native vegetation, potentially driving over nests. Human activities and noise may interfere with nesting, foraging, and brood-rearing.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Identify areas of highest population densities and quality habitat for focused conservation attention. Prioritize conservation needs as projects/development are proposed.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Maintain strong adherence to the Montana Environmental Policy Act (MEPA).	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.

		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
7.1 Laws, Regulations & Codes	Pass laws/bills to minimize the use of pesticides, particularly insecticides including neonicotinoid seed treatments. Make highly toxic pesticides illegal.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
7.1 Laws, Regulations & Codes	Promote native vegetation seeding and prohibit persistent non-native species seeding during reclamation or restoration (e.g., along roadsides, energy production).	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
7.1 Laws, Regulations & Codes	Re-seed with native species only, without persistent non-native species. Restrict the construction of new roads and railroads (especially elevated roads) in grassland bird habitat. Apply Migratory Bird Treaty Act timing restrictions for construction in core habitat of ground-nesting bird species.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
7.1 Laws, Regulations & Codes	Reduce disparity in subsidies between annual cropland and grass-based agriculture. Implement policies that better mitigate risk for ranching operations.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
7.1 Laws, Regulations & Codes	Restrict construction of new utility and service lines. Require seeding of native vegetation, without persistent non-native species, at all utility installation sites, including waterlines.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.
7.1 Laws, Regulations & Codes	Support science-based laws and bills to address climate change.	11.3 Changes in Temperature Regimes	Changes in temperature can lengthen growing seasons, increase non-native vegetation monocultures, and impact the timing of the breeding season of grassland birds and cause

			their range to expand or contract. Hotter/drier summers can lead to droughts. Cooler temperatures can promote additional biomass growth throughout grasslands.
		11.4 Changes in Precipitation & Hydrological Regimes	Increased precipitation in the spring could increase non-native vegetation monocultures (Cheatgrass, Sweetclover, Kentucky Bluegrass, Smooth Brome) and woody vegetation expansion. Low moisture could impact prey populations for grassland birds. High moisture could promote cropland expansion.
		11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
7.2 Policies & Guidelines	Reduce disparity in subsidies between annual cropland and grass-based agriculture. Implement policies that better mitigate risk for ranching operations.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
9. Education & Training			
9.2 Training & Individual Capacity Development	Increase agencies' and public awareness of the threat posed by non-native vegetation to grassland species and habitats.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
9.2 Training & Individual Capacity Development	Provide technical assistance and information to landowners about woody vegetation encroachment and management guides.	8.2 Problematic Native Plants & Animals	Encroachment of native woody vegetation (Rocky Mountain Juniper, Ponderosa Pine) results in a complete loss of habitat for most grassland songbirds.
9.2 Training & Individual Capacity Development	Provide technical assistance to landowners through incentive programs and workshops. Support rancher-led organizations such as the Ranchers Stewardship Alliance.	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.

9.2 Training & Individual Capacity Development	Provide trainings and information to stakeholders and agencies on pesticide use and effects on grassland birds.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
9.2 Training & Individual Capacity Development	Providing office and in-field trainings for agency personnel and workshops to landowners about prescribed fire management.	7.1 Fire & Fire Suppression	Altered fire regimes and fire suppression leading to high intensity fires reduces local breeding densities and leads to encroachment of woody vegetation in grassland habitat.
10. Institutional Development			
10.3 Alliance & Partnership Development	Proactively improve and increase partnerships with pesticide applicators to ensure that the methods and products used are the best available for wildlife and habitats.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
10.3 Alliance & Partnership Development	Work proactively with oil and gas contractors and companies to ensure best methods for wildlife and habitats are incorporated.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
10.3 Alliance & Partnership Development	Work proactively with renewable energy contractors and companies to ensure best methods for wildlife and habitats are incorporated.	3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
10.3 Alliance & Partnership Development	Work proactively with road and railroad contractors and companies to ensure best methods for wildlife and habitats are incorporated.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
10.3 Alliance & Partnership Development	Work proactively with utility and service line contractors and companies to ensure best methods for wildlife and habitats are incorporated.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.

10.3 Alliance & Partnership Development	Work with ranching communities, agricultural extensions, and universities to find and share common solutions.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
10.4 Financing Conservation	Promote incentive programs for landowners to manage non-native species. Create available funding for district/city weed managers.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.

Thick-billed Longspur Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Limit construction and disturbance during grassland bird breeding, nesting, and brood-rearing season (April 1- July 15), keep noise levels < 49 dBA during the breeding season, and ensure sites and surroundings are reclaimed back to native grassland habitat post-construction.	3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
1.1 Site/Area Stewardship	See Black-tailed/White-tailed Prairie Dog Threats and Actions.	5.1 Hunting & Collecting Terrestrial Animals	Loss of Black-tailed Prairie Dogs due to recreational shooting and direct and indirect mortality from poisoning can alter

			vegetation compositions and degrade habitat for grassland birds.
		8.4 Pathogens & Microbes	Loss of Black-tailed Prairie Dogs due to sylvatic plague can alter vegetation compositions and degrade habitat for grassland birds.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Provide signage on public lands indicating no off-road travel. Conduct outreach campaigns to clean and dry recreational machines before and after use to minimize the spread of non-native species. Increase enforcement on public lands to ensure signage and recreational rules are being met.	6.1 Recreational Activities	ATV/UTV recreational use causes degradation of grassland habitats by impacting vegetation and soil, spreading non-native vegetation, potentially driving over nests. Human activities and noise may interfere with nesting, foraging, and brood-rearing.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Provide agency comments and review of potential new transmission line builds to mitigate pre/post construction effects and ensure species and habitats of concern are considered.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.
4.3 Non-Criminal Legal Action	Reduce permitting of new dams, reservoirs, and other water impoundments in important grassland bird habitat, except where livestock cannot access water from other sources (e.g., groundwater, rural water systems).	7.2 Dams & Water Management / Use	Disruption of natural hydrological processes (e.g., artificial dam construction, loss of beavers) that impact function of ephemeral or perennial prairie streams and floodplains can degrade habitat.
4.3 Non-Criminal Legal Action	Through the agency review process of new road and railroad construction, provide recommendations to mitigate effects and ensure species and habitats of concern are considered.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.

4.3 Non-Criminal Legal Action	Through the agency, provide project-specific comments and recommendations to companies to mitigate pre- and post-construction effects and ensure that species of concern are considered.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
4.3 Non-Criminal Legal Action	Through the agency, provide project-specific comments and recommendations to development companies to mitigate pre- and post-construction effects and ensure species and habitats of concern are considered. Consult FWP's Crucial Areas Planning System (CAPS) and other sites such as Montana Natural Heritage Program for indications of species of concern.	1.1 Housing & Urban Areas	Housing development in core grassland habitat will decrease breeding habitat via fragmentation and conversion, including destruction of native vegetation, installation of vertical structures avoided by grassland birds, introduction or expansion of meso-predators and human commensal species (e.g., cats, crows, raccoons), noise disturbance, and increase of non-native plant species.
5. Livelihood Economic & Moral Incentives			
5.1 Linked Enterprises & Alternative Livelihoods	Incentivize ranching over farming.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.2 Better Products & Management Practices	Manage wireless technology by constructing shorter cellular towers or reducing reliance on cell towers (i.e., move towards satellite or other alternatives).	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.

5.2 Better Products & Management Practices	Provide information to landowners about management practices that minimize negative effects on grassland bird nesting success. Mow fields after July 15 so nestlings can fledge. Seed fields early, before May 10 to limit nest destruction by machinery. Minimize tillage and use of pesticides and herbicides.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.3 Market-Based Incentives	Incentivize meat and fiber produced on properties with a grazing management plan compatible with grassland bird habitat.	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.
5.3 Market-Based Incentives	Promote the value of agriculture products produced while stewarding grassland, such as beef, bison and fiber.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.4 Direct Economic Incentives	Compensate livestock producers when production goals and wildlife habitat goals do not align (e.g., resting and heavy grazing).	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.
5.4 Direct Economic Incentives	Incentivize ranching over farming.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.5 Non-Monetary Values	Convey the link between conservation and the effects of a changing climate on human health and populations.	11.3 Changes in Temperature Regimes	Changes in temperature can lengthen growing seasons, increase non-native vegetation monocultures, and impact the timing of the breeding season of grassland birds and cause their range to expand or contract. Hotter/drier summers can lead to droughts. Cooler temperatures can promote additional biomass growth throughout grasslands.
		11.4 Changes in Precipitation & Hydrological Regimes	Increased precipitation in the spring could increase non-native vegetation monocultures (Cheatgrass, Sweetclover, Kentucky Bluegrass, Smooth Brome) and woody vegetation expansion. Low moisture could impact prey populations for grassland birds. High moisture could promote cropland expansion.

		11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
5.5 Non-Monetary Values	Educating the public on the importance of minimal disturbance and the impacts of habitat destruction on grassland birds.	6.1 Recreational Activities	ATV/UTV recreational use causes degradation of grassland habitats by impacting vegetation and soil, spreading non-native vegetation, potentially driving over nests. Human activities and noise may interfere with nesting, foraging, and brood-rearing.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Identify areas of highest population densities and quality habitat for focused conservation attention. Prioritize conservation needs as projects/development are proposed.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Maintain strong adherence to the Montana Environmental Policy Act (MEPA).	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil

			and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
7.1 Laws, Regulations & Codes	Pass laws/bills to minimize the use of pesticides, particularly insecticides including neonicotinoid seed treatments. Make highly toxic pesticides illegal.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
7.1 Laws, Regulations & Codes	Promote native vegetation seeding and prohibit persistent non-native species seeding during reclamation or restoration (e.g., along roadsides, energy production).	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
7.1 Laws, Regulations & Codes	Re-seed with native species only, without persistent non-native species. Restrict the construction of new roads and railroads (especially elevated roads) in grassland bird habitat. Apply Migratory Bird Treaty Act timing restrictions for construction in core habitat of ground-nesting bird species.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
7.1 Laws, Regulations & Codes	Reduce disparity in subsidies between annual cropland and grass-based agriculture. Implement policies that better mitigate risk for ranching operations.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
7.1 Laws, Regulations & Codes	Restrict construction of new utility and service lines. Require seeding of native vegetation, without persistent non-native species, at all utility installation sites, including waterlines.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.

7.1 Laws, Regulations & Codes	Support science-based laws and bills to address climate change.	11.3 Changes in Temperature Regimes	Changes in temperature can lengthen growing seasons, increase non-native vegetation monocultures, and impact the timing of the breeding season of grassland birds and cause their range to expand or contract. Hotter/drier summers can lead to droughts. Cooler temperatures can promote additional biomass growth throughout grasslands.
		11.4 Changes in Precipitation & Hydrological Regimes	Increased precipitation in the spring could increase non-native vegetation monocultures (Cheatgrass, Sweetclover, Kentucky Bluegrass, Smooth Brome) and woody vegetation expansion. Low moisture could impact prey populations for grassland birds. High moisture could promote cropland expansion.
		11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
7.2 Policies & Guidelines	Reduce disparity in subsidies between annual cropland and grass-based agriculture. Implement policies that better mitigate risk for ranching operations.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
9. Education & Training			
9.2 Training & Individual Capacity Development	Increase agencies' and public awareness of the threat posed by non-native vegetation to grassland species and habitats.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
9.2 Training & Individual Capacity Development	Provide technical assistance and information to landowners about woody vegetation encroachment and management guides.	8.2 Problematic Native Plants & Animals	Encroachment of native woody vegetation (Rocky Mountain Juniper, Ponderosa Pine) results in a complete loss of habitat for most grassland songbirds.
9.2 Training & Individual Capacity Development	Provide technical assistance to landowners through incentive programs and workshops.	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.

	Support rancher-led organizations such as the Ranchers Stewardship Alliance.		
9.2 Training & Individual Capacity Development	Provide trainings and information to stakeholders and agencies on pesticide use and effects on grassland birds.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
9.2 Training & Individual Capacity Development	Providing office and in-field trainings for agency personnel and workshops to landowners about prescribed fire management.	7.1 Fire & Fire Suppression	Altered fire regimes and fire suppression leading to high intensity fires reduces local breeding densities and leads to encroachment of woody vegetation in grassland habitat.
10. Institutional Development			
10.3 Alliance & Partnership Development	Proactively improve and increase partnerships with pesticide applicators to ensure that the methods and products used are the best available for wildlife and habitats.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
10.3 Alliance & Partnership Development	Work proactively with oil and gas contractors and companies to ensure best methods for wildlife and habitats are incorporated.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
10.3 Alliance & Partnership Development	Work proactively with renewable energy contractors and companies to ensure best methods for wildlife and habitats are incorporated.	3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
10.3 Alliance & Partnership Development	Work proactively with road and railroad contractors and companies to ensure best methods for wildlife and habitats are incorporated.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
10.3 Alliance & Partnership Development	Work proactively with utility and service line contractors and companies to ensure best methods for wildlife and habitats are incorporated.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.

10.3 Alliance & Partnership Development	Work with ranching communities, agricultural extensions, and universities to find and share common solutions.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
10.4 Financing Conservation	Promote incentive programs for landowners to manage non-native species. Create available funding for district/city weed managers.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.

Varied Thrush Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners and land managers about alternative options for pest and weed control (e.g., native predators, regenerative grazing, biocontrol, mechanical removal) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).
C. Enabling Conditions Actions			
9. Education & Training			

9.2 Training & Individual Capacity Development	Develop a document of best management practices for timber in mature and old-growth stands, with a focus on maintaining important patch sizes and habitat features for Species of Greatest Conservation Need dependent on old-growth stands. To facilitate communication on vegetation management between foresters and biologists, develop a document with common terms used in forest management and in descriptions of biological needs of forest-dependent Species of Greatest Conservation Need.	5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests reduces breeding habitat through direct destruction of habitat and through fragmentation of suitable forest patches.
10. Institutional Development			
10.3 Alliance & Partnership Development	Encourage landowners with forested areas on their properties to engage with DNRC's Forest Stewardship Program to responsibly manage their forests.	5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests reduces breeding habitat through direct destruction of habitat and through fragmentation of suitable forest patches.

Veery Threats and Conservation Actions

There are no species-specific threats and actions for Veery. See Chapter 5.4 for HGCN threats and actions.

White-faced Ibis Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			

3. Awareness Raising			
3.1 Outreach & Communications	Raise awareness of the benefits of flood irrigation and other practices that leave some standing water on the landscape to White-faced Ibis.	2.1 Annual & Perennial Non-Timber Crops	Human disturbance from agricultural operations and recreation can cause nest abandonment.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Through the agency review process of projects, identify opportunities to protect wetlands or provide recommendations for water management (e.g., in a 1989 drought in Nevada, water allotment was concentrated in a management unit to accommodate ibis nesting).	2.1 Annual & Perennial Non-Timber Crops	Transition from flood-irrigation to center pivot irrigation reduces foraging opportunities.

Yellow Rail Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Through the agency review process of projects, identify opportunities to protect wetlands.	7.2 Dams & Water Management / Use	Altered hydrology through wetland drainage and wetland loss impacts food availability and nesting habitat.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.2 Easements & Resource Rights	Pursue conservation of semi-permanent and temporary wetlands and water rights that	11.1 Ecosystem Encroachment	Reduction in breeding habitat through drought. Shift in breeding or winter range.

	maintain them in places where Yellow Rails occur and refugia models suggest greater climate stability.		

Yellow-billed Cuckoo Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct outreach on the importance of insect populations, the impacts of both small and large scale use of pesticides, and alternative options.	9.3 Agricultural & Forestry Effluents	Insecticides can cause direct and indirect mortality.
3.1 Outreach & Communications	Conduct outreach to private landowners on alternatives to bank armoring and the consequences of channel simplification.	7.3 Other Ecosystem Modifications	Loss of riparian habitat due to channel simplification (e.g., bank stabilization using riprap and side-channel isolation).
3.1 Outreach & Communications	Raise awareness on the challenges bird face with building collisions and promote solutions from the Bird Collision Prevention Alliance. Promote 'lights out' campaigns targeting migration events.	1.2 Commercial & Industrial Areas	Collisions with buildings and other commercial structures.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Work with landowners and natural resources agencies to implement FWP guidelines (Fish and Wildlife Recommendations for Subdivision Development). Recommend a	1.1 Housing & Urban Areas	Loss of habitat from conversion to housing.
		4.1 Roads & Railroads	The frequent placement of roads and railroads along rivers causes loss and degradation of riparian habitat.

	preferred setback distance of 500 m (minimum 90 m) for structures from a river, based on cuckoo home range size and foraging requirements. Avoid removal of understory and maintain diversity of riparian species. Minimize ground disturbance during the breeding season (May 15-September 30).	7.2 Dams & Water Management / Use	Loss of riparian forest due to channelization, dewatering for irrigation, and hydrological changes on dammed rivers.
5. Livelihood Economic & Moral Incentives			
5.3 Market-Based Incentives	Provide monetary incentive to support regenerative agricultural practices on private lands.	11.3 Changes in Temperature Regimes	Increased temperatures may lead to declines in prey abundance (e.g., lepidopteran larvae).
		11.4 Changes in Precipitation & Hydrological Regimes	Loss of habitat and changes in riparian community due to changes in precipitation.
		11.5 Severe/Extreme Weather Events	Extreme weather events (e.g., hail, wind, rain) can cause direct and indirect mortality.
5.4 Direct Economic Incentives	Create a tax incentive for companies to employ solutions to reduce collisions.	1.2 Commercial & Industrial Areas	Collisions with buildings and other commercial structures.
5.4 Direct Economic Incentives	Incentivize instream flow.	7.2 Dams & Water Management / Use	Loss of riparian forest due to channelization, dewatering for irrigation, and hydrological changes on dammed rivers.
5.4 Direct Economic Incentives	Provide compensation or tax incentives to reduce use of herbicides and pesticides or use environmentally-friendly products.	9.3 Agricultural & Forestry Effluents	Insecticides can cause direct and indirect mortality.
5.4 Direct Economic Incentives	Provide economic incentives to deter conversion of riparian habitat and offset financial impacts to landowners.	2.1 Annual & Perennial Non-Timber Crops	Conversion of riparian forests adjacent to rivers into agricultural areas.
5.4 Direct Economic Incentives	Provide monetary incentives to exclude livestock from riparian habitats (e.g., virtual fencing) and implement practices that reduce impacts of grazing. Work with NRCS on cost-share programs to build sustainable alternative water sources for livestock.	2.3 Livestock Farming & Ranching	Grazing can result in habitat loss and degradation.

C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.5 Site Infrastructure	Work with natural resource agencies to incorporate solutions from the Bird Collision Prevention Alliance into new building plans or maintenance of existing buildings.	1.2 Commercial & Industrial Areas	Collisions with buildings and other commercial structures.
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Change policy to allow bison grazing on state lands when requested by the lessee.	2.3 Livestock Farming & Ranching	Grazing can result in habitat loss and degradation.
7.2 Policies & Guidelines	Restrict permitting for gravel pits in areas identified as important breeding habitat for the species.	3.2 Mining & Quarrying	Loss of riparian habitat from mining (e.g., gold, gravel pits) along river corridors.
9. Education & Training			
9.2 Training & Individual Capacity Development	Provide guidance or training to permitted mining/quarrying operators on the importance of riparian species and how to avoid impacting important breeding habitat.	3.2 Mining & Quarrying	Loss of riparian habitat from mining (e.g., gold, gravel pits) along river corridors.
9.2 Training & Individual Capacity Development	Provide workshops for landowners on native revegetation and removal of invasive species along riparian habitat.	8.1 Invasive Non-Native/Alien Plants & Animals	Loss of riparian habitat from encroachment of non-native plants.
9.2 Training & Individual Capacity Development	Provide workshops for landowners on the benefits of keeping livestock out of riparian habitat, how to minimize livestock impacts on riparian areas, and how to sustainably provide alternative water sources for livestock.	2.3 Livestock Farming & Ranching	Grazing can result in habitat loss and degradation.

Eastern Screech-Owl Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Construct nest boxes to mitigate existing loss of habitat.	1.1 Housing & Urban Areas	Encroachment of development into cottonwood riparian areas increases human-caused sources of mortality (e.g., outdoor cats, European Starlings, corvids, window strikes, vehicle collisions, poisoning from pesticide use).
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Distribute outreach materials for landowners near suitable habitat about the importance of key elements (e.g., snags) and effects of development on favoring invasive species and corvids. Conduct public outreach about urban-associated causes of owl mortality, such as window collisions, free-range cats, and pesticides, and mitigation options (e.g., apply window decals, keep cats indoors, reduce feral cat populations, restrict seasonal timing of pesticide use).	1.1 Housing & Urban Areas	Encroachment of development into cottonwood riparian areas increases human-caused sources of mortality (e.g., outdoor cats, European Starlings, corvids, window strikes, vehicle collisions, poisoning from pesticide use).
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Develop policies to mitigate the impacts of development within critical habitat, including designating and protecting critical habitat areas, limiting development activities during breeding season, providing guidelines on	1.1 Housing & Urban Areas	Encroachment of development into cottonwood riparian areas increases human-caused sources of mortality (e.g., outdoor cats, European Starlings, corvids, window strikes, vehicle collisions, poisoning from pesticide use).

	pesticide use, and maintaining proper stream/river hydrological functions.		

Great Gray Owl Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Buffer known nest sites near trails and campsite modifications or construction.	6.1 Recreational Activities	Recreationists may disturb or displace owls, particularly nesting birds.
1.1 Site/Area Stewardship	Buffer montane and wetland meadows surrounding nest sites from grazing.	2.3 Livestock Farming & Ranching	Grazing in montane and wetland meadows can result in reduced forb and grass diversity, prey abundance, and prey availability.
1.1 Site/Area Stewardship	Conserve critical wintering areas, including low elevation areas and riparian corridors, that serve as refugia from limiting snow conditions. Retain suitable nesting structures with sufficient canopy cover (e.g., snags and stick nests within mature forest).	11.5 Severe/Extreme Weather Events	Increase in early freezes with no snow cover and mid-winter freeze-thaw cycles can reduce prey base. Increase in snow crusts that reduce winter foraging availability can result in decreased fitness. Increase in windstorms that knock down snags and stick nests. Spring storm events can result in nest failure.
1.1 Site/Area Stewardship	Conserve key wintering areas.	1.1 Housing & Urban Areas	Housing and urban development suitable nesting habitat or winter habitat.
1.1 Site/Area Stewardship	Implement an integrated pest management system, including reduction of food sources for rodents, use of safe traps, and use of safer alternatives to Second-Generation Anticoagulant Rodenticides (if poison is needed).	9.3 Agricultural & Forestry Effluents	Mortality and prey reductions through rodent control, rodenticide use, and aerial spraying of pesticides.

1.1 Site/Area Stewardship	Retain intermittent perches in meadows and immediately around meadow edges (e.g., downed trees, lone live trees or snags).	7.1 Fire & Fire Suppression	Fire suppression has allowed for conifer encroachment by various species in and adjacent to forest openings.
1.1 Site/Area Stewardship	Retain suitable nesting structures with sufficient canopy cover (e.g., snags and stick nests within mature forest).	11.3 Changes in Temperature Regimes	Climate change can increase beetle/pest outbreaks and loss of canopy cover. Hotter, drier summers can increase fire risk, especially high-severity fires, and loss of canopy cover, and can increase stress to adult owls and reduce reproductive output (e.g., nestling survival). Overall reduction of the boreal range.
		11.4 Changes in Precipitation & Hydrological Regimes	Changes in snowpack regimes and increasing frequency and severity of drought can result in changes to the hydrological system underlying montane and wetland meadows. Wet springs can result in nestling mortality.
2. Species Management			
2.1 Species Stewardship	Lower speed limits and remove perches to deter owls from roadways, particularly in collision hot spots and in breeding and wintering areas.	4.2 Utility & Service Lines	Mortality from road collisions.
2.1 Species Stewardship	Minimize disturbance at nest sites during the breeding period, especially during inclement weather to prevent flushing birds off their nests. Provide artificial nesting platforms where nest sites have been lost due to wildfire but habitat is otherwise still adequate.	11.5 Severe/Extreme Weather Events	Increase in early freezes with no snow cover and mid-winter freeze-thaw cycles can reduce prey base. Increase in snow crusts that reduce winter foraging availability can result in decreased fitness. Increase in windstorms that knock down snags and stick nests. Spring storm events can result in nest failure.
2.1 Species Stewardship	Minimize disturbance at nest sites during the breeding period, particularly during inclement weather to avoid flushing birds off their nests, and during the incubation period when nest abandonment is more likely.	11.4 Changes in Precipitation & Hydrological Regimes	Changes in snowpack regimes and increasing frequency and severity of drought can result in changes to the hydrological system underlying montane and wetland meadows. Wet springs can result in nestling mortality.
2.1 Species Stewardship	Minimize disturbance at nest sites during the breeding period, particularly during	11.3 Changes in Temperature Regimes	Climate change can increase beetle/pest outbreaks and loss of canopy cover. Hotter, drier summers can increase fire risk,

	inclement weather to avoid flushing birds off their nests.		especially high-severity fires, and loss of canopy cover, and can increase stress to adult owls and reduce reproductive output (e.g., nestling survival). Overall reduction of the boreal range.
2.1 Species Stewardship	Provide artificial nesting platforms where nest sites have been lost due to wildfire but habitat is otherwise still adequate.	7.1 Fire & Fire Suppression	Fire suppression has resulted in a current fire regime characterized by intense, frequent fires that can remove nesting structures, reduces breeding habitat quality, reduce forest structure, and consequently reduces prey availability.
2.1 Species Stewardship	Through state agencies, manage for healthy populations of American Black Bears, Mountain Lions, furbearers, and species classified as nongame and predators.	8.2 Problematic Native Plants & Animals	Predation of nestlings by Golden Eagles, Common Raven, American Goshawks, Great Horned Owls, Red-tailed Hawks, and American Black Bears. Predation of adult owls by Bald Eagles, Golden Eagles, Great Horned Owls, Coyotes, and Mountain Lions.
2.3 Ex-Situ Conservation	Bring injured birds to a rehabilitation facility.	4.2 Utility & Service Lines	Mortality from road collisions, collisions with utility and service lines, and electrocutions.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Engage recreationists through social media and signage to prevent disturbance.	6.1 Recreational Activities	Recreationists may disturb or displace owls, particularly nesting birds.
3.1 Outreach & Communications	Increase public awareness of the importance of reducing travel speeds, particularly at dusk, night, and dawn, to reduce wildlife-vehicle collisions.	4.2 Utility & Service Lines	Mortality from road collisions.
3.1 Outreach & Communications	Raise awareness about the risks posed by Second-Generation Anticoagulant Rodenticides and the advantages of integrated pest management systems.	9.3 Agricultural & Forestry Effluents	Mortality and prey reductions through rodent control, rodenticide use, and aerial spraying of pesticides.
3.2 Protests & Civil Disobedience	Education about the ecological and cultural importance of raptors.	5.1 Hunting & Collecting Terrestrial Animals	Direct persecution (e.g., shooting).
4. Law Enforcement & Prosecution			

4.2 Criminal Prosecution & Conviction	Conduct investigations and enforce laws in response to instances of illegal raptor persecution.	5.1 Hunting & Collecting Terrestrial Animals	Direct persecution (e.g., shooting).
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Work with power companies to modify lines that frequently cause collisions or electrocutions.	4.2 Utility & Service Lines	Mortality from collisions or electrocutions.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Create forest openings in the summer range as part of a forestry prescription on both public and private lands. Conserve native shrubland and grasslands used for foraging by Great Gray Owls, and attempt to maintain multiple vegetation layers within a forest stand.	7.1 Fire & Fire Suppression	Fire suppression has allowed for conifer encroachment by various species in and adjacent to forest openings.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Implement seasonal closures around nest trees or platforms in Wildlife Management Areas.	6.1 Recreational Activities	Recreationists may disturb or displace owls, particularly nesting birds.
9. Education & Training			
9.2 Training & Individual Capacity Development	Collaborate with partner agencies and organizations to develop uniform seasonal closures where necessary.	6.1 Recreational Activities	Recreationists may disturb or displace owls, particularly nesting birds.
9.2 Training & Individual Capacity Development	Provide technical assistance on habitat improvement projects (wildlife openings) to private landowners.	7.1 Fire & Fire Suppression	Fire suppression has allowed for conifer encroachment by various species in and adjacent to forest openings.
9.2 Training & Individual Capacity Development	Provide technical assistance to private landowners to encourage use of pheromone	8.2 Problematic Native Plants & Animals	Large scale habitat loss and degradation due to beetle kill.

	treatment in areas at risk of Bark Beetle infestations.		
9.2 Training & Individual Capacity Development	Provide technical assistance to private landowners who are implementing forest management in known Great Gray Owl nesting territories.	5.3 Logging & Wood Harvesting	Timber harvest can result in loss of nesting and roosting sites.

Sharp-tailed Grouse Threats and Conservation Actions

Threats and actions for Sharp-tailed Grouse will be included in the final version of the 2025 SWAP.

Western Screech-Owl Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Construct nest boxes to mitigate existing loss of habitat.	1.1 Housing & Urban Areas	Encroachment of development into cottonwood riparian areas increases human-caused sources of mortality (e.g., outdoor cats, European Starlings, corvids, window strikes, vehicle collisions, poisoning from pesticide use). Increasing housing development in western Montana valleys removes riparian deciduous forest habitat and alters stream hydrology.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Distribute outreach materials for landowners near suitable habitat about the importance of	1.1 Housing & Urban Areas	Encroachment of development into cottonwood riparian areas increases human-caused sources of mortality (e.g., outdoor

	key elements (e.g., snags) and effects of development on favoring invasive species and corvids. Conduct public outreach about urban-associated causes of owl mortality, such as window collisions, free-range cats, and pesticides, and mitigation options (e.g., apply window decals, keep cats indoors, reduce feral cat populations, restrict seasonal timing of pesticide use).		cats, European Starlings, corvids, window strikes, vehicle collisions, poisoning from pesticide use). Increasing housing development in western Montana valleys removes riparian deciduous forest habitat and alters stream hydrology.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Develop policies to mitigate the impacts of development within critical habitat, including designating and protecting critical habitat areas, limiting development activities during breeding season, providing guidelines on pesticide use, and maintaining proper stream/river hydrological functions.	1.1 Housing & Urban Areas	Encroachment of development into cottonwood riparian areas increases human-caused sources of mortality (e.g., outdoor cats, European Starlings, corvids, window strikes, vehicle collisions, poisoning from pesticide use). Increasing housing development in western Montana valleys removes riparian deciduous forest habitat and alters stream hydrology.

Boreal Owl Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Buffer known nest sites from timber projects.	5.3 Logging & Wood Harvesting	Logging and wood harvesting can result in loss of cavity nesting sites.

1.1 Site/Area Stewardship	Conserve critical wintering areas (including low-elevation areas and riparian corridors) that serve as refugia from limiting snow conditions.	11.5 Severe/Extreme Weather Events	Increase in windstorms that knock down snags and stick nests. Spring storm events that result in nest failure. Increase in early freezes with no snow cover and mid-winter freeze-thaw cycles reducing prey base. Increase in snow crusts (rain on snow) that reduce winter foraging availability (due to temporary loss of habitat), resulting in decreased fitness.
1.1 Site/Area Stewardship	Conserve key wintering areas.	1.1 Housing & Urban Areas	Housing and urban development in areas of suitable nesting or winter habitats.
1.1 Site/Area Stewardship	Implement an integrated pest management system, including reduction of food sources for rodents, use of safe traps, and use of safer alternatives to Second-Generation Anticoagulant Rodenticides (if poison is needed).	9.3 Agricultural & Forestry Effluents	Mortality and prey reductions through rodent control, rodenticide use, and aerial spraying of pesticides.
1.1 Site/Area Stewardship	Retain intermittent perches in meadows (e.g., downed trees, lone live trees or snags).	7.1 Fire & Fire Suppression	Fire suppression has allowed for conifer encroachment in and adjacent to forest openings.
1.1 Site/Area Stewardship	Retain suitable nesting structures with sufficient canopy cover (e.g., snags and stick nests within mature forest).	11.3 Changes in Temperature Regimes	Overall reduction of the boreal range results in habitat loss. Hotter, drier summers increase fire risk and loss of canopy cover. Climate change increases beetle/pest outbreaks and loss of canopy cover. Hotter, drier summers result in increased stress to adult owls and reduced reproductive output (e.g., nestling survival).
		11.4 Changes in Precipitation & Hydrological Regimes	Warmer temperatures, increased spring snowstorms, and wet springs may impact breeding and nestling survival. Changes in snowpack regimes and increasing frequency and severity of drought may result in changes to the hydrological system underlying montane and wetland meadows.
1.2 Ecosystem & Natural Process (Re)Creation	Provide artificial nesting boxes where nest sites have been lost to timber harvest.	5.3 Logging & Wood Harvesting	Logging and wood harvesting can result in loss of cavity nesting sites.
2. Species Management			

2.1 Species Stewardship	Collaborate with state agencies and other states to ensure effective management of forest carnivores (e.g., marten) populations.	8.2 Problematic Native Plants & Animals	Predation of fledglings and adults by American Goshawks, Cooper's Hawks, and Great Horned Owls. Predation on nestlings in the cavity by Martins. Predation of eggs in the cavity by squirrels.
2.1 Species Stewardship	Lower speed limits and remove perches to deter owls from roadways, particularly in collision hot spots and in breeding and wintering areas.	4.2 Utility & Service Lines	Mortality from road collisions.
2.1 Species Stewardship	Minimize disturbance at nest sites during the breeding period, especially during inclement weather to prevent flushing birds off their nests. Provide artificial nesting platforms where nest sites have been lost due to wildfire but habitat is otherwise still adequate.	11.5 Severe/Extreme Weather Events	Increase in windstorms that knock down snags and stick nests. Spring storm events that result in nest failure. Increase in early freezes with no snow cover and mid-winter freeze-thaw cycles reducing prey base. Increase in snow crusts (rain on snow) that reduce winter foraging availability (due to temporary loss of habitat), resulting in decreased fitness.
2.1 Species Stewardship	Minimize disturbance at nest sites during the breeding period, particularly during inclement weather to avoid flushing birds off their nests.	11.3 Changes in Temperature Regimes	Overall reduction of the boreal range results in habitat loss. Hotter, drier summers increase fire risk and loss of canopy cover. Climate change increases beetle/pest outbreaks and loss of canopy cover. Hotter, drier summers result in increased stress to adult owls and reduced reproductive output (e.g., nestling survival).
		11.4 Changes in Precipitation & Hydrological Regimes	Warmer temperatures, increased spring snowstorms, and wet springs may impact breeding and nestling survival. Changes in snowpack regimes and increasing frequency and severity of drought may result in changes to the hydrological system underlying montane and wetland meadows.
2.1 Species Stewardship	Provide artificial nest boxes where nest sites have been lost due to wildfire but habitat is otherwise still adequate.	7.1 Fire & Fire Suppression	Fire suppression has resulted in a current fire regime characterized by intense, frequent fires that can remove nesting structures, reduces breeding habitat quality, reduce forest structure, and consequently reduces prey availability.
2.1 Species Stewardship	Provide artificial nesting boxes where nest sites have been lost to timber harvest.	5.3 Logging & Wood Harvesting	Logging and wood harvesting can result in loss of cavity nesting sites.

2.3 Ex-Situ Conservation	Rehabilitate injured raptors off-site.	4.2 Utility & Service Lines	Mortality from road collisions.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Engage recreationists through social media and signage to prevent disturbance.	6.1 Recreational Activities	Recreationists may disturb or displace nesting birds.
3.1 Outreach & Communications	Increase public awareness of the importance of reducing travel speeds, particularly at dusk, night, and dawn, to reduce wildlife-vehicle collisions.	4.2 Utility & Service Lines	Mortality from road collisions.
3.1 Outreach & Communications	Raise awareness about the risks posed by Second-Generation Anticoagulant Rodenticides and the advantages of integrated pest management systems.	9.3 Agricultural & Forestry Effluents	Mortality and prey reductions through rodent control, rodenticide use, and aerial spraying of pesticides.
3.2 Protests & Civil Disobedience	Education about the ecological and cultural importance of raptors.	2.3 Livestock Farming & Ranching	Direct persecution (e.g., shooting).
4. Law Enforcement & Prosecution			
4.2 Criminal Prosecution & Conviction	Conduct investigations and enforce laws in response to instances of illegal raptor persecution.	2.3 Livestock Farming & Ranching	Direct persecution (e.g., shooting).
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Implement seasonal closures around nest trees or platforms in Wildlife Management Areas.	6.1 Recreational Activities	Recreationists may disturb or displace nesting birds.
9. Education & Training			
9.2 Training & Individual Capacity Development	Collaborate with partner agencies and organizations to develop uniform seasonal closures where necessary.	6.1 Recreational Activities	Recreationists may disturb or displace nesting birds.

9.2 Training & Individual Capacity Development	Provide technical assistance to private landowners to encourage use of pheromone treatment in areas at risk of Bark Beetle infestations.	8.2 Problematic Native Plants & Animals	Large scale habitat loss and degradation due to beetle kill.
11. Other Action			
11.1 Other Action: NA/NONE	nan.	8.2 Problematic Native Plants & Animals	Predation on Boreal Owls by larger native owl species (Barred Owl and Great Horned Owl). Native Barred Owl range expansion.

Chimney Swift Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Recommend avoiding capping chimneys (e.g., brick, terra-cotta, stone) used by roosting and nesting birds with wire grates. When cleaning chimneys, clean outside of the breeding season (May 1- August 15).	1.1 Housing & Urban Areas	Modernization, destruction, and new construction of buildings and infrastructure may result in loss of roosting and nesting habitat due to chimney capping, closures, and unsuitable chimney material (sheet metal).
2. Species Management			
2.1 Species Stewardship	Build appropriate Chimney Swift nesting boxes to provide additional nesting/roosting sites when other man-made structures become unusable or destroyed.	1.1 Housing & Urban Areas	Modernization, destruction, and new construction of buildings and infrastructure may result in loss of roosting and nesting habitat due to chimney capping, closures, and unsuitable chimney material (sheet metal).
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			

3.1 Outreach & Communications	Create educational and outreach programs for the public about species conservation. Continue promoting citizen science efforts and multi-agency collaborations (e.g., Montana Audubon).	1.1 Housing & Urban Areas	Modernization, destruction, and new construction of buildings and infrastructure may result in loss of roosting and nesting habitat due to chimney capping, closures, and unsuitable chimney material (sheet metal).
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Provide agency comments when development, construction, or renovation may be taking place near Chimney Swift habitat to ensure species of concern are taken into account.	1.1 Housing & Urban Areas	Modernization, destruction, and new construction of buildings and infrastructure may result in loss of roosting and nesting habitat due to chimney capping, closures, and unsuitable chimney material (sheet metal).
4.3 Non-Criminal Legal Action	Provide recommendations to land management agencies about the importance of retaining old growth trees.	7.3 Other Ecosystem Modifications	Loss and degradation of old-growth trees (e.g., cottonwoods) may reduce the availability of natural tree cavities for nesting/roosting.
5. Livelihood Economic & Moral Incentives			
5.5 Non-Monetary Values	Convey the link between conservation and the effects of a changing climate on human health and populations.	11.3 Changes in Temperature Regimes	Changes in temperature regimes (warming climate) can alter the production and availability of insect populations.
		11.4 Changes in Precipitation & Hydrological Regimes	Changes in precipitation may impact timing of prey availability. Changes in hydrological regimes may impact cottonwood regeneration.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Support science-based laws and bills to address climate change.	11.3 Changes in Temperature Regimes	Changes in temperature regimes (warming climate) can alter the production and availability of insect populations.
		11.4 Changes in Precipitation & Hydrological Regimes	Changes in precipitation may impact timing of prey availability. Changes in hydrological regimes may impact cottonwood regeneration.
10. Institutional Development			

10.3 Alliance & Partnership Development	Work with pesticide applicators to ensure best practices and products are used to reduce impacts to wildlife and habitats. Partner with local conservation districts and urban insect control programs.	9.3 Agricultural & Forestry Effluents	Herbicide/pesticide use and runoff causes loss of invertebrate prey.

Gray Flycatcher Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate and engage the public in preventing the spread of invasive species, and encourage reporting to facilitate early detection.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive annual grasses degrade habitat quality and increase potential for wildfires that cause habitat loss.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Consider employing curtailments during intense migration periods to reduce risk of mortality.	3.3 Renewable Energy	Development and maintenance of wind and solar farms can lead to habitat loss and fragmentation. Established infrastructure degrades the quality of the surrounding habitat.
C. Enabling Conditions Actions			
10. Institutional Development			
10.3 Alliance & Partnership Development	Collaborate with the local weed districts, partner agencies, and NGOs to coordinate weed management efforts.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive annual grasses degrade habitat quality and increase potential for wildfires that cause habitat loss.

Plumbeous Vireo Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Trap/control brown-headed cowbirds.	8.2 Problematic Native Plants & Animals	Brown-headed Cowbird expansion and nest parasitism of this species.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct targeted outreach addressing the impacts of domestic cats on wildlife populations.	8.1 Invasive Non-Native/Alien Plants & Animals	Predation by domestic and feral cats.

Tennessee Warbler Threats and Conservation Actions

There are no species-specific threats and actions for Tennessee Warbler. See Chapter 5.4 for HGCN threats and actions.

Dusky Grouse Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			

1.1 Site/Area Stewardship	Buffer known nest sites from timber projects, trail and road construction, and campsite modifications or construction.	5.3 Logging & Wood Harvesting	Timber harvest can result in loss of nesting and roosting sites.
1.2 Ecosystem & Natural Process (Re)Creation	Provide nesting habitat where nest sites have been lost to timber harvest.	5.3 Logging & Wood Harvesting	Timber harvest can result in loss of nesting and roosting sites.
2. Species Management			
2.1 Species Stewardship	Through state agencies, continue to manage for healthy populations of upland game birds.	5.1 Hunting & Collecting Terrestrial Animals	Hunting.
2.1 Species Stewardship	Through state agencies, manage for healthy populations of American Black Bears, furbearers, and species classified as nongame and predators, to ensure healthy populations of ground-nesting upland game birds.	8.2 Problematic Native Plants & Animals	Nest predation by corvids (jays, ravens), Red Squirrels, weasels, and mid-sized mammals (Marten, Red Fox), or American Black Bears. Predation of adults by raptors (Great Horned Owls, American Goshawks) and mammals (Marten, Bobcat, Red Fox).
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Create forest openings in the summer range as part of a forestry prescription on both public and private lands. Conserve native shrubland/grasslands used by Dusky Grouse during summer.	7.1 Fire & Fire Suppression	Fire suppression has allowed for conifer encroachment in and adjacent to forest openings.
6.4 Conservation Planning	Implement a prescription in forest management plans to retain large stick nests, large diameter snags, and surrounding mature forests during logging. Work with the USFS to include the use of buffers before, during, and after logging in forest management plans.	5.3 Logging & Wood Harvesting	Timber harvest can result in loss of nesting and roosting sites.
9. Education & Training			

9.2 Training & Individual Capacity Development	Provide technical assistance on habitat improvement projects (wildlife openings) to private landowners.	7.1 Fire & Fire Suppression	Fire suppression has allowed for conifer encroachment in and adjacent to forest openings.
9.2 Training & Individual Capacity Development	Provide technical assistance to private landowners to encourage use of pheromone treatment in areas at risk of Bark Beetle infestations.	11.3 Changes in Temperature Regimes	Overall reduction of low-altitude boreal forests in Montana results in habitat loss. Hotter, drier summers increase fire risk and loss of canopy cover. Climate change increases beetle/pest outbreaks and loss of canopy cover.
		8.2 Problematic Native Plants & Animals	Large scale habitat loss and degradation due to beetle kill.
9.2 Training & Individual Capacity Development	Provide technical assistance to private landowners to encourage use of pheromone treatment instead of aerial application of pesticides in areas at risk of Bark Beetle infestations.	9.3 Agricultural & Forestry Effluents	Aerial pesticide spraying reduces insects used as a food source.

Prairie Falcon Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Work with landowners to foster small mammal habitat on non-arable and non-crop land (e.g., irrigation canals, field boundaries, ditches). Restrict access to breeding habitat on public lands during breeding season. Restrict or reduce small mammal shooting on public lands.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland. Intensive agricultural operations.
		5.1 Hunting & Collecting Terrestrial Animals	Ingesting small mammal carcasses that have been shot with lead projectiles.
		6.1 Recreational Activities	Rock climbing and hiking near cliffs and crevices.

B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct outreach through social media campaigns, educational exhibits, and educational programming.	6.1 Recreational Activities	Rock climbing and hiking near cliffs and crevices.
3.1 Outreach & Communications	Continue using social, print, and televised media to illustrate the hazards of using chemical applications.	2.3 Livestock Farming & Ranching	Alterations to native vegetation and reduced grass and forb diversity can lead to habitat loss for the species' prey base.
3.1 Outreach & Communications	Continue using social, print, and televised media to illustrate the importance of non-lead based ammunition.	5.1 Hunting & Collecting Terrestrial Animals	Ingesting small mammal carcasses that have been shot with lead projectiles.
C. Enabling Conditions Actions			
9. Education & Training			
9.1 Formal Education	Teach specific conservation skills as part of university curriculum in agricultural majors.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland. Intensive agricultural operations.
		2.3 Livestock Farming & Ranching	Alterations to native vegetation and reduced grass and forb diversity can lead to habitat loss for the species' prey base.
9.2 Training & Individual Capacity Development	Host workshops on the use of conservation tools for interested agricultural producers.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland. Intensive agricultural operations.
		2.3 Livestock Farming & Ranching	Alterations to native vegetation and reduced grass and forb diversity can lead to habitat loss for the species' prey base.

Cassin's Vireo Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			

2. Species Management			
2.1 Species Stewardship	Trap/control brown-headed cowbirds.	8.2 Problematic Native Plants & Animals	Brown-headed Cowbird expansion and nest parasitism of this species.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct targeted outreach addressing the impacts of domestic cats on wildlife populations.	8.1 Invasive Non-Native/Alien Plants & Animals	Predation by domestic and feral cats.

Grasshopper Sparrow Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Develop and promote economically viable mowing practices that allow young to fledge before hay fields are disturbed (e.g., identify and promote grassland-friendly hay that does not require mowing before mid-July). This may include promoting different strategies on private, federal, and state land.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Incompatible and high-intensity mowing schedules of hay fields and grassy nesting areas.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate consumers on products to support healthy grasslands and people.	2.3 Livestock Farming & Ranching	Disturbance of breeding habitat by intensive or overgrazing practices.

3.1 Outreach & Communications	Increase awareness of ecosystem services provided by grasslands and economic tradeoffs of grassland conversion. Educate consumers on products that support healthy grasslands and people.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Incompatible and high-intensity mowing schedules of hay fields and grassy nesting areas.
		7.1 Fire & Fire Suppression	Suppression of natural fire patterns leads to encroachment of woody vegetation in grassland habitat.
3.1 Outreach & Communications	Initiate programs to educate the public on the impact of feral and domestic cats to grassland birds. Educate consumers on products that support healthy grasslands and people, reseeding with native species instead of Cheatgrass and Smooth Brome (Bromus inermis), and the benefits of native grasses to ranchers and farmers as well as the landscape.	8.1 Invasive Non-Native/Alien Plants & Animals	Domestic and feral outdoor cats. Invasive and exotic grasses (e.g., Crested Wheatgrass, Smooth Brome, Kentucky bluegrass) can replace natural grasslands.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Comment on Environmental Assessments requesting consideration of grassland birds in action, mitigation and reclamation plans.	3.1 Oil & Gas Drilling	Noise and landscape disturbances can decrease habitat connectivity and suitability for grassland bird species.
		3.3 Renewable Energy	Infrastructure, construction, and associated disturbances (e.g., roads, laydown yards) at wind and solar farm sites can cause direct and indirect fatalities and disturbance.
5. Livelihood Economic & Moral Incentives			
5.1 Linked Enterprises & Alternative Livelihoods	Develop programs that subsidize sunk and transitional costs (e.g., machinery) to corn and soy growers.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Incompatible and high-intensity mowing schedules of hay fields and grassy nesting areas.
5.2 Better Products & Management Practices	In years with extreme weather, incentivize farmers to not cut hay, providing protection for nesting birds (e.g., from hail storms).	11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
5.2 Better Products & Management Practices	Use multi-bore pads and clustering wells to minimize impact. Apply additional restrictions during the breeding season (May	3.1 Oil & Gas Drilling	Noise and landscape disturbances can decrease habitat connectivity and suitability for grassland bird species.

	to mid-July), like reducing noise levels, disturbances, and drilling.		
5.3 Market-Based Incentives	Develop or strengthen incentives and markets for grazing practices that benefit grassland birds. Incentivize farming and ranching that employs best management practices that support grassland birds and their habitat. Develop markets for late-cut hay and provide incentives to farmers and buyers.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Incompatible and high-intensity mowing schedules of hay fields and grassy nesting areas.
5.4 Direct Economic Incentives	Create subsidiary or compensation programs to reimburse farmers for declines in hay value related to delayed mowing, or for taking sub-optimal land out of hay production.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Incompatible and high-intensity mowing schedules of hay fields and grassy nesting areas.
5.4 Direct Economic Incentives	Provide incentives and support to landowners to reduce shrub growth, focusing on the benefit to beef production, and maintain grassland bird preferred habitat. Aim for large contiguous grasslands 8-166 cm in height with 12-95% grass cover, 4-40% forb cover, <35% shrub cover, 5-61% litter cover, and <9 cm litter depth. Encourage mowing outside the breeding season to remove encroaching shrubs and limit expansion.	7.1 Fire & Fire Suppression	Suppression of natural fire patterns leads to encroachment of woody vegetation in grassland habitat.
5.4 Direct Economic Incentives	Reward farmers employing best management practices.	2.3 Livestock Farming & Ranching	Disturbance of breeding habitat by intensive or overgrazing practices.
5.4 Direct Economic Incentives	Use grasslands to sequester carbon and earn carbon credits for land owners.	11.3 Changes in Temperature Regimes	Climate change can lead to a reduction in precipitation and loss of wet grassland habitats.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			

7.1 Laws, Regulations & Codes	Engage with lawmakers to retain and expand CRP in the U.S. Farm Bill conservation programs to strengthen, promote, improve, and enhance quality grassland habitat.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Incompatible and high-intensity mowing schedules of hay fields and grassy nesting areas.
7.1 Laws, Regulations & Codes	Increase effectiveness of grassland lobbying groups by developing guidance on ecosystem services that could be used to support new and expanding programs, like the U.S. Farm Bill.	3.3 Renewable Energy	Infrastructure, construction, and associated disturbances (e.g., roads, laydown yards) at wind and solar farm sites can cause direct and indirect fatalities and disturbance.
7.1 Laws, Regulations & Codes	Increase effectiveness of grassland lobbying groups.	3.1 Oil & Gas Drilling	Noise and landscape disturbances can decrease habitat connectivity and suitability for grassland bird species.
		8.1 Invasive Non-Native/Alien Plants & Animals	Domestic and feral outdoor cats. Invasive and exotic grasses (e.g., Crested Wheatgrass, Smooth Brome, Kentucky bluegrass) can replace natural grasslands.
7.1 Laws, Regulations & Codes	Increase the effectiveness of grassland lobbying groups to implement climate legislation that protects grasslands.	11.3 Changes in Temperature Regimes	Climate change can lead to a reduction in precipitation and loss of wet grassland habitats.
9. Education & Training			
9.2 Training & Individual Capacity Development	Educate stakeholders and relevant individuals of the effects of pesticides in birds, humans, and the environment.	9.3 Agricultural & Forestry Effluents	Pesticide use on grassland bird food resources and habitat sites.
9.2 Training & Individual Capacity Development	Generate awareness among ranching and agricultural stakeholders on the importance of early detection and containment of invasive grasses. Implement citizen science monitoring programs for early identification of invasive grasses.	8.1 Invasive Non-Native/Alien Plants & Animals	Domestic and feral outdoor cats. Invasive and exotic grasses (e.g., Crested Wheatgrass, Smooth Brome, Kentucky bluegrass) can replace natural grasslands.
10. Institutional Development			
10.2 External Organizational Development & Support	Work with wildlife services in areas without predator control guidelines and provide	5.1 Hunting & Collecting Terrestrial Animals	The increase in mesopredator populations due to the removal of large predators leads to an increase in nest predations.

	incentives to landowners to leave larger predators.		
10.3 Alliance & Partnership Development	Build partnerships with agricultural interests and beef producers to advocate for and incentivize lands kept in grazing.	2.1 Annual & Perennial Non-Timber Crops	Conversion of pasture, hay fields, and rangeland to crops. Incompatible and high-intensity mowing schedules of hay fields and grassy nesting areas.
10.3 Alliance & Partnership Development	Foster relationships and exchanges between grassland conservation entities and agricultural stakeholders.	2.3 Livestock Farming & Ranching	Disturbance of breeding habitat by intensive or overgrazing practices.
		9.3 Agricultural & Forestry Effluents	Pesticide use on grassland bird food resources and habitat sites.
10.3 Alliance & Partnership Development	Partner with vet clinics and non-profits to initiate trap-spay-release programs.	8.1 Invasive Non-Native/Alien Plants & Animals	Domestic and feral outdoor cats. Invasive and exotic grasses (e.g., Crested Wheatgrass, Smooth Brome, Kentucky bluegrass) can replace natural grasslands.

Hammond's Flycatcher Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct targeted outreach addressing the impacts of domestic cats on wildlife populations.	8.1 Invasive Non-Native/Alien Plants & Animals	Predation by domestic and feral cats.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	When managing forests, consider species impacts and habitat needs.	5.3 Logging & Wood Harvesting	Thinning and timber harvest removes mature forests.

Lark Bunting Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Limit construction and disturbance during grassland bird breeding, nesting, and brood-rearing season (April 1- July 15), keep noise levels < 49 dBA during the breeding season, and ensure sites and surroundings are reclaimed back to native grassland habitat post-construction.	3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Provide signage on public lands indicating no off-road travel. Conduct outreach campaigns to clean and dry recreational machines before and after use to minimize the spread of non-native species. Increase enforcement on public lands to ensure signage and recreational rules are being met.	6.1 Recreational Activities	ATV/UTV recreational use causes degradation of grassland habitats by impacting vegetation and soil, spreading non-native vegetation, potentially driving over nests. Human activities and noise may interfere with nesting, foraging, and brood-rearing.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Provide agency comments and review of potential new transmission line builds to mitigate pre/post construction effects and	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines

	ensure species and habitats of concern are considered.		affects survival due to collisions during migration and by increasing predator perching sites.
4.3 Non-Criminal Legal Action	Reduce permitting of new dams, reservoirs, and other water impoundments in important grassland bird habitat, except where livestock cannot access water from other sources (e.g., groundwater, rural water systems).	7.2 Dams & Water Management / Use	Disruption of natural hydrological processes (e.g., artificial dam construction, loss of beavers) that impact function of ephemeral or perennial prairie streams and floodplains can degrade habitat.
4.3 Non-Criminal Legal Action	Through the agency review process of new road and railroad construction, provide recommendations to mitigate effects and ensure species and habitats of concern are considered.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
4.3 Non-Criminal Legal Action	Through the agency, provide project-specific comments and recommendations to companies to mitigate pre- and post-construction effects and ensure that species of concern are considered.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
4.3 Non-Criminal Legal Action	Through the agency, provide project-specific comments and recommendations to development companies to mitigate pre- and post-construction effects and ensure species and habitats of concern are considered. Consult FWP's Crucial Areas Planning System (CAPS) and other sites such as	1.1 Housing & Urban Areas	Housing development in core grassland habitat will decrease breeding habitat via fragmentation and conversion, including destruction of native vegetation, installation of vertical structures avoided by grassland birds, introduction or expansion of meso-predators and human commensal species (e.g., cats, crows, raccoons), noise disturbance, and increase of non-native plant species.

	Montana Natural Heritage Program for indications of species of concern.		
5. Livelihood Economic & Moral Incentives			
5.1 Linked Enterprises & Alternative Livelihoods	Incentivize ranching over farming.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.2 Better Products & Management Practices	Manage wireless technology by constructing shorter cellular towers or reducing reliance on cell towers (i.e., move towards satellite or other alternatives).	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.
5.2 Better Products & Management Practices	Provide information to landowners about management practices that minimize negative effects on grassland bird nesting success. Mow fields after July 15 so nestlings can fledge. Seed fields early, before May 10 to limit nest destruction by machinery. Minimize tillage and use of pesticides and herbicides.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.3 Market-Based Incentives	Incentivize meat and fiber produced on properties with a grazing management plan compatible with grassland bird habitat.	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.
5.3 Market-Based Incentives	Promote the value of agriculture products produced while stewarding grassland, such as beef, bison and fiber.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
5.4 Direct Economic Incentives	Compensate livestock producers when production goals and wildlife habitat goals do not align (e.g., resting and heavy grazing).	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.
5.4 Direct Economic Incentives	Incentivize ranching over farming.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.

5.5 Non-Monetary Values	Convey the link between conservation and the effects of a changing climate on human health and populations.	11.3 Changes in Temperature Regimes	Changes in temperature can lengthen growing seasons, increase non-native vegetation monocultures, and impact the timing of the breeding season of grassland birds and cause their range to expand or contract. Hotter/drier summers can lead to droughts. Cooler temperatures can promote additional biomass growth throughout grasslands.
		11.4 Changes in Precipitation & Hydrological Regimes	Increased precipitation in the spring could increase non-native vegetation monocultures (Cheatgrass, Sweetclover, Kentucky Bluegrass, Smooth Brome) and woody vegetation expansion. Low moisture could impact prey populations for grassland birds. High moisture could promote cropland expansion.
		11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
5.5 Non-Monetary Values	Educating the public on the importance of minimal disturbance and the impacts of habitat destruction on grassland birds.	6.1 Recreational Activities	ATV/UTV recreational use causes degradation of grassland habitats by impacting vegetation and soil, spreading non-native vegetation, potentially driving over nests. Human activities and noise may interfere with nesting, foraging, and brood-rearing.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Identify areas of highest population densities and quality habitat for focused conservation attention. Prioritize conservation needs as projects/development are proposed.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.

		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Maintain strong adherence to the Montana Environmental Policy Act (MEPA).	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
		3.2 Mining & Quarrying	Mining and quarrying degrades and fragments suitable grassland habitat for grassland birds by changing vegetation structure, introducing non-native species, contaminating soil and water, and increasing disturbance via roads and machinery.
		3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.
7.1 Laws, Regulations & Codes	Pass laws/bills to minimize the use of pesticides, particularly insecticides including neonicotinoid seed treatments. Make highly toxic pesticides illegal.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
7.1 Laws, Regulations & Codes	Promote native vegetation seeding and prohibit persistent non-native species seeding during reclamation or restoration (e.g., along roadsides, energy production).	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
7.1 Laws, Regulations & Codes	Re-seed with native species only, without persistent non-native species. Restrict the construction of new roads and railroads (especially elevated roads) in grassland bird habitat. Apply Migratory Bird Treaty Act timing	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.

	restrictions for construction in core habitat of ground-nesting bird species.		
7.1 Laws, Regulations & Codes	Reduce disparity in subsidies between annual cropland and grass-based agriculture. Implement policies that better mitigate risk for ranching operations.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
7.1 Laws, Regulations & Codes	Restrict construction of new utility and service lines. Require seeding of native vegetation, without persistent non-native species, at all utility installation sites, including waterlines.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.
7.1 Laws, Regulations & Codes	Support science-based laws and bills to address climate change.	11.3 Changes in Temperature Regimes	Changes in temperature can lengthen growing seasons, increase non-native vegetation monocultures, and impact the timing of the breeding season of grassland birds and cause their range to expand or contract. Hotter/drier summers can lead to droughts. Cooler temperatures can promote additional biomass growth throughout grasslands.
		11.4 Changes in Precipitation & Hydrological Regimes	Increased precipitation in the spring could increase non-native vegetation monocultures (Cheatgrass, Sweetclover, Kentucky Bluegrass, Smooth Brome) and woody vegetation expansion. Low moisture could impact prey populations for grassland birds. High moisture could promote cropland expansion.
		11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
7.2 Policies & Guidelines	Reduce disparity in subsidies between annual cropland and grass-based agriculture. Implement policies that better mitigate risk for ranching operations.	2.1 Annual & Perennial Non-Timber Crops	Loss and conversion of native mixed-grass and short-grass prairie to annual crops or non-native perennial pasture reduces suitable breeding habitat.
9. Education & Training			

9.2 Training & Individual Capacity Development	Increase agencies' and public awareness of the threat posed by non-native vegetation to grassland species and habitats.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
9.2 Training & Individual Capacity Development	Provide technical assistance and information to landowners about woody vegetation encroachment and management guides.	8.2 Problematic Native Plants & Animals	Encroachment of native woody vegetation (Rocky Mountain Juniper, Ponderosa Pine) results in a complete loss of habitat for most grassland songbirds.
9.2 Training & Individual Capacity Development	Provide technical assistance to landowners through incentive programs and workshops. Support rancher-led organizations such as the Ranchers Stewardship Alliance.	2.3 Livestock Farming & Ranching	Livestock grazing (or lack thereof), depending on timing, intensity, and duration, can create unsuitable habitat.
9.2 Training & Individual Capacity Development	Provide trainings and information to stakeholders and agencies on pesticide use and effects on grassland birds.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
9.2 Training & Individual Capacity Development	Providing office and in-field trainings for agency personnel and workshops to landowners about prescribed fire management.	7.1 Fire & Fire Suppression	Altered fire regimes and fire suppression leading to high intensity fires reduces local breeding densities and leads to encroachment of woody vegetation in grassland habitat.
10. Institutional Development			
10.3 Alliance & Partnership Development	Proactively improve and increase partnerships with pesticide applicators to ensure that the methods and products used are the best available for wildlife and habitats.	9.3 Agricultural & Forestry Effluents	Herbicide and pesticide spraying, use, and runoff may impact invertebrate abundance and species health.
10.3 Alliance & Partnership Development	Work proactively with oil and gas contractors and companies to ensure best methods for wildlife and habitats are incorporated.	3.1 Oil & Gas Drilling	Degradation, conversion, and fragmentation of grassland habitat due to oil and gas structures and activity associated with drilling can decrease breeding habitat.
10.3 Alliance & Partnership Development	Work proactively with renewable energy contractors and companies to ensure best methods for wildlife and habitats are incorporated.	3.3 Renewable Energy	Solar and wind farms can cause disturbances that affect breeding and result in degradation, fragmentation, and loss of large tracts of native grassland. Collisions into wind farms during migration affects survival.

10.3 Alliance & Partnership Development	Work proactively with road and railroad contractors and companies to ensure best methods for wildlife and habitats are incorporated.	4.1 Roads & Railroads	Vehicle and train collisions cause direct mortalities. Road construction, fragmentation, and edge effects lead to habitat loss. Roads and railroads provide a conduit for spread of non-native species. Increase of meso-predator movements and denning sites along roads and culverts increases predation.
10.3 Alliance & Partnership Development	Work proactively with utility and service line contractors and companies to ensure best methods for wildlife and habitats are incorporated.	4.2 Utility & Service Lines	Utility and service lines can cause disturbances that affect breeding and can result in degradation, fragmentation, and loss of large tracts of native grassland. Utility and service lines affects survival due to collisions during migration and by increasing predator perching sites.
10.3 Alliance & Partnership Development	Work with ranching communities, agricultural extensions, and universities to find and share common solutions.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.
10.4 Financing Conservation	Promote incentive programs for landowners to manage non-native species. Create available funding for district/city weed managers.	8.1 Invasive Non-Native/Alien Plants & Animals	Encroachment of non-native vegetative species (e.g., Crested Wheatgrass, Smooth Brome, annual bromes), particularly non-native grasses or forbs that tend to form monocultures within grasslands, creates unfavorable habitat for grassland birds.

Marbled Godwit Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
4. Law Enforcement & Prosecution			

4.3 Non-Criminal Legal Action	Through the agency review process of projects, identify opportunities to protect grassland.	2.1 Annual & Perennial Non-Timber Crops	Conversion of grassland to cropland.
4.3 Non-Criminal Legal Action	Through the agency review process of projects, identify opportunities to protect wetlands.	7.2 Dams & Water Management / Use	Altered hydrology through wetland drainage and wetland loss.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.2 Easements & Resource Rights	Pursue conservation of semi-permanent and temporary wetlands and water rights that maintain them in places where Marbled Godwits occur and refugia models suggest greater climate stability.	11.1 Ecosystem Encroachment	Reduction in breeding habitat through drought. Shift in breeding or winter range.

Red-naped Sapsucker Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Develop and distribute educational materials and best management practices when administering firewood permits, focused on discouraging cutting of burned, dead, and dying trees >20 inches DBH.	4.1 Roads & Railroads	Roads, railroads, and other transportation infrastructure running along or through floodplains constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests. Roads used to access forested areas can increase snag and snag recruit removal for use as firewood.

3.1 Outreach & Communications	Develop and distribute educational materials and best management practices when administering firewood permits, focused on discouraging cutting of trees >15 inches DBH and avoiding Western Larch, Black Cottonwood, and Ponderosa Pine.	5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests can remove large-diameter trees and canopy closure needed for nesting, and snags and downed woody debris needed for foraging.
3.1 Outreach & Communications	Develop and distribute educational materials to livestock producers in forested areas and river bottoms with large-diameter trees, about the importance of those trees to nesting and foraging woodpeckers and other species.	2.3 Livestock Farming & Ranching	Removal of injured, dead, and dying large-diameter trees on private properties to maintain open rangelands removes important nesting and foraging trees. Overgrazing of riparian areas can limit establishment and growth of cottonwood trees used for nesting and foraging.
3.1 Outreach & Communications	Develop and distribute educational materials to new and existing landowners in forested areas and river bottoms with large-diameter trees, about the importance of those trees to nesting and foraging woodpeckers and other species.	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees on private properties in river bottoms and in forested areas removes important nest trees and foraging resources.
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners and land managers about alternative options for pest and weed control (e.g., native predators, regenerative grazing, biocontrol, mechanical removal) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Strengthen and promote enforcement of state and county laws and regulations around removal and manipulation of riparian vegetation in floodplains by private	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees on private properties in river

	landowners, and encourage reporting and remedy of violations.		bottoms and in forested areas removes important nest trees and foraging resources.
4.1 Detection & Arrest	Strengthen and promote enforcement of state and county laws and regulations around removal and manipulation of riparian vegetation in floodplains.	2.3 Livestock Farming & Ranching	Removal of injured, dead, and dying large-diameter trees on private properties to maintain open rangelands removes important nesting and foraging trees. Overgrazing of riparian areas can limit establishment and growth of cottonwood trees used for nesting and foraging.
		4.1 Roads & Railroads	Roads, railroads, and other transportation infrastructure running along or through floodplains constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests. Roads used to access forested areas can increase snag and snag recruit removal for use as firewood.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Promote increasing fines for violations of streamside protection laws so that fines do not become a 'fee' for vegetation removal/disturbance.	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees on private properties in river bottoms and in forested areas removes important nest trees and foraging resources.
		2.3 Livestock Farming & Ranching	Removal of injured, dead, and dying large-diameter trees on private properties to maintain open rangelands removes important nesting and foraging trees. Overgrazing of riparian areas can limit establishment and growth of cottonwood trees used for nesting and foraging.
9. Education & Training			
9.2 Training & Individual Capacity Development	Develop a document that provides best management practices for timber in mature and old-growth stands, with a focus on	5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests can remove large-diameter trees and canopy closure needed for nesting, and snags and downed woody debris needed for foraging.

	maintaining important patch sizes and habitat features for Species of Greatest Conservation Need dependent on old-growth stands. Facilitate communication on vegetation management between foresters and biologists by developing a document with common terms used in forest management and in descriptions of biological needs of forest-dependent Species of Greatest Conservation Need.		
10. Institutional Development			
10.3 Alliance & Partnership Development	Encourage landowners with forested areas on their properties to engage with DNRC's Forest Stewardship Program to responsibly manage their forests.	1.1 Housing & Urban Areas	Encroachment of development into floodplains of large rivers and streams constricts lateral channel migration, reducing floodplain processes that create and maintain cottonwood forests important for this species. Removal of injured, dead, and dying large-diameter trees on private properties in river bottoms and in forested areas removes important nest trees and foraging resources.
		5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests can remove large-diameter trees and canopy closure needed for nesting, and snags and downed woody debris needed for foraging.

Upland Sandpiper Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			

3.1 Outreach & Communications	Educate consumers on products to support healthy grasslands and people.	2.3 Livestock Farming & Ranching	In high-density grazing areas, nests and chicks can be trampled. Overgrazing leads to unsuitable grassland habitat.
3.1 Outreach & Communications	Increase awareness of ecosystem services provided by grasslands and economic tradeoffs of grassland conversion. Educate consumers on products that support healthy grasslands and people.	2.1 Annual & Perennial Non-Timber Crops	Incompatible and high-intensity mowing schedules of hay fields and grassy nesting areas. Loss of native grassland systems to row crops is a major threat to the species. The species may potentially benefit from row crops for foraging.
		7.1 Fire & Fire Suppression	Modifications to natural fire regimes increases woody cover in native grasslands, decreasing suitable habitat.
3.1 Outreach & Communications	Initiate programs to educate the public on the impact of feral and domestic cats to grassland birds.	8.1 Invasive Non-Native/Alien Plants & Animals	Domestic and feral outdoor cats.
3.1 Outreach & Communications	Raise awareness of the ecosystem services grasslands provide and the economic impact of their conversion.	11.3 Changes in Temperature Regimes	Climate change can lead to a reduction in precipitation and loss of wet grassland habitats.
4. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Comment on Environmental Assessments requesting consideration of grassland birds in action, mitigation and reclamation plans.	3.1 Oil & Gas Drilling	Reduction in quantity and quality of connected habitat for grassland bird species.
		3.3 Renewable Energy	Wind energy production results in direct mortality through collisions with windmills and associated infrastructure. Grassland bird species distribution and habitat use may be impacted from trying to avoid wind farm infrastructure or fragmented/low-quality habitats.
5. Livelihood Economic & Moral Incentives			
5.1 Linked Enterprises & Alternative Livelihoods	Develop programs that subsidize sunk and transitional costs (e.g., machinery) to corn and soy growers to convert monoculture crops to grazing lands.	2.1 Annual & Perennial Non-Timber Crops	Incompatible and high-intensity mowing schedules of hay fields and grassy nesting areas. Loss of native grassland systems to row crops is a major threat to the species. The species may potentially benefit from row crops for foraging.
5.2 Better Products & Management Practices	Encourage rational moderate grazing practices that are compatible with increasing grass height and density among grazing	2.3 Livestock Farming & Ranching	In high-density grazing areas, nests and chicks can be trampled. Overgrazing leads to unsuitable grassland habitat.

	habitats. Delay grazing until sandpiper young are able to fly.		
5.2 Better Products & Management Practices	In years with extreme weather, incentivize farmers to not cut hay, providing protection for nesting birds (e.g., from hail storms).	11.5 Severe/Extreme Weather Events	Extreme weather events such as early frosts, rainstorms, hail, flooding, or extreme heat or cold can impact grassland birds during nesting and brood rearing and can affect adult and fledging survival.
5.2 Better Products & Management Practices	Use multi-bore pads and clustering wells to minimize impact. Apply additional restrictions during the breeding season (May to mid-July), like reducing noise levels, disturbances, and drilling.	3.1 Oil & Gas Drilling	Reduction in quantity and quality of connected habitat for grassland bird species.
5.3 Market-Based Incentives	Develop or strengthen incentives and markets for grazing practices that benefit grassland birds. Incentivize farming and ranching that employs best management practices that support grassland birds and their habitat. Develop markets for late-cut hay and provide incentives to farmers and buyers.	2.1 Annual & Perennial Non-Timber Crops	Incompatible and high-intensity mowing schedules of hay fields and grassy nesting areas. Loss of native grassland systems to row crops is a major threat to the species. The species may potentially benefit from row crops for foraging.
5.4 Direct Economic Incentives	Create subsidiary or compensation programs to reimburse farmers for declines in hay value related to delayed mowing, or for taking sub-optimal land out of hay production.	2.1 Annual & Perennial Non-Timber Crops	Incompatible and high-intensity mowing schedules of hay fields and grassy nesting areas. Loss of native grassland systems to row crops is a major threat to the species. The species may potentially benefit from row crops for foraging.
5.4 Direct Economic Incentives	Provide incentives and support to landowners to reduce shrub growth, focusing on the benefit to beef production.	7.1 Fire & Fire Suppression	Modifications to natural fire regimes increases woody cover in native grasslands, decreasing suitable habitat.
5.4 Direct Economic Incentives	Reward farmers employing best management practices.	2.3 Livestock Farming & Ranching	In high-density grazing areas, nests and chicks can be trampled. Overgrazing leads to unsuitable grassland habitat.
5.4 Direct Economic Incentives	Use grasslands to sequester carbon and earn carbon credits for land owners.	11.3 Changes in Temperature Regimes	Climate change can lead to a reduction in precipitation and loss of wet grassland habitats.

C. Enabling Conditions Actions

7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Engage with lawmakers to retain and expand CRP in the U.S. Farm Bill conservation programs to strengthen, promote, improve, and enhance quality grassland habitat.	2.1 Annual & Perennial Non-Timber Crops	Incompatible and high-intensity mowing schedules of hay fields and grassy nesting areas. Loss of native grassland systems to row crops is a major threat to the species. The species may potentially benefit from row crops for foraging.
7.1 Laws, Regulations & Codes	Increase effectiveness of grassland lobbying groups by developing guidance on ecosystem services that could be used to support new and expanding programs, like the U.S. Farm Bill.	3.3 Renewable Energy	Wind energy production results in direct mortality through collisions with windmills and associated infrastructure. Grassland bird species distribution and habitat use may be impacted from trying to avoid wind farm infrastructure or fragmented/low-quality habitats.
7.1 Laws, Regulations & Codes	Increase effectiveness of grassland lobbying groups.	3.1 Oil & Gas Drilling	Reduction in quantity and quality of connected habitat for grassland bird species.
7.1 Laws, Regulations & Codes	Increase the effectiveness of grassland lobbying groups to implement climate legislation that protects grasslands.	9.3 Agricultural & Forestry Effluents	Risk of consuming grasshoppers treated with monocrotophos on wintering grounds. Data exists on significant impacts to Swainson's Hawks, but none confirmed for Upland Sandpipers. Upland Sandpipers will forage in cropland and are at a higher risk of consumption.
9. Education & Training			
9.2 Training & Individual Capacity Development	Educate stakeholders and relevant individuals of the effects of pesticides in birds, humans, and the environment.	9.3 Agricultural & Forestry Effluents	Risk of consuming grasshoppers treated with monocrotophos on wintering grounds. Data exists on significant impacts to Swainson's Hawks, but none confirmed for Upland Sandpipers. Upland Sandpipers will forage in cropland and are at a higher risk of consumption.
10. Institutional Development			
10.2 External Organizational Development & Support	Work with wildlife services in areas without predator control guidelines and provide incentives to landowners to leave larger predators.	5.1 Hunting & Collecting Terrestrial Animals	The increase in mesopredator populations due to the removal of large predators leads to an increase in nest predations.
10.3 Alliance & Partnership Development	Build partnerships with agricultural interests and beef producers to advocate for and incentivize lands kept in grazing.	2.1 Annual & Perennial Non-Timber Crops	Incompatible and high-intensity mowing schedules of hay fields and grassy nesting areas. Loss of native grassland

			systems to row crops is a major threat to the species. The species may potentially benefit from row crops for foraging.
10.3 Alliance & Partnership Development	Foster relationships and exchanges between grassland conservation entities and agricultural stakeholders.	2.3 Livestock Farming & Ranching	In high-density grazing areas, nests and chicks can be trampled. Overgrazing leads to unsuitable grassland habitat.
		9.3 Agricultural & Forestry Effluents	Risk of consuming grasshoppers treated with monocrotophos on wintering grounds. Data exists on significant impacts to Swainson's Hawks, but none confirmed for Upland Sandpipers. Upland Sandpipers will forage in cropland and are at a higher risk of consumption.
10.3 Alliance & Partnership Development	Partner with vet clinics and non-profits to initiate trap-spay-release programs.	8.1 Invasive Non-Native/Alien Plants & Animals	Domestic and feral outdoor cats.

Williamson's Sapsucker Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Avoid or minimize development around potential breeding sites, or maintain vegetated buffers between developed areas and potential breeding sites. Avoid or minimize removing large-diameter (>20 inches DBH) live, injured, dying, and dead trees around developed areas.	1.1 Housing & Urban Areas	Removal of injured, dead, and dying large-diameter trees on private properties in river bottoms and forested areas removes important nest trees and foraging resources.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			

3.1 Outreach & Communications	Develop and distribute educational materials and best management practices when administering firewood permits, focused on discouraging cutting of burned, dead, and dying trees >20 inches DBH.	4.1 Roads & Railroads	Roads used to access forested areas can increase snag and snag recruit removal for use as firewood.
3.1 Outreach & Communications	Develop and distribute educational materials and best management practices when administering firewood permits, focused on discouraging cutting of trees >15 inches DBH and avoiding Western Larch, Black Cottonwood, and Ponderosa Pine.	5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests can remove large-diameter trees and canopy closure needed for nesting, and snags and downed woody debris needed for foraging.
3.1 Outreach & Communications	Develop and distribute educational materials to new and existing landowners in forested areas and river bottoms with large-diameter trees, about the importance of those trees to nesting and foraging woodpeckers and other species.	1.1 Housing & Urban Areas	Removal of injured, dead, and dying large-diameter trees on private properties in river bottoms and forested areas removes important nest trees and foraging resources.
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners and land managers about alternative options for pest and weed control (e.g., native predators, regenerative grazing, biocontrol, mechanical removal) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates).
C. Enabling Conditions Actions			
9. Education & Training			
9.2 Training & Individual Capacity Development	Develop a document that provides best management practices for timber in mature and old-growth stands, with a focus on maintaining important patch sizes and habitat features for Species of Greatest	5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests can remove large-diameter trees and canopy closure needed for nesting, and snags and downed woody debris needed for foraging.

	Conservation Need dependent on old-growth stands. Facilitate communication on vegetation management between foresters and biologists by developing a document with common terms used in forest management and in descriptions of biological needs of forest-dependent Species of Greatest Conservation Need.		
10. Institutional Development			
10.3 Alliance & Partnership Development	Encourage landowners with forested areas on their properties to engage with DNRC's Forest Stewardship Program to responsibly manage their forests.	1.1 Housing & Urban Areas	Removal of injured, dead, and dying large-diameter trees on private properties in river bottoms and forested areas removes important nest trees and foraging resources.
		5.3 Logging & Wood Harvesting	Timber harvest in mature and old-growth forests can remove large-diameter trees and canopy closure needed for nesting, and snags and downed woody debris needed for foraging.

Arctic Grayling Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.2 Ecosystem & Natural Process (Re)Creation	Initiate a project to improve over-winter habitat in Upper Red Rock Lake. Initiate a project to reconnect Narrows Creek with Elk Lake for grayling spawning habitat. Work with USFWS to improve the existing dam on Lower Red Rock Lake, which may increase depth	11.4 Changes in Precipitation & Hydrological Regimes	Reduced flows caused by lower winter precipitation and early run-off decrease survival of arctic grayling due to elevated water temperatures, decreased summer and winter habitat, and lack of tributary connection.

	and Dissolved Oxygen levels in Upper Red Rock Lake during winter.		
1.2 Ecosystem & Natural Process (Re)Creation	Initiate projects that improve streamflows through improvements to irrigation or off-channel watering.	2.3 Livestock Farming & Ranching	Irrigation diversions can cause entrainment or prevent fish passage. Incompatible grazing practices may impact aquatic habitat and stream temperatures.
2. Species Management			
2.2 Species Re-Introduction & Translocation	Introduce Arctic Grayling into areas with low Brown Trout densities or fishless habitat created by fish removal projects for Westslope Cutthroat Trout.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition and predation by Brown Trout.
B. Behavioral Change/Threat Reduction			
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Increase enforcement during fishing closures and in key grayling habitat.	5.4 Fishing & Harvesting Aquatic Resources	Arctic Grayling are highly susceptible to angling.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Consider closing portions of Red Rock Creek to fishing until improvements to Upper Red Rock Lake are made and the population reaches recovery goals. Continue protective angling regulations for Arctic Grayling (e.g., catch-and-release for grayling on all rivers, spawning closures in Red Rock Creek).	5.4 Fishing & Harvesting Aquatic Resources	Arctic Grayling are highly susceptible to angling.
7.1 Laws, Regulations & Codes	Continue liberal fishing regulations to encourage the harvest of non-native trout in the upper Big Hole River.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition and predation by Brown Trout.

Columbia River Redband Trout Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Investigate the possibility of removing non-native species where redband populations occur.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
1.1 Site/Area Stewardship	Protect existing pure Columbia River Redband populations.	12.1 Other	Geographically restricted range; isolated populations. Limited genetic diversity with little to no genetic exchange.
1.1 Site/Area Stewardship	Protect existing redband populations through physical isolation where feasible.	8.3 Introduced Genetic Material	Hybridization with introduced fish species.
2. Species Management			
2.1 Species Stewardship	Remove potentially hybridizing species where feasible.	8.3 Introduced Genetic Material	Hybridization with introduced fish species.
2.1 Species Stewardship	Review past and current fish stocking practices and modify current practices as appropriate. Remove non-native competitors where feasible.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
2.2 Species Re-Introduction & Translocation	Explore opportunities to reestablish Columbia River Redband Trout into historic habitats through translocations and hatchery production.	8.3 Introduced Genetic Material	Hybridization with introduced fish species.
2.2 Species Re-Introduction & Translocation	Identify opportunities to expand current distribution within the native range.	12.1 Other	Geographically restricted range; isolated populations. Limited genetic diversity with little to no genetic exchange.
2.3 Ex-Situ Conservation	Establish Columbia River Redband Trout broodstock for conservation and recreation purposes.	12.1 Other	Geographically restricted range; isolated populations. Limited genetic diversity with little to no genetic exchange.

2.3 Ex-Situ Conservation	Establish Columbia River Redband Trout broodstock from remaining wild populations to support restoration efforts to expand their distribution.	8.3 Introduced Genetic Material	Hybridization with introduced fish species.
C. Enabling Conditions Actions			
10. Institutional Development			
10.3 Alliance & Partnership Development	Collaborate with landowners and land management agencies to limit or mitigate activities that may be detrimental to redbands.	5.3 Logging & Wood Harvesting	Impacts to stream channel integrity, habitat complexity, woody debris recruitment, temperature, and sedimentation.
10.3 Alliance & Partnership Development	Coordinate with co-managers and stakeholders to produce beneficial outcomes for improving redband trout status in Montana.	8.3 Introduced Genetic Material	Hybridization with introduced fish species.

Pallid Sturgeon Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Install passage structures at low head diversion dams that block or impede upstream and downstream passage.	7.2 Dams & Water Management / Use	Dams and associated reservoirs that block passage to spawning sites and/or compromise downstream drift distance.
2. Species Management			

2.1 Species Stewardship	Manage non-native predators when feasible.	8.1 Invasive Non-Native/Alien Plants & Animals	Predation by non-native fish.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct outreach and education regarding benefits of a more natural approach to bank stabilization or permission of natural channel migration.	7.3 Other Ecosystem Modifications	Channel simplification due to streambank armoring or dredging, impacts available spawning, rearing, and foraging habitat.
3.1 Outreach & Communications	Conduct outreach and education regarding benefits of instream flows for Pallid Sturgeon.	7.2 Dams & Water Management / Use	Increases in municipal water demand cause negative impacts to current flow regimes.
3.1 Outreach & Communications	Educate anglers on the importance of native species and how to identify Shovelnose Sturgeon vs. Pallid Sturgeon.	5.4 Fishing & Harvesting Aquatic Resources	Anglers illegally or incidentally contribute to mortality of Pallid Sturgeon while pursuing other recreational species.
3.1 Outreach & Communications	Showcase aquatic invasive species and use other educational opportunities to help prevent future introductions and highlight the importance of native species.	8.1 Invasive Non-Native/Alien Plants & Animals	Predation by non-native fish.
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Increase enforcement efforts during critical periods when Pallid Sturgeon are most likely to be encountered by anglers, and enhance penalties for illegal harvesting of Pallid Sturgeon.	5.4 Fishing & Harvesting Aquatic Resources	Anglers illegally or incidentally contribute to mortality of Pallid Sturgeon while pursuing other recreational species.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Work with irrigators to install screens or make other modifications that reduce entrainment.	2.3 Livestock Farming & Ranching	Irrigation withdrawals can result in stranding, and cause entrainment of drifting embryos and larvae.
5.2 Better Products & Management Practices	Work with the energy industry to establish and use best practices for minimizing the risk	3.1 Oil & Gas Drilling	Pipeline crossings and their potential failure can introduce contaminants and pollutants to water that have the propensity

	of pipeline failure and extent of spill, and implementing effective cleanup.		to bioaccumulate in long-lived fishes and can impact long-term survival and reproduction.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Create regulations that further limit the pursuit of Pallid Sturgeon. Maintain enforcement presence during Pallid Sturgeon spawning seasons and monitor regulated recreational fishing activity.	5.4 Fishing & Harvesting Aquatic Resources	Anglers illegally or incidentally contribute to mortality of Pallid Sturgeon while pursuing other recreational species.
7.1 Laws, Regulations & Codes	Use the existing permitting process to protect and/or enhance habitats (e.g., SPA124, 404) and increase awareness that such permits exist.	7.2 Dams & Water Management / Use	Increases in municipal water demand cause negative impacts to current flow regimes.
		7.3 Other Ecosystem Modifications	Channel simplification due to streambank armoring or dredging, impacts available spawning, rearing, and foraging habitat.
7.1 Laws, Regulations & Codes	Use the existing permitting process to protect and/or enhance habitats (e.g., SPA124, 404) and increase awareness that such permits exist.	3.1 Oil & Gas Drilling	Pipeline crossings and their potential failure can introduce contaminants and pollutants to water that have the propensity to bioaccumulate in long-lived fishes and can impact long-term survival and reproduction.

White Sturgeon Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.2 Ecosystem & Natural Process (Re)Creation	Coordinate flow fluctuations with Libby Dam as practical to emulate more normative hydrologic conditions.	7.2 Dams & Water Management / Use	Altered hydrologic regime – hydrograph, peak flows, thermograph, reduced nutrient transport.

2. Species Management			
2.3 Ex-Situ Conservation	Continue conservation aquaculture program.	7.2 Dams & Water Management / Use	Altered hydrologic regime – hydrograph, peak flows, thermograph, reduced nutrient transport.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Support site-specific selenium standard for Lake Koocanusa (and the Kootenai River).	3.2 Mining & Quarrying	Elevated selenium levels in Lake Koocanusa from Canadian coal mines extending downstream past the Montana-Idaho border.
10. Institutional Development			
10.3 Alliance & Partnership Development	Continue to coordinate with partners downstream in Idaho and British Columbia.	7.2 Dams & Water Management / Use	Altered hydrologic regime – hydrograph, peak flows, thermograph, reduced nutrient transport.

Northern Redbelly X Finescale Dace Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Manage non-native fish species to reduce impacts to Northern Redbelly.	8.1 Invasive Non-Native/Alien Plants & Animals	Changes in riparian community can compromise habitat. Non-native species (e.g., Northern Pike, Smallmouth Bass, trout species) predate this species.
2.1 Species Stewardship	Reestablish or improve flows in intermittent reaches. Include selective passage above existing barriers. Upgrade irrigation diversions to include fish screens when necessary.	7.2 Dams & Water Management / Use	Impoundments and diversions alter flow regimes, fragment habitat, and degrade water quality.

2.2 Species Re-Introduction & Translocation	Conduct translocations to improve genetic diversity.	4.1 Roads & Railroads	Habitat fragmentation created by culvert infrastructure.
2.2 Species Re-Introduction & Translocation	Reintroduce and/or translocate Northern Redbelly to locations where non-native fish would not limit the success of the action.	8.1 Invasive Non-Native/Alien Plants & Animals	Changes in riparian community can compromise habitat. Non-native species (e.g., Northern Pike, Smallmouth Bass, trout species) predate this species.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate bait seiners and/or anglers about Northern Redbelly Dace identification and fishing regulations.	5.4 Fishing & Harvesting Aquatic Resources	Commercial and private bait fish collection can impact this species.
3.1 Outreach & Communications	Provide better outreach and communication on how increasing housing and streambank encroachment is affecting our small streams.	1.1 Housing & Urban Areas	Active channel encroachment, and locked-in channel (e.g., engineered channel to stay in banks) can degrade habitat, while excessive groundwater use can dry streams.
3.1 Outreach & Communications	Provide better outreach and communication where streams may be impacted by recreational OHV use near prairie streams.	6.1 Recreational Activities	nan.
3.1 Outreach & Communications	Providing knowledge of the species and guidelines for increasing stewardship.	2.3 Livestock Farming & Ranching	Cattle trampling and overwidening, overgrazing and nutrient loading (from CAFOs and from herbicide and pesticide use) degrades and pollutes habitat.
		4.2 Utility & Service Lines	Drilling under streambeds can impact habitat.
3.1 Outreach & Communications	Work with federal agencies on developing awareness of streams where Northern Redbelly Dace occur and could be impacted by missile activities.	6.2 War, Civil Unrest & Military Exercises	Nuclear weapon sites near prairie streams.
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Maintain enforcement presence to deter illegal activity and detect violation of harvest restrictions and other fishing regulations that	5.4 Fishing & Harvesting Aquatic Resources	Commercial and private bait fish collection can impact this species.

	protect vulnerable Northern Redbelly Dace populations.		
4.3 Non-Criminal Legal Action	Work with public lands agencies on developing statutory authority to prevent excessive OHV use near prairie streams where Northern Redbelly Dace occur.	6.1 Recreational Activities	nan.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Ensure that adequate mitigation measures and best management practices are employed in future extraction operations.	3.1 Oil & Gas Drilling	Pollution from operations enters streams.
5.4 Direct Economic Incentives	Create incentives that promote more eco-conscious drilling practices.	3.1 Oil & Gas Drilling	Pollution from operations enters streams.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Ensure that Northern Redbelly Dace conservation measures are included in USFS Forest Plans.	5.3 Logging & Wood Harvesting	nan.
6.5 Site Infrastructure	Construct water treatment plants and other mitigation infrastructure to address legacy effects of past mining operations.	3.2 Mining & Quarrying	Loss of spring water input.
6.5 Site Infrastructure	Construct wind farms in areas away from intermittent and perennial streams.	3.3 Renewable Energy	Encroachment on or nearby streambank or active channel can impact habitat.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Amend policies (or create additional ones) that restrict private ponds from being built in or around floodplains, with more stringent language limiting the type of species permissible for stocking in drainages of concern.	2.4 Marine & Freshwater Aquaculture	Private fish ponds threaten introduction of non-native fish into watershed.

7.1 Laws, Regulations & Codes	Develop more stringent commercial bait regulations. Propose new seining restrictions where appropriate.	5.4 Fishing & Harvesting Aquatic Resources	Commercial and private bait fish collection can impact this species.
10. Institutional Development			
10.3 Alliance & Partnership Development	Convene watershed coalition to collaboratively work with partner agencies, NGOs, and private landowners to garner community support for private lands conservation activities.	2.1 Annual & Perennial Non-Timber Crops	Lack of natural riparian area or community for stream cover/shading.
		2.3 Livestock Farming & Ranching	Cattle trampling and overwidening, overgrazing and nutrient loading (from CAFOs and from herbicide and pesticide use) degrades and pollutes habitat.
10.3 Alliance & Partnership Development	Work with state and federal agencies on more proactive fire suppression activities that are not harmful to streams (e.g., GIS data of avoidance zones for retardants or water drops with concerns of aquatic invasive species).	7.1 Fire & Fire Suppression	Fire encroachment on or nearby streambank or active channel.
10.3 Alliance & Partnership Development	Work with transportation agencies and/or counties to communicate the impacts of road crossings and collaborate on guidance for better road crossing infrastructure.	4.1 Roads & Railroads	Habitat fragmentation created by culvert infrastructure.

Blue Sucker Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			

1.1 Site/Area Stewardship	Install passage structures at low head diversion dams that block or impede upstream and downstream passage.	7.2 Dams & Water Management / Use	Dams and associated reservoirs can block passage to spawning sites and alter natural flow and temperature patterns.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct outreach and education regarding benefits of a more natural approach to bank stabilization or permission of natural channel migration.	7.3 Other Ecosystem Modifications	Channel simplification from bank stabilization and dredging can impact available spawning, rearing, and foraging habitat.
3.1 Outreach & Communications	Educate anglers and bowfishers on the importance of native species.	5.4 Fishing & Harvesting Aquatic Resources	Anglers may kill native non-game fish when caught on hook and line because they are perceived as "undesirable". Indiscriminate shooting of "undesirable" fish by bowfishers.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Work with irrigators to install screens or make other modifications that reduce entrainment.	2.3 Livestock Farming & Ranching	Irrigation withdrawals in tributary streams can limit access to spawning habitat, result in stranding, and cause entrainment of drifting larvae.
5.2 Better Products & Management Practices	Work with the energy industry to establish and use best practices for minimizing the risk of pipeline failure and extent of spill, and implementing effective cleanup.	3.1 Oil & Gas Drilling	Pipeline crossings and their potential failure can introduce contaminants and pollutants that have the propensity to bioaccumulate in long-lived fishes and can impact long-term survival and reproduction.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Create regulations that limit the shooting of Species of Concern with bowfishing gear. Pursue regulations discouraging wanton waste of non-game species, particularly those listed as Species of Concern.	5.4 Fishing & Harvesting Aquatic Resources	Anglers may kill native non-game fish when caught on hook and line because they are perceived as "undesirable". Indiscriminate shooting of "undesirable" fish by bowfishers.
7.1 Laws, Regulations & Codes	Use the existing permitting process to protect and/or enhance habitats (e.g., SPA124, 404)	3.1 Oil & Gas Drilling	Pipeline crossings and their potential failure can introduce contaminants and pollutants that have the propensity to

	and increase awareness that such permits exist.		bioaccumulate in long-lived fishes and can impact long-term survival and reproduction.
		7.3 Other Ecosystem Modifications	Channel simplification from bank stabilization and dredging can impact available spawning, rearing, and foraging habitat.

Bull Trout Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Install barriers or isolate populations, where appropriate, and manipulate non-native fish populations to benefit Bull Trout where appropriate and possible.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
		8.3 Introduced Genetic Material	Hybridization with nonnative brook trout.
1.2 Ecosystem & Natural Process (Re)Creation	Facilitate upstream and downstream passage at large dams (e.g., hydropower facilities) where appropriate. Modify irrigation diversions to enable unrestricted fish passage where appropriate.	7.2 Dams & Water Management / Use	Habitat fragmentation from dams and irrigation diversions. Dam impoundments can create unsuitable conditions and predator traps. Irrigation withdrawals reduce habitat suitability and connectivity.
2. Species Management			
2.1 Species Stewardship	Remove or suppress nonnative fish where appropriate and possible.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
		8.3 Introduced Genetic Material	Hybridization with nonnative brook trout.

2.2 Species Re-Introduction & Translocation	Consider translocating populations when conserving in place is not feasible or effective.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
2.2 Species Re-Introduction & Translocation	Consider translocating populations when conserving in place is not feasible or effective. Explore opportunities to introduce Bull Trout into novel, highly suitable habitats. Explore genetic rescue translocations where appropriate.	8.3 Introduced Genetic Material	Hybridization with nonnative brook trout and small remaining population sizes affect this species.
2.2 Species Re-Introduction & Translocation	Explore opportunities to introduce Bull Trout into novel habitats predicted to remain thermally suitable in the long term. Explore reintroductions into areas where limiting factors have been corrected.	11.3 Changes in Temperature Regimes	Increases in stream temperatures are expected to reduce the amount of thermally suitable habitat.
2.2 Species Re-Introduction & Translocation	Explore opportunities to introduce Bull Trout into novel habitats that are predicted to remain suitable long-term in the face of climate change. Explore reintroductions into areas where limiting factors have been corrected.	11.4 Changes in Precipitation & Hydrological Regimes	Hydrologic regime changes may exacerbate stream warming and increase the risk of redd scouring.
2.2 Species Re-Introduction & Translocation	Seek opportunities to expand distributions to increase redundancy of local populations on the landscape.	7.1 Fire & Fire Suppression	Frequency and severity of wildfires exacerbated by climate change.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate the public about Bull Trout fishing regulations and identification (so they can be distinguished from Brook Trout).	5.4 Fishing & Harvesting Aquatic Resources	Excessive fishing mortality could cause population-level impacts.
3.1 Outreach & Communications	Prevent illegal introductions of nonnative fish species by educating the public about deleterious effects.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.

4. Law Enforcement & Prosecution			
4.2 Criminal Prosecution & Conviction	Maintain enforcement presence to deter illegal activity and detect violation of harvest restrictions and other fishing regulations that protect Bull Trout.	5.4 Fishing & Harvesting Aquatic Resources	Excessive fishing mortality could cause population-level impacts.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Ensure that adequate mitigation measures and best management practices are employed in future extraction operations.	3.2 Mining & Quarrying	Mining and quarrying can degrade habitat and impact water quality.
5.2 Better Products & Management Practices	Improve fish ladders at dams. Minimize impacts of diversion construction and maintenance through stream permitting oversight.	7.2 Dams & Water Management / Use	Habitat fragmentation from dams and irrigation diversions. Dam impoundments can create unsuitable conditions and predator traps. Irrigation withdrawals reduce habitat suitability and connectivity.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.3 Land/Water Use Zoning & Designation	Review subdivision requests and make recommendations based on FWP's Fish and Wildlife Recommendations for Subdivision Development.	1.1 Housing & Urban Areas	Habitat degradation from residential development.
6.4 Conservation Planning	Identify and prioritize conservation areas that are less vulnerable to climate-driven stream changes.	11.3 Changes in Temperature Regimes	Increases in stream temperatures are expected to reduce the amount of thermally suitable habitat.
		11.4 Changes in Precipitation & Hydrological Regimes	Hydrologic regime changes may exacerbate stream warming and increase the risk of redd scouring.
6.5 Site Infrastructure	Construct water treatment plants and other mitigation infrastructure to address legacy effects of past mining operations.	3.2 Mining & Quarrying	Mining and quarrying can degrade habitat and impact water quality.
7. Legal & Policy Frameworks			

7.1 Laws, Regulations & Codes	Increase harvest limits of non-native fish.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
7.1 Laws, Regulations & Codes	Propose new angling restrictions where appropriate.	5.4 Fishing & Harvesting Aquatic Resources	Excessive fishing mortality could cause population-level impacts.
10. Institutional Development			
10.3 Alliance & Partnership Development	Convene watershed coalition to collaboratively work with partner agencies, NGOs, and private landowners to garner community support for private lands conservation activities.	2.1 Annual & Perennial Non-Timber Crops	Hay and crop production encroaches on riparian and stream corridors.
		2.3 Livestock Farming & Ranching	Habitat degradation due to incompatible agricultural practices.
10.3 Alliance & Partnership Development	Convene watershed coalition to collaboratively work with partner agencies, NGOs, and private landowners to garner community support for voluntary water conservation measures to improve drought resiliency and foster support and trust to enable water leasing projects to occur.	7.2 Dams & Water Management / Use	Habitat fragmentation from dams and irrigation diversions. Dam impoundments can create unsuitable conditions and predator traps. Irrigation withdrawals reduce habitat suitability and connectivity.

Columbia Slimy Sculpin Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
	Look for opportunities to translocate populations to thermally suitable habitats	11.3 Changes in Temperature Regimes	Columbia slimy sculpin are cold water obligates, and their distribution is more closely tied to temperature than any other

2.2 Species Re-Introduction & Translocation	above impassable barriers (such as waterfalls) that prevent access to suitable habitat. Consider Columbia Slimy Sculpin in translocation projects with sympatric Bull Trout or Westslope Cutthroat Trout.		fish species in Montana. Changes, specifically increases, to water temperature have dramatic and deleterious consequences to their persistence in streams. Impassable barriers will often limit their upstream distribution and should be minimized to allow penetration further upstream to seek suitable thermal habitats.
		7.2 Dams & Water Management / Use	Altered hydrological regime (flow and temperature) can limit distribution. Dams and diversions can restrict passage; even impediments as high as 200mm can restrict passage for sculpin.

Lake Trout Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.2 Ecosystem & Natural Process (Re)Creation	Identify projects to improve the habitat in lakes with native Lake Trout populations (Twin Lake and Elk Lake) to improve the species' resiliency to climate change.	11.4 Changes in Precipitation & Hydrological Regimes	Low water levels caused by decreased snowpack and precipitation may reduce availability of suitable lake trout spawning habitat.
		12.1 Other	Decreased genetic variation due to small remaining population (genetic bottleneck) as well as irregular or inconsistent recruitment threaten this species, though there is little information on the limiting factors for the native populations.
2. Species Management			
	Identify locations for introducing native Lake Trout to create additional conservation	11.3 Changes in Temperature Regimes	Climate change can alter habitat through changes in air and water temperature.

2.2 Species Re-Introduction & Translocation	populations in habitats more resilient to climate change.	11.4 Changes in Precipitation & Hydrological Regimes	Low water levels caused by decreased snowpack and precipitation may reduce availability of suitable lake trout spawning habitat.
2.2 Species Re-Introduction & Translocation	Identify locations to introduce native Lake Trout to create additional conservation populations in habitats more resilient to climate change. Use translocation to improve genetic diversity.	12.1 Other	Decreased genetic variation due to small remaining population (genetic bottleneck) as well as irregular or inconsistent recruitment threaten this species, though there is little information on the limiting factors for the native populations.

C. Enabling Conditions Actions

6. Conservation Designation & Planning

6.4 Conservation Planning	Develop a management plan for native Lake Trout in Elk Lake and Twin Lake.	11.3 Changes in Temperature Regimes	Climate change can alter habitat through changes in air and water temperature.
		11.4 Changes in Precipitation & Hydrological Regimes	Low water levels caused by decreased snowpack and precipitation may reduce availability of suitable lake trout spawning habitat.
		12.1 Other	Decreased genetic variation due to small remaining population (genetic bottleneck) as well as irregular or inconsistent recruitment threaten this species, though there is little information on the limiting factors for the native populations.

Northern Pearl Dace Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			

2.1 Species Stewardship	Removal of Northern Pike and potentially other non-native predators from prairie streams and ponds.	8.1 Invasive Non-Native/Alien Plants & Animals	Introduced predators such as Northern Pike have been shown to reduce the distribution and population densities of Pearl Dace.
2.2 Species Re-Introduction & Translocation	Potential re-introduction of Pearl Dace into historic habitats.	8.1 Invasive Non-Native/Alien Plants & Animals	Introduced predators such as Northern Pike have been shown to reduce the distribution and population densities of Pearl Dace.
C. Enabling Conditions Actions			
8. Research & Monitoring			
8.1 Basic Research and Status Monitoring	Conduct research to identify conservation actions.	11.3 Changes in Temperature Regimes	Changes in the timing of prairie and mountain snow melt could change the hydrological regime of prairie streams and impact spawning and recruitment. Warming prairie streams could limit habitat availability.
11. Other Action			
11.1 Other Action: NA/Habitat protection	Protect the best available habitat for Pearl Dace from negative impacts.	11.3 Changes in Temperature Regimes	Changes in the timing of prairie and mountain snow melt could change the hydrological regime of prairie streams and impact spawning and recruitment. Warming prairie streams could limit habitat availability.

Northern Redbelly Dace Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Conduct species re-introduction and translocation where appropriate.	8.1 Invasive Non-Native/Alien Plants & Animals	Non-native species (e.g., Northern Pike, Smallmouth Bass, trout spp) predate this species and non-native plants in the riparian plant community can compromise habitat.

2.1 Species Stewardship	Reestablish or improve flows in intermittent reaches. Include selective passage above existing barriers. Upgrade irrigation diversions to include fish screens when necessary.	7.2 Dams & Water Management / Use	Impoundments and diversions alter flow regimes, fragment habitat, and degrade water quality.
2.2 Species Re-Introduction & Translocation	Conduct translocations to improve genetic diversity.	4.1 Roads & Railroads	Habitat fragmentation created by culvert infrastructure.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate bait seiners and/or anglers about Northern Redbelly Dace identification and fishing regulations.	5.4 Fishing & Harvesting Aquatic Resources	Commercial and private bait fish collection can impact this species.
3.1 Outreach & Communications	Provide better outreach and communication on how increasing housing and streambank encroachment is affecting our small streams.	1.1 Housing & Urban Areas	Active channel encroachment, and locked in' channel (e.g., engineered channel to stay in banks) can degrade habitat, while excessive groundwater use can dry streams.
3.1 Outreach & Communications	Provide better outreach and communication where streams may be impacted by recreational OHV use near prairie streams.	6.1 Recreational Activities	nan.
3.1 Outreach & Communications	Providing knowledge of the species and guidelines for increasing stewardship.	2.3 Livestock Farming & Ranching	Cattle trampling and overwidening, overgrazing and nutrient loading (from CAFOs and from herbicide and pesticide use) degrades and pollutes habitat.
		4.2 Utility & Service Lines	Drilling under streambeds can impact habitat.
3.1 Outreach & Communications	Work with federal agencies on developing awareness of streams where Northern Redbelly Dace occur and could be impacted by missile activities.	6.2 War, Civil Unrest & Military Exercises	Nuclear weapon sites near prairie streams.
4. Law Enforcement & Prosecution			

4.1 Detection & Arrest	Maintain enforcement presence to deter illegal activity and detect violation of harvest restrictions and other fishing regulations that protect vulnerable Northern Redbelly Dace populations.	5.4 Fishing & Harvesting Aquatic Resources	Commercial and private bait fish collection can impact this species.
4.3 Non-Criminal Legal Action	Work with public lands agencies on developing statutory authority to prevent excessive OHV use near prairie streams where Northern Redbelly Dace occur.	6.1 Recreational Activities	nan.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Ensure that adequate mitigation measures and best management practices are employed in future extraction operations.	3.1 Oil & Gas Drilling	Pollution from operations enters streams.
5.4 Direct Economic Incentives	Create incentives that promote more eco-conscious drilling practices.	3.1 Oil & Gas Drilling	Pollution from operations enters streams.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Ensure that Northern Redbelly Dace conservation measures are included in USFS Forest Plans.	5.3 Logging & Wood Harvesting	nan.
6.5 Site Infrastructure	Construct water treatment plants and other mitigation infrastructure to address legacy effects of past mining operations.	3.2 Mining & Quarrying	Loss of spring water input.
6.5 Site Infrastructure	Construct wind farms in areas away from intermittent and perennial streams.	3.3 Renewable Energy	Encroachment on or nearby streambank or active channel can impact habitat.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Amend or create policies that restrict private ponds from being built in or around floodplains, with more stringent language	2.4 Marine & Freshwater Aquaculture	Private fish ponds threaten introduction of non-native fish into watershed.

	limiting the type of species permissible for stocking in drainages of concern.		
7.1 Laws, Regulations & Codes	Develop more stringent commercial bait regulations. Propose new seining restrictions where appropriate.	5.4 Fishing & Harvesting Aquatic Resources	Commercial and private bait fish collection can impact this species.
10. Institutional Development			
10.3 Alliance & Partnership Development	Convene watershed coalition to collaboratively work with partner agencies, NGOs, and private landowners to garner community support for private lands conservation activities.	2.1 Annual & Perennial Non-Timber Crops	Lack of natural riparian area or community for stream cover/shading.
		2.3 Livestock Farming & Ranching	Cattle trampling and overwidening, overgrazing and nutrient loading (from CAFOs and from herbicide and pesticide use) degrades and pollutes habitat.
10.3 Alliance & Partnership Development	Work with state and federal agencies on more proactive fire suppression activities that are not harmful to streams (e.g., GIS data of avoidance zones for retardants or water drops with concerns of aquatic invasive species).	7.1 Fire & Fire Suppression	Fire encroachment on or nearby streambank or active channel.
10.3 Alliance & Partnership Development	Work with transportation agencies and/or counties to communicate the impacts of road crossings and collaborate on guidance for better road crossing infrastructure.	4.1 Roads & Railroads	Habitat fragmentation created by culvert infrastructure.

Sicklefin Chub Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			

2.1 Species Stewardship	Manage non-native predators when feasible.	8.1 Invasive Non-Native/Alien Plants & Animals	Predation by non-native fish.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate anglers and baitfish collectors on the identification and importance of native species.	5.4 Fishing & Harvesting Aquatic Resources	Removal of wild individuals used for bait fish can impact the population.
3.1 Outreach & Communications	Showcase aquatic invasive species and use other educational opportunities to help prevent future introductions and highlight the importance of native species.	8.1 Invasive Non-Native/Alien Plants & Animals	Predation by non-native fish.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Encourage screening of irrigation intakes or other modifications when appropriate.	2.3 Livestock Farming & Ranching	Irrigation withdraws resulting in entrainment.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Cite offenders to reinforce current bait regulations.	5.4 Fishing & Harvesting Aquatic Resources	Removal of wild individuals used for bait fish can impact the population.

Westslope Cutthroat Trout Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			

1. Land/Water Protection			
1.1 Site/Area Stewardship	Install barriers or otherwise isolate remaining Westslope Cutthroat Trout populations from non-native species when necessary. Remove or suppress invasive species as appropriate and feasible.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
1.1 Site/Area Stewardship	Install barriers or otherwise isolate remaining Westslope Cutthroat Trout populations to protect them from hybridization where appropriate. Remove or suppress invasive species as appropriate and feasible.	8.3 Introduced Genetic Material	Increased hybridization with other species.
2. Species Management			
2.1 Species Stewardship	Continue to conserve and protect integrity of remaining populations. Increase non-hybridized stock populations.	8.3 Introduced Genetic Material	Increased hybridization as well as isolated and small populations threaten this species.
2.1 Species Stewardship	Include selective passage above existing barriers.	7.2 Dams & Water Management / Use	Loss of fish spawning habitat due to dewatering of streams for irrigation and because of barriers created by dams and road culverts. This can isolate populations.
2.1 Species Stewardship	Remove non-native fish where appropriate and feasible.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
2.2 Species Re-Introduction & Translocation	Conduct translocations to improve genetic diversity.	4.1 Roads & Railroads	Habitat fragmentation associated with stream crossing infrastructure isolates populations.
2.2 Species Re-Introduction & Translocation	Restore Westslope Cutthroat Trout to habitat that is isolated from hybridizing species to expand distribution.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
2.2 Species Re-Introduction & Translocation	Restore the species to habitats isolated from hybridizing species. Conduct reintroductions in areas where the species has been	8.3 Introduced Genetic Material	Increased hybridization as well as isolated and small populations threaten this species.

	extirpated or severely reduced to reestablish populations.		
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate anglers about Westslope Cutthroat Trout identification and fishing regulations.	5.4 Fishing & Harvesting Aquatic Resources	Excessive fishing mortality could cause population-level impacts.
4. Law Enforcement & Prosecution			
4.2 Criminal Prosecution & Conviction	Maintain enforcement presence to deter illegal activity and detect violation of harvest restrictions and other fishing regulations that protect vulnerable Cutthroat Trout populations.	5.4 Fishing & Harvesting Aquatic Resources	Excessive fishing mortality could cause population-level impacts.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Ensure that adequate mitigation measures and best management practices are employed in future extraction operations.	3.2 Mining & Quarrying	Mining and quarrying can degrade habitat and impact water quality.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.3 Land/Water Use Zoning & Designation	Review subdivision requests and make recommendations based on FWP's Fish and Wildlife Recommendations for Subdivision Development.	1.1 Housing & Urban Areas	Habitat degradation from residential development impacts populations.
6.4 Conservation Planning	Continue to use the WCT Memorandum of Understanding (Montana Cutthroat Trout Steering Committee 2007) to identify and protect conservation areas.	12.1 Other	Isolated populations or small population sizes.
6.4 Conservation Planning	Ensure that Northern Redbelly Dace conservation measures are included in USFS Forest Plans.	5.3 Logging & Wood Harvesting	Degradation of habitat from logging impacts to stream channel integrity, habitat complexity, woody debris recruitment, temperature, and sedimentation.

6.5 Site Infrastructure	Construct water treatment plants and other mitigation infrastructure to address legacy effects of past mining operations.	3.2 Mining & Quarrying	Mining and quarrying can degrade habitat and impact water quality.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Increase harvest limits of non-native fish.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
7.1 Laws, Regulations & Codes	Maintain current angling regulations that benefit Westslope Cutthroat Trout. Propose new angling restrictions where appropriate.	5.4 Fishing & Harvesting Aquatic Resources	Excessive fishing mortality could cause population-level impacts.
10. Institutional Development			
10.3 Alliance & Partnership Development	Convene watershed coalition to collaboratively work with partner agencies, NGOs, and private landowners to garner community support for private lands conservation activities.	2.1 Annual & Perennial Non-Timber Crops	Hay and crop production encroaching on riparian and stream corridors degrade stream habitats.
		2.3 Livestock Farming & Ranching	Habitat degradation due to incompatible agricultural practices.

Yellowstone Cutthroat Trout Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Install barriers or otherwise isolate remaining Yellowstone Cutthroat Trout populations from non-native species when necessary. Remove or suppress invasive species as appropriate and feasible.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.

1.1 Site/Area Stewardship	Install barriers or otherwise isolate remaining Yellowstone Cutthroat Trout populations to protect them from hybridization where applicable. Remove or suppress invasive species as appropriate and feasible.	8.3 Introduced Genetic Material	Increased hybridization with other species.
2. Species Management			
2.1 Species Stewardship	Include selective passage above existing barriers.	7.2 Dams & Water Management / Use	Habitat fragmentation from dams and irrigation diversions. Dam impoundments can create unsuitable conditions and predator traps. Irrigation withdrawals reduce habitat suitability and connectivity.
2.1 Species Stewardship	Increase populations of non-hybridized Yellowstone Cutthroat Trout.	12.1 Other	Isolated populations or small population sizes.
2.1 Species Stewardship	Protect integrity of remaining Yellowstone Cutthroat Trout conservation populations. Continue to conserve remaining populations.	8.3 Introduced Genetic Material	Increased hybridization with other species.
2.1 Species Stewardship	Remove non-native fish where appropriate and feasible.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
2.2 Species Re-Introduction & Translocation	Conduct translocations to improve genetic diversity.	4.1 Roads & Railroads	Habitat fragmentation associated with stream crossing infrastructure.
2.2 Species Re-Introduction & Translocation	Restore Yellowstone Cutthroat Trout to habitat that is isolated from hybridizing species, where applicable, to expand distribution.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
2.2 Species Re-Introduction & Translocation	Restore the species to habitats isolated from hybridizing species. Conduct reintroductions in areas where the species has been extirpated or severely reduced to reestablish populations.	8.3 Introduced Genetic Material	Increased hybridization as well as isolated and small populations threaten this species.
B. Behavioral Change/Threat Reduction			

3. Awareness Raising			
3.1 Outreach & Communications	Educate anglers about Yellowstone Cutthroat Trout identification and fishing regulations.	5.4 Fishing & Harvesting Aquatic Resources	Excessive fishing mortality could cause population-level impacts.
4. Law Enforcement & Prosecution			
4.2 Criminal Prosecution & Conviction	Maintain enforcement presence to deter illegal activity and detect violation of harvest restrictions and other fishing regulations that protect vulnerable Cutthroat Trout populations.	5.4 Fishing & Harvesting Aquatic Resources	Excessive fishing mortality could cause population-level impacts.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Ensure that adequate mitigation measures and best management practices are employed in future extraction operations.	3.2 Mining & Quarrying	Mining and quarrying can degrade habitat and impact water quality.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.3 Land/Water Use Zoning & Designation	Review subdivision requests and make recommendations based on FWP's Fish and Wildlife Recommendations for Subdivision Development.	1.1 Housing & Urban Areas	Habitat degradation from residential development.
6.4 Conservation Planning	Continue to use the YCT Memorandum of Understanding (Montana Cutthroat Trout Steering Committee 2007) to identify and protect conservation areas.	12.1 Other	Isolated populations or small population sizes.
6.4 Conservation Planning	Ensure that Yellowstone Cutthroat Trout conservation measures are included in USFS Forest Plans.	5.3 Logging & Wood Harvesting	Impacts to stream channel integrity, habitat complexity, woody debris recruitment, temperature, and sedimentation.
6.5 Site Infrastructure	Construct water treatment plants and other mitigation infrastructure to address legacy effects of past mining operations.	3.2 Mining & Quarrying	Mining and quarrying can degrade habitat and impact water quality.

7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Increase harvest limits of non-native fish.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
7.1 Laws, Regulations & Codes	Propose new angling restrictions where appropriate. Maintain current angling regulations that benefit Yellowstone cutthroat trout.	5.4 Fishing & Harvesting Aquatic Resources	Excessive fishing mortality could cause population-level impacts.
10. Institutional Development			
10.3 Alliance & Partnership Development	Convene watershed coalition to collaboratively work with partner agencies, NGOs, and private landowners to garner community support for private lands conservation activities.	2.1 Annual & Perennial Non-Timber Crops	Hay and crop production encroaching on riparian and stream corridors.
		2.3 Livestock Farming & Ranching	Habitat degradation due to incompatible agricultural practices.

Sturgeon Chub Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Implement intake conditions or recommendations (e.g., screening and velocity requirements).	2.3 Livestock Farming & Ranching	Irrigation withdrawals can entrain fish and dewater instream habitats.
2. Species Management			

2.1 Species Stewardship	Nonnative species removal where practical.	8.1 Invasive Non-Native/Alien Plants & Animals	Predation by non-native species and re-established native species.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Continue efforts to educate landowners and the public about the importance of native fish and their habitats.	3.1 Oil & Gas Drilling	Energy development can impact habitat.
		4.1 Roads & Railroads	Channelization through riprap and other bank stabilization measures used to protect transportation infrastructure along rivers can impact available habitat.
3.1 Outreach & Communications	Continue efforts to educate landowners and the public about the importance of native fish and their habitats. Work with water users to highlight the importance of improving the efficiency of water use, especially in tributary habitat vulnerable to low flows.	2.3 Livestock Farming & Ranching	Irrigation withdrawals can entrain fish and dewater instream habitats.
3.1 Outreach & Communications	Continue efforts to educate landowners and the public about the importance of native fish and their habitats. Work with water users to highlight the importance of improving water use practices to offset climate induced changes (e.g., establish drought plans and/or minimum instream flows).	11.4 Changes in Precipitation & Hydrological Regimes	Altered flow regimes (e.g., timing of spring runoff, baseflow conditions) of snowmelt dominated systems caused by climate change.
3.1 Outreach & Communications	Continue efforts to educate the public about the importance of native fish and their habitats, including the potential consequences of illegal introductions.	8.1 Invasive Non-Native/Alien Plants & Animals	Predation by non-native species and re-established native species.
5. Livelihood Economic & Moral Incentives			
5.4 Direct Economic Incentives	Protect instream and riparian habitats through conservation easements, leases and/or acquisitions.	4.1 Roads & Railroads	Channelization through riprap and other bank stabilization measures used to protect transportation infrastructure along rivers can impact available habitat.

C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Use the existing permitting process to protect and/or enhance habitats (e.g., SPA124, 404) and increase awareness that such permits exist.	4.1 Roads & Railroads	Channelization through riprap and other bank stabilization measures used to protect transportation infrastructure along rivers can impact available habitat.
7.1 Laws, Regulations & Codes	Use the existing permitting process to protect and/or enhance habitats (e.g., establish and enforce water quality standards).	3.1 Oil & Gas Drilling	Energy development can impact habitat.

Iowa Darter Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Prioritize and protect best available habitat for Iowa Darter to minimize climate change impacts to maintaining streamflow and cooling riparian zones and streams.	11.3 Changes in Temperature Regimes	Changes in the timing of prairie and mountain snow melt could change the hydrological regime of prairie streams and impact spawning and recruitment. Warming prairie streams could limit habitat availability.
2. Species Management			
2.1 Species Stewardship	Removal of Northern Pike and potentially other non-native predators from prairie streams and ponds.	8.1 Invasive Non-Native/Alien Plants & Animals	Introduced predators such as Northern Pike have been shown to reduce the distribution and population densities of Iowa Darter.
2.2 Species Re-Introduction & Translocation	Potential re-introduction of Iowa Darter into historic habitats and outside of known habitats with introduced predators.	8.1 Invasive Non-Native/Alien Plants & Animals	Introduced predators such as Northern Pike have been shown to reduce the distribution and population densities of Iowa Darter.

B. Behavioral Change/Threat Reduction

3. Awareness Raising

3.1 Outreach & Communications	Educate the public on how roadways and railways often act as barriers to prairie fishes, and promote programs to improve stream crossings to protect prairie streams and their fauna.	4.1 Roads & Railroads	Fragmentation created by roads and rails through culverts or blocked passage; passage necessary to connect dynamic prairie stream habitats through seasonal disturbances.
3.1 Outreach & Communications	Educate the public on safe application of chemicals and the importance of healthy prairie streams for prairie fishes and other prairie fauna.	9.3 Agricultural & Forestry Effluents	Herbicide, pesticide and fertilizer run off into prairie streams can negatively impact streams that Iowa Darter inhabit.
3.1 Outreach & Communications	Educate the public on the importance of native fish species and the harmful effects of illegal fish introductions to prairie ecosystems and their native fauna.	8.1 Invasive Non-Native/Alien Plants & Animals	Introduced predators such as Northern Pike have been shown to reduce the distribution and population densities of Iowa Darter.
3.1 Outreach & Communications	Educate the public on the importance of protecting native prairie fish habitat, and maintaining water temperature and streamflow levels.	11.3 Changes in Temperature Regimes	Changes in the timing of prairie and mountain snow melt could change the hydrological regime of prairie streams and impact spawning and recruitment. Warming prairie streams could limit habitat availability.
3.1 Outreach & Communications	Educate the public on the role of riparian buffers and improved land management practices in protecting prairie streams and their fauna.	2.1 Annual & Perennial Non-Timber Crops	Loss of riparian vegetation due to farming practices can increase stream temperatures and fine sediment inputs.
		2.3 Livestock Farming & Ranching	Livestock can negatively impact the riparian zone and bed and banks of streams as well as pollute streams with livestock waste. This can have negative impacts on prairie streams that Iowa Darter inhabit.

Northern Pikeminnow Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.2 Ecosystem & Natural Process (Re)Creation	Improve or initiate passage at dams. Reduce or eliminate entrainment in irrigation diversions. Manage dams to stimulate natural hydrologic regimes and to reduce recruitment of non-native predators and competitors.	7.2 Dams & Water Management / Use	Habitat fragmentation from dams and irrigation diversions. Reservoirs can create ideal habitat conditions for the species. However, reservoirs often also create suitable habitat for invasive non-native predators and are hot spots for non-native predator introduction. Irrigation withdrawals reduce habitat suitability, connectivity and entrain fish.
		8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
2. Species Management			
2.1 Species Stewardship	Reduce or eliminate invasive non-native species where appropriate and possible.	7.2 Dams & Water Management / Use	Habitat fragmentation from dams and irrigation diversions. Reservoirs can create ideal habitat conditions for the species. However, reservoirs often also create suitable habitat for invasive non-native predators and are hot spots for non-native predator introduction. Irrigation withdrawals reduce habitat suitability, connectivity and entrain fish.
		8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
2.2 Species Re-Introduction & Translocation	Considered reintroduction into natal waters where extirpated if appropriate and possible.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			

3.1 Outreach & Communications	Prevent illegal introductions of nonnative fish species by educating the public about deleterious effects.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Improve passage efficiency at dams or work to initiate passage where it does not occur. Minimize impacts of diversions through screening, permitting, monitoring, and fish salvage.	7.2 Dams & Water Management / Use	Habitat fragmentation from dams and irrigation diversions. Reservoirs can create ideal habitat conditions for the species. However, reservoirs often also create suitable habitat for invasive non-native predators and are hot spots for non-native predator introduction. Irrigation withdrawals reduce habitat suitability, connectivity and entrain fish.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Increase harvest limits of nonnative fish. Increase penalties for illegal introduction of invasive fish.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.

Peamouth Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.2 Ecosystem & Natural Process (Re)Creation	Improve or initiate passage at dams. Reduce or eliminate entrainment in irrigation diversions. Manage dams to stimulate natural hydrologic regimes and to reduce	7.2 Dams & Water Management / Use	Habitat fragmentation from dams and irrigation diversions. Reservoirs can create ideal habitat conditions for the species. However, reservoirs often also create suitable habitat for invasive non-native predators and are hot spots for non-native

	recruitment of non-native predators and competitors.		predator introduction. Irrigation withdrawals reduce habitat suitability, connectivity and entrain fish.
		8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
2. Species Management			
2.1 Species Stewardship	Reduce or eliminate invasive non-native species where appropriate and possible.	7.2 Dams & Water Management / Use	Habitat fragmentation from dams and irrigation diversions. Reservoirs can create ideal habitat conditions for the species. However, reservoirs often also create suitable habitat for invasive non-native predators and are hot spots for non-native predator introduction. Irrigation withdrawals reduce habitat suitability, connectivity and entrain fish.
		8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
2.2 Species Re-Introduction & Translocation	Considered reintroduction into natal waters where extirpated if appropriate and possible.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Prevent illegal introductions of nonnative fish species by educating the public about deleterious effects.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Improve passage efficiency at dams or work to initiate passage where it does not occur. Minimize impacts of diversions through screening, permitting, monitoring, and fish salvage.	7.2 Dams & Water Management / Use	Habitat fragmentation from dams and irrigation diversions. Reservoirs can create ideal habitat conditions for the species. However, reservoirs often also create suitable habitat for invasive non-native predators and are hot spots for non-native predator introduction. Irrigation withdrawals reduce habitat suitability, connectivity and entrain fish.

C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Increase harvest limits of nonnative fish. Increase penalties for illegal introduction of invasive fish.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with and predation by non-native fish species.

Sauger Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Install passage structures at low head diversion dams that block or impede upstream and downstream passage.	7.2 Dams & Water Management / Use	Dams and associated reservoirs can block passage to spawning sites and alter natural flow, turbidity, and temperature regimes. Increased water clarity from dam operation can affect Sauger that are adapted to turbid waters and benefit competing introduced species (e.g., Walleye, Smallmouth Bass).
2. Species Management			
2.1 Species Stewardship	Consider a change to fishing regulations to manage nonnative species.	8.1 Invasive Non-Native/Alien Plants & Animals	Competition with non-native fish species. Hybridization with Walleye.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			

3.1 Outreach & Communications	Conduct outreach regarding the benefits of a more natural approach to bank stabilization, natural channel migration, and instream flows for Sauger.	7.3 Other Ecosystem Modifications	Habitat can be impacted by channel simplification (as a result of bank armoring) and water withdrawals for municipal use and energy development (e.g., fracking, coal bed methane).
3.1 Outreach & Communications	Educate anglers on the importance of native species and of complying with regulations.	5.4 Fishing & Harvesting Aquatic Resources	Overharvest and exploitation from legal and illegal angling.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Work with irrigators to install screens or make other modifications that reduce entrainment.	2.3 Livestock Farming & Ranching	Irrigation withdraws in tributary streams can limit access to spawning habitat, result in stranding, and cause entrainment of drifting larvae.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Maintain appropriate harvest regulations to protect population viability.	5.4 Fishing & Harvesting Aquatic Resources	Overharvest and exploitation from legal and illegal angling.
7.1 Laws, Regulations & Codes	Use the existing permitting process to protect and/or enhance habitats (e.g., SPA124, 404) and increase awareness that such permits exist.	7.3 Other Ecosystem Modifications	Habitat can be impacted by channel simplification (as a result of bank armoring) and water withdrawals for municipal use and energy development (e.g., fracking, coal bed methane).

Shortnose Gar Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			

1.2 Ecosystem & Natural Process (Re)Creation	Consider mimicking a natural spring hydrograph out of Fort Peck Dam to flood lowlands and fill oxbow bends, providing warmer, slow-moving habitats, as the water is significantly colder through the summer and early fall season than historically.	7.2 Dams & Water Management / Use	Loss of conditions preferred by Shortnose Gar, like warm, slow moving backwater areas where submergent vegetation can establish. Fort Peck Dam is a hypolimnetic release dam which provides much colder than natural water temperatures, and has altered the flow regime where flooding of lowlands does not occur often and oxbow bends are no longer functional (loss of backwaters and sidechannels).
2. Species Management			
2.1 Species Stewardship	Monitor population status and harvest.	5.4 Fishing & Harvesting Aquatic Resources	Bowfishing harvest at Fort Peck Dredge Cuts may impact this Shortnose Gar population.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate the public on the new FWP catch card and harvest limit for Shortnose Gar.	5.4 Fishing & Harvesting Aquatic Resources	Bowfishing harvest at Fort Peck Dredge Cuts may impact this Shortnose Gar population.
11. Other Action			
11.1 Other Action: NA/Create a management plan for Shortnose Gar in Montana	Create a plan to better understand the status of Shortnose Gar in Montana, including distribution, population metrics, life history traits, and potential population bottlenecks.	7.2 Dams & Water Management / Use	There is very limited information on Shortnose Gar in Montana. Basic distribution data is about all that is currently available. Data related to population dynamics information is needed.

Torrent Sculpin Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat

A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.2 Ecosystem & Natural Process (Re)Creation	Ensure extant habitat remains suitable for Torrent Sculpin, since much of their habitat has been lost by the creation of Lake Koocanusa.	7.2 Dams & Water Management / Use	Libby Dam has restricted the distribution of this species to ~81% of its historically occupied habitat in the state. The resulting Koocanusa reservoir is unsuitable habitat and may pose a limitation to this species' ability to move between populations causing deleterious isolation.
1.2 Ecosystem & Natural Process (Re)Creation	Restore, protect, or enhance habitat for Torrent Sculpins.	7.3 Other Ecosystem Modifications	The creation of Lake Koocanusa eliminated occupied river and tributary habitat now. The construction of the reservoir may have also changed the substrate type in some habitat making it less suitable.
2. Species Management			
2.2 Species Re-Introduction & Translocation	If habitat near Lake Koocanusa becomes unsuitable or fragmented, look for opportunities to translocation populations into suitable habitats or bolster other fragmented populations.	7.3 Other Ecosystem Modifications	The creation of Lake Koocanusa has eliminated occupied river and tributary habitat. The construction of the reservoir may have also changed the substrate type in some habitat making it less suitable.
2.2 Species Re-Introduction & Translocation	If local isolated populations were to decline, consider translocating fish into new areas with suitable habitats. Consider including Torrent Sculpins in projects that may involve the translocation of Bull Trout or Westslope Cutthroat Trout into novel habitats for long-term persistence.	7.2 Dams & Water Management / Use	Libby Dam has restricted the distribution of this species to ~81% of its historically occupied habitat in the state. The resulting Koocanusa reservoir is unsuitable habitat and may pose a limitation to this species' ability to move between populations causing deleterious isolation.

Cedar Sculpin Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.2 Species Re-Introduction & Translocation	Look for opportunities to translocate populations to thermally suitable habitats above impassable barriers (such as waterfalls) that prevent access to suitable habitat.	7.2 Dams & Water Management / Use	Altered hydrological regime (flow and temperature) can limit distribution. Dams and diversions can restrict passage; even impediments as high as 200mm can restrict passage for sculpin.

Paddlefish Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Install passage structures at low head diversion dams that block or impede upstream and downstream passage.	7.2 Dams & Water Management / Use	Dams and associated reservoirs can block passage to spawning sites and alter natural flow, turbidity, and temperature regimes.
2. Species Management			
2.1 Species Stewardship	Manage non-native predators when feasible.	8.1 Invasive Non-Native/Alien Plants & Animals	Predation by non-native fish.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			

3.1 Outreach & Communications	Conduct outreach and education regarding benefits of a more natural approach to bank stabilization or permission of natural channel migration.	7.3 Other Ecosystem Modifications	Channel simplification from bank stabilization and dredging can impact available spawning, rearing, and foraging habitat.
3.1 Outreach & Communications	Educate anglers on the importance of native species, how to spot illegal caviar activity, and Paddlefish susceptibility to propeller strikes and high concentration areas.	5.4 Fishing & Harvesting Aquatic Resources	Illegal harvest motivated by caviar trade and mortality associated with boat collisions/propeller strikes are additional sources of mortality for this species.
3.1 Outreach & Communications	Showcase aquatic invasive species and use other educational opportunities to help prevent future introductions and highlight the importance of native species.	8.1 Invasive Non-Native/Alien Plants & Animals	Predation by non-native fish.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Work with irrigators to install screens or make other modifications that reduce entrainment.	2.3 Livestock Farming & Ranching	Irrigation withdrawals can limit access to spawning habitat, result in stranding, and cause entrainment of drifting larvae.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Craft regulations that help minimize unintentional sources of mortality, including boat strikes. Maintain enforcement presence during Paddlefish spawning seasons and monitor regulated recreational fishing activity.	5.4 Fishing & Harvesting Aquatic Resources	Illegal harvest motivated by caviar trade and mortality associated with boat collisions/propeller strikes are additional sources of mortality for this species.
7.1 Laws, Regulations & Codes	Use the existing permitting process to protect and/or enhance habitats (e.g., SPA124, 404) and increase awareness that such permits exist.	7.3 Other Ecosystem Modifications	Channel simplification from bank stabilization and dredging can impact available spawning, rearing, and foraging habitat.

Black-footed Ferret Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Consider predator control at Black-footed Ferret reintroduction sites.	8.2 Problematic Native Plants & Animals	Coyotes and badgers may depredate black-footed ferrets.
1.1 Site/Area Stewardship	Control invasive weeds to maintain habitat quality in areas with (potential for) extensive prairie dog colonies to establish Black-footed Ferret recovery sites.	2.3 Livestock Farming & Ranching	Overgrazing by cattle can degrade native prairie grassland habitat otherwise suitable for prairie dogs, resulting in a lack of prey base and habitat for ferrets.
1.1 Site/Area Stewardship	Treat prairie dog colonies at recovery sites for sylvatic plague by either applying deltamethrin with mechanical sprayers in every burrow, on foot or ATV, or using FipBits or fipronil-treated grain.	8.4 Pathogens & Microbes	Sylvatic plague can cause mortality in both ferrets and their primary prey item (prairie dogs). Ferrets are also susceptible to canine distemper.
2. Species Management			
2.1 Species Stewardship	Vaccinate wild and captive-reared ferrets for canine distemper.	8.4 Pathogens & Microbes	Sylvatic plague can cause mortality in both ferrets and their primary prey item (prairie dogs). Ferrets are also susceptible to canine distemper.
2.2 Species Re-Introduction & Translocation	Work with USFWS and willing landowners or agencies to release ferrets at recovery sites. Select recovery sites with >1,500 acres of active prairie dog colonies, preferably >4,500 acres, which can host 30 adult ferrets, or >15,000 acres for >100 adult ferrets. Conduct annual plague mitigation at recovery sites.	8.4 Pathogens & Microbes	Sylvatic plague can cause mortality in both ferrets and their primary prey item (prairie dogs). Ferrets are also susceptible to canine distemper.
2.3 Ex-Situ Conservation	Through funds or engagement in working groups, support the work of the USFWS	8.3 Introduced Genetic Material	Black-footed ferrets have very low genetic diversity.

	Black-footed Ferret recovery center and zoos that maintain captive breeding programs.	8.4 Pathogens & Microbes	Sylvatic plague can cause mortality in both ferrets and their primary prey item (prairie dogs). Ferrets are also susceptible to canine distemper.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct outreach to conservation-minded landowners interested in Black-footed Ferret recovery, and opportunities to voluntarily conserve prairie dogs on their property.	5.1 Hunting & Collecting Terrestrial Animals	Prairie dog control results in a lack of prey base and habitat for ferrets.
3.1 Outreach & Communications	For ferret reintroduction sites near roads, post wildlife crossing notices along roadways and/or lower the speed limit.	4.1 Roads & Railroads	Vehicle collision is a source of direct mortality.
5. Livelihood Economic & Moral Incentives			
5.4 Direct Economic Incentives	Work with partner agencies and NGOs to seek funding sources for direct payments to landowners with large prairie dog colonies (>1,500 active acres) that are willing to conserve prairie dogs on their lands as a prey base for ferrets.	5.1 Hunting & Collecting Terrestrial Animals	Prairie dog control results in a lack of prey base and habitat for ferrets.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Use the Homes on the Range, the Montana Black-footed Ferret Conservation and Management Guidelines, and other tools to prioritize conservation of areas with (potential for) extensive prairie dog colonies to establish Black-footed Ferret recovery sites.	2.1 Annual & Perennial Non-Timber Crops	Conversion of native prairie to croplands eliminates prairie dog colonies, resulting in a lack of prey base and habitat for ferrets.
7. Legal & Policy Frameworks			

7.1 Laws, Regulations & Codes	Seek authorization to regulate take of prairie dogs where reduction of the prey base could impact ferret recovery.	5.1 Hunting & Collecting Terrestrial Animals	Prairie dog control results in a lack of prey base and habitat for ferrets.
10. Institutional Development			
10.3 Alliance & Partnership Development	Build partnerships with NGOs, tribes, agricultural producers, grazing associations, and agencies to promote habitat conservation programs in areas with (and potential for) extensive prairie dog colonies to establish Black-footed Ferret recovery sites.	2.1 Annual & Perennial Non-Timber Crops	Conversion of native prairie to croplands eliminates prairie dog colonies, resulting in a lack of prey base and habitat for ferrets.
10.4 Financing Conservation	Fund plague mitigation programs and support ferret recovery on tribal lands. If possible, engage in ferret reintroduction work on agency or private lands.	8.4 Pathogens & Microbes	Sylvatic plague can cause mortality in both ferrets and their primary prey item (prairie dogs). Ferrets are also susceptible to canine distemper.

White-tailed Prairie Dog Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Treat prairie dog colonies at recovery sites for sylvatic plague by either applying deltamethrin with mechanical sprayers in every burrow, on foot or ATV, or using FipBits or fipronil-treated grain.	8.4 Pathogens & Microbes	Sylvatic plague.
2. Species Management			

2.2 Species Re-Introduction & Translocation	Consider translocating Black-tailed Prairie Dogs to augment colonies, particularly to establish or maintain active ferret recovery sites. Ferret release sites must support >1500 acres of active prairie dog colonies, preferably >4500 acres which can host 30 adult ferrets. Sites with > 15,000 acres can receive > 100 adults.	8.4 Pathogens & Microbes	Sylvatic plague.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Develop K-12 educational programs that identify the unique role of prairie dogs in maintaining prairie ecosystems and providing habitat for other wildlife. Foster appreciation for this species. Outreach to conservation-minded landowners willing to voluntarily conserve prairie dogs on their property.	5.1 Hunting & Collecting Terrestrial Animals	Prairie dog control is a source of direct mortality.
5. Livelihood Economic & Moral Incentives			
5.4 Direct Economic Incentives	Work with partner agencies and NGOs to seek funding sources for direct payments to landowners with White-Tailed Prairie Dog colonies that are willing to conserve prairie dogs on their lands.	5.1 Hunting & Collecting Terrestrial Animals	Prairie dog control is a source of direct mortality.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Use the Homes on the Range, the Montana Black-footed Ferret Conservation and Management Guidelines, and other tools to prioritize conservation of areas with (potential for) White-tailed prairie dog	2.1 Annual & Perennial Non-Timber Crops	Conversion of native prairie to croplands eliminates prairie dog colonies, resulting in a lack of prey base and habitat for ferrets.

	colonies. Conserve large tracts of intact native prairie grasslands to further White-tailed prairie dog conservation.		
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Seek authorization to regulate take of White-tailed Prairie Dogs, as the species has a very limited range in Montana.	5.1 Hunting & Collecting Terrestrial Animals	Prairie dog control is a source of direct mortality.
10. Institutional Development			
10.3 Alliance & Partnership Development	Build partnerships with NGOs, tribes, agricultural producers, grazing associations, and agencies to promote habitat conservation programs in areas with (and potential for) White-tailed Prairie Dog colonies.	2.1 Annual & Perennial Non-Timber Crops	Conversion of native prairie to croplands eliminates prairie dog colonies, resulting in a lack of prey base and habitat for ferrets.

Northern Myotis Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Consider implementing and monitoring environmental treatments (e.g., UV-C light, PEG 8000). Explore novel habitat treatments (e.g., RNAi). Restrict access or consider timing restrictions to known hibernacula and maternity roosts impacted by White-Nose Syndrome.	8.4 Pathogens & Microbes	White-nose syndrome.

1.1 Site/Area Stewardship	Restrict recreational access to known hibernacula (with bat-friendly methods) during the overwintering period.	7.3 Other Ecosystem Modifications	Loss of (e.g., closure of mines without bat-friendly gating techniques) or disturbance to (e.g., cave recreation during winter) potential winter roosting habitat.
1.2 Ecosystem & Natural Process (Re)Creation	Work with Irrigation Districts, Water Right holders, DNRC, and NRCS to explore changes in timing and amounts of instream flows (e.g., Arctic Grayling in the Big Hole example) to facilitate cottonwood regeneration.	7.2 Dams & Water Management / Use	Changes in hydrologic cycles (e.g., overbank flows).
2. Species Management			
2.1 Species Stewardship	Consider implementing and monitoring probiotic treatments at known hibernacula, and vaccine treatments (e.g., bat fungal disease immunogen) at known maternity colonies.	8.4 Pathogens & Microbes	White-nose syndrome.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Promote education, outreach, and communication with local caving (e.g., Northern Rocky Mountain Grotto) and climbing (e.g., Climbers for Bat Conservation) communities to encourage members to adhere to National White-nose Syndrome Decontamination Protocol.	8.4 Pathogens & Microbes	White-nose syndrome.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Develop management recommendations and work with local oil and gas developers to	3.1 Oil & Gas Drilling	Disturbance (e.g., noise, flaring) to bats during oil and gas drilling and associated new development.

	minimize disturbance to bats during oil and gas drilling.		
6.4 Conservation Planning	Follow guidance from the FWP Montana Bat Conservation and Management Plan to limit spread of disease and to conserve bats and their habitats.	8.4 Pathogens & Microbes	White-nose syndrome.
6.4 Conservation Planning	Use of appropriate survey methodology and adherence to the Guidelines for the Protection of Bat Roosts and management protocols designated for Townsend's big-eared bat (Pierson et al. 1999), as these are also appropriate for Northern Myotis, especially at potential winter habitats.	7.3 Other Ecosystem Modifications	Loss of potential roosting habitat (e.g., closure of mines without bat-friendly gating techniques) or disturbance to (e.g., cave recreation during winter) potential winter roosting habitat.
6.4 Conservation Planning	Work with land management agencies regarding the timing, scope, and location of timber harvest activities within known geographic range of Northern Long-eared Bat relative to known maternity roosts/hibernacula.	5.3 Logging & Wood Harvesting	Improper siting and/or timing of timber harvest and prescribed fire potential impacts to maternity roosts and hibernacula.
6.4 Conservation Planning	Work with state and federal land management agencies regarding potential compensatory mitigation (e.g., habitat conservation plan).	3.3 Renewable Energy	Potential collisions with wind turbines and other associated development (e.g., power lines). Potential habitat loss due to wind-infrastructure development.
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Work with wind energy developers to ensure minimal disturbance to bats. Conduct pre- and post-construction monitoring as recommended by state and federal guidance documents (e.g., 'Recommendations to Reduce Bat Fatalities at Wind Energy Facilities in Montana').	3.3 Renewable Energy	Potential collisions with wind turbines and other associated development (e.g., power lines). Potential habitat loss due to wind-infrastructure development.

Northern Bog Lemming Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Exclude stock used for backcountry access from grazing in peatlands while in the backcountry. Consider vegetation community types when managing winter recreation use, particularly in wet meadows at lower elevations with lower snow depths.	6.1 Recreational Activities	Groomed trails for multi-use winter recreation, including snowmobiling, skiing and fat-tire biking, leads to snow compaction, which may compact soils and vegetation and may collapse small mammal tunnel networks. OHV use in and around peatlands can damage habitat and introduce pollutants and invasive plant species.
1.1 Site/Area Stewardship	Prohibit livestock from grazing in peatlands while in the backcountry, as it is very hard to mitigate negative impacts in these systems. If grazing will occur in or around peatlands, use light stocking rates and rotational grazing systems to limit impacts. Graze later in the year to reduce soil impacts.	2.3 Livestock Farming & Ranching	Grazing in peatlands can degrade habitat as a result of hummocking, worn trails, lower water storage capacity, earlier seasonal drying of sphagnum and other mosses, introducing or favoring non-native plant species, changes in water chemistry (i.e., nutrient loading) that alters native plant communities, and compacting the soil.
1.1 Site/Area Stewardship	Where roads already occur, minimize maintenance activities that result in ground disturbance, or conduct those activities during winter when the ground is fully frozen.	4.1 Roads & Railroads	Road and parking lot construction and maintenance can result in the destruction of peatland habitats, introduction/favoring of invasive plant species, and increased access to peatlands or encroachment by people. Road building through, along, or upstream of peatlands can alter groundwater flow pathways feeding peatlands leading to habitat loss and/or degradation.
1.1 Site/Area Stewardship	Where timber harvest occurs, minimize maintenance activities that result in ground disturbance, or conduct those activities during winter when the ground is fully frozen.	5.3 Logging & Wood Harvesting	Timber harvest close to peatlands can remove or alter vegetated buffers that help reduce invasive plant species and capture sediment and pollutant runoff from timber harvest operations and associated roads. Timber harvest operations

			and associated roads and disturbances can lead to soil compaction, habitat loss or degradation, and change in groundwater flow pathways that feed peatlands.
2. Species Management			
2.1 Species Stewardship	Implement beaver conflict mitigation measures and programs to increase tolerance for beavers on the landscape.	7.3 Other Ecosystem Modifications	Removing beavers from peatlands through recreational trapping or conflict management may impact ecosystem functions. Loss of beavers from vast areas has reduced habitat and maintained stream systems in a degraded state with diminished or lost floodplain processes important for dispersal of lemmings (e.g., wide, wet riparian zones used as corridors).
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Develop and distribute educational materials about peatland ecosystems to landowners whose land includes or borders peatlands.	1.1 Housing & Urban Areas	Development encroaching on peatlands results in direct destruction of habitat, introduces pollutants and excessive nutrients (e.g., yard/livestock runoff), and/or provides pathways for introduction and spread of invasive plant and animal species (e.g., invasive weeds, outdoor cats).
		1.2 Commercial & Industrial Areas	Commercial development encroaching on peatlands results in direct destruction of habitat, introduction of pollutants and excessive nutrients (e.g., yard runoff), and/or provides pathways for introduction and spread of invasive plant species.
3.1 Outreach & Communications	Develop and distribute educational materials to recreationists about the importance of peatlands and how human activities can damage these ecosystems. Target anglers, boaters, hikers, and stock users about invasive weeds, user-trail creation, waste management, and soil compaction.	1.3 Tourism & Recreation	Recreational development encroaching on peatlands destroys habitat and provides easier pathways for introduction and spread of invasive plant species. Established and user-created trails through and adjacent to peatlands to access waterbodies for recreation may create shallow drains and introduce/favor invasive plants.

3.1 Outreach & Communications	Develop and distribute educational materials to recreationists about the importance of peatlands and how human activities can damage these ecosystems. Target anglers, boaters, hikers, and stock users about invasive weeds, user-trail creation, waste management, and soil compaction. Increase engagement with OHV, snowmobile, ski, and fat-tire bike groups to educate about the importance of peatlands and the potential impacts these recreational activities can have on peatlands.	6.1 Recreational Activities	Groomed trails for multi-use winter recreation, including snowmobiling, skiing and fat-tire biking, leads to snow compaction, which may compact soils and vegetation and may collapse small mammal tunnel networks. OHV use in and around peatlands can damage habitat and introduce pollutants and invasive plant species.
3.1 Outreach & Communications	Develop and distribute outreach materials to landowners and managers of livestock that have access to peatlands, about the sensitivity of peatlands and their elevated biodiversity.	2.3 Livestock Farming & Ranching	Grazing in peatlands can degrade habitat as a result of hummocking, worn trails, lower water storage capacity, earlier seasonal drying of sphagnum and other mosses, introducing or favoring non-native plant species, changes in water chemistry (i.e., nutrient loading) that alters native plant communities, and compacting the soil.
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners about alternative options for pest and weed control (e.g., native predators, regenerative grazing, mechanical and biocontrol treatments) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Pesticide, herbicide, and fire-retardant use can pollute waters flowing into peatlands, potentially changing pH and/or reducing prey base.
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Monitor and report violations of wetland protection requirements in USFS and BLM grazing leases that overlap peatlands.	2.3 Livestock Farming & Ranching	Grazing in peatlands can degrade habitat as a result of hummocking, worn trails, lower water storage capacity, earlier seasonal drying of sphagnum and other mosses, introducing or favoring non-native plant species, changes in water chemistry (i.e., nutrient loading) that alters native plant communities, and compacting the soil.

4.1 Detection & Arrest	Strengthen and promote enforcement of state and local wetland protection laws and encourage reporting and remedy of violations.	1.1 Housing & Urban Areas	Development encroaching on peatlands results in direct destruction of habitat, introduces pollutants and excessive nutrients (e.g., yard/livestock runoff), and/or provides pathways for introduction and spread of invasive plant and animal species (e.g., invasive weeds, outdoor cats).
		1.2 Commercial & Industrial Areas	Commercial development encroaching on peatlands results in direct destruction of habitat, introduction of pollutants and excessive nutrients (e.g., yard runoff), and/or provides pathways for introduction and spread of invasive plant species.

C. Enabling Conditions Actions

6. Conservation Designation & Planning

6.1 Protected Area Designation and/or Acquisition	Promote additional 'Research Natural Area', 'Special Interest Botanical Area', and 'Outstanding Natural Area' designations for unprotected peatlands on USFS and BLM lands.	2.3 Livestock Farming & Ranching	Grazing in peatlands can degrade habitat as a result of hummocking, worn trails, lower water storage capacity, earlier seasonal drying of sphagnum and other mosses, introducing or favoring non-native plant species, changes in water chemistry (i.e., nutrient loading) that alters native plant communities, and compacting the soil.
		4.1 Roads & Railroads	Road and parking lot construction and maintenance can result in the destruction of peatland habitats, introduction/favoring of invasive plant species, and increased access to peatlands or encroachment by people. Road building through, along, or upstream of peatlands can alter groundwater flow pathways feeding peatlands leading to habitat loss and/or degradation.
		5.3 Logging & Wood Harvesting	Timber harvest operations can change groundwater flow pathways that feed peatlands through soil compaction, road building, and other soil disturbance, leading to habitat loss and/or degradation. Timber harvest too close to peatlands can reduce, remove, or alter vegetated buffers that help reduce infestations of invasive plant species and capture sediment

			and pollutant runoff from timber harvest operations and associated roads.
		8.1 Invasive Non-Native/Alien Plants & Animals	Invasive plant species can invade peatlands and change or reduce structural and forage resources.
6.1 Protected Area Designation and/or Acquisition	Promote additional 'Research Natural Area', 'Special Interest Botanical Area', and 'Outstanding Natural Area' designations for unprotected peatlands on USFS and BLM lands. Work with the USFS/BLM to reduce or eliminate OHV, snowmobile, and trail grooming activities in these areas.	6.1 Recreational Activities	Groomed trails for multi-use winter recreation, including snowmobiling, skiing and fat-tire biking, leads to snow compaction, which may compact soils and vegetation and may collapse small mammal tunnel networks. OHV use in and around peatlands can damage habitat and introduce pollutants and invasive plant species.
6.3 Land/Water Use Zoning & Designation	Work with county governments on zoning regulations that protect peatlands from encroachment by development or incompatible land uses (e.g., wetland draining or ditching, wetland filling, dumping, pothole blasting, road building, livestock grazing).	1.1 Housing & Urban Areas	Development encroaching on peatlands results in direct destruction of habitat, introduces pollutants and excessive nutrients (e.g., yard/livestock runoff), and/or provides pathways for introduction and spread of invasive plant and animal species (e.g., invasive weeds, outdoor cats).
		1.2 Commercial & Industrial Areas	Commercial development encroaching on peatlands results in direct destruction of habitat, introduction of pollutants and excessive nutrients (e.g., yard runoff), and/or provides pathways for introduction and spread of invasive plant species.
		4.1 Roads & Railroads	Road and parking lot construction and maintenance can result in the destruction of peatland habitats, introduction/favoring of invasive plant species, and increased access to peatlands or encroachment by people. Road building through, along, or upstream of peatlands can alter groundwater flow pathways feeding peatlands leading to habitat loss and/or degradation.
6.4 Conservation Planning	Work with USFS, BLM, DRNC, CSKT, and private timber companies on forest management planning efforts to	1.1 Housing & Urban Areas	Development encroaching on peatlands results in direct destruction of habitat, introduces pollutants and excessive nutrients (e.g., yard/livestock runoff), and/or provides

	accommodate conservation considerations for this species. Include robust protections for all peatlands, including 100-m buffers within which there can be no road or trail construction, snowmobile or OHV use, commercial timber harvest, prescribed burning, livestock grazing, or major ground disturbance.		pathways for introduction and spread of invasive plant and animal species (e.g., invasive weeds, outdoor cats).
		1.2 Commercial & Industrial Areas	Commercial development encroaching on peatlands results in direct destruction of habitat, introduction of pollutants and excessive nutrients (e.g., yard runoff), and/or provides pathways for introduction and spread of invasive plant species.
		1.3 Tourism & Recreation	Recreational development encroaching on peatlands destroys habitat and provides easier pathways for introduction and spread of invasive plant species. Established and user-created trails through and adjacent to peatlands to access waterbodies for recreation may create shallow drains and introduce/favor invasive plants.
		2.3 Livestock Farming & Ranching	Grazing in peatlands can degrade habitat as a result of hummocking, worn trails, lower water storage capacity, earlier seasonal drying of sphagnum and other mosses, introducing or favoring non-native plant species, changes in water chemistry (i.e., nutrient loading) that alters native plant communities, and compacting the soil.
		4.1 Roads & Railroads	Road and parking lot construction and maintenance can result in the destruction of peatland habitats, introduction/favoring of invasive plant species, and increased access to peatlands or encroachment by people. Road building through, along, or upstream of peatlands can alter groundwater flow pathways feeding peatlands leading to habitat loss and/or degradation.
		5.3 Logging & Wood Harvesting	Timber harvest operations can change groundwater flow pathways that feed peatlands through soil compaction, road building, and other soil disturbance, leading to habitat loss and/or degradation. Timber harvest too close to peatlands can reduce, remove, or alter vegetated buffers that help reduce infestations of invasive plant species and capture sediment

			and pollutant runoff from timber harvest operations and associated roads.
		6.1 Recreational Activities	Groomed trails for multi-use winter recreation, including snowmobiling, skiing and fat-tire biking, leads to snow compaction, which may compact soils and vegetation and may collapse small mammal tunnel networks. OHV use in and around peatlands can damage habitat and introduce pollutants and invasive plant species.
		7.1 Fire & Fire Suppression	Severe fires can change water delivery to peatlands, either by altering flow leading to less water delivery or dramatically increasing water delivery through removal of trees that uptake from shallow groundwater. Uncharacteristically dense stands of trees surrounding peatlands or encroaching into peatlands can lead to extreme fire events that cause direct destruction of peatlands or lead to excess sediment delivery to peatlands after fires.
6.4 Conservation Planning	Work with USFS, BLM, DRNC, CSKT, and private timber companies on water management planning efforts to incorporate conservation considerations for Northern Bog Lemmings.	7.2 Dams & Water Management / Use	Development of springs to facilitate livestock grazing upstream of peatlands can alter water delivery to peatlands and livestock use can introduce pollutants and excessive nutrients to the water feeding those peatlands. Long-term static water levels can lead to the gradual reduction of native plant diversity in peatlands due to loss of natural disturbance regime. Water control structures result in unnatural water fluctuations both in magnitude and seasonality resulting in damage to peatland soils and associated plant communities as well as small mammal pathway networks.
6.5 Site Infrastructure	Avoid putting groomed trails in peatlands or within 100 m of peatlands.	6.1 Recreational Activities	Groomed trails for multi-use winter recreation, including snowmobiling, skiing and fat-tire biking, leads to snow compaction, which may compact soils and vegetation and may collapse small mammal tunnel networks. OHV use in and around peatlands can damage habitat and introduce pollutants and invasive plant species.

6.5 Site Infrastructure	Close and rehabilitate user-created trails and provide a more limited access corridor for recreationists to access small lakes without walking through sensitive peatland habitat.	1.3 Tourism & Recreation	Recreational development encroaching on peatlands destroys habitat and provides easier pathways for introduction and spread of invasive plant species. Established and user-created trails through and adjacent to peatlands to access waterbodies for recreation may create shallow drains and introduce/favor invasive plants.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Prohibit peat mining within the known range of the species in Montana. Site hardrock and gravel mines >300 m from peatlands and prevent mine operators from cutting through springs or the water table feeding into wetlands.	3.2 Mining & Quarrying	Hardrock and gravel mining can contaminate water sources that feed peatlands or change how water moves across the landscape, altering water delivery to peatlands and resulting in habitat degradation. Peat mining directly destroys peatland habitats that may take centuries to millennia to recover.
10. Institutional Development			
10.3 Alliance & Partnership Development	Work with local snowmobile clubs to clear stumps and other hazards from upland meadows to use as recreation areas instead of continuing to use peatlands.	6.1 Recreational Activities	Groomed trails for multi-use winter recreation, including snowmobiling, skiing and fat-tire biking, leads to snow compaction, which may compact soils and vegetation and may collapse small mammal tunnel networks. OHV use in and around peatlands can damage habitat and introduce pollutants and invasive plant species.

Little Brown Myotis Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			

1.1 Site/Area Stewardship	Consider implementing and monitoring environmental treatments (e.g., UV-C light, PEG 8000). Explore novel habitat treatments (e.g., RNAi). Restrict access or consider timing restrictions to known hibernacula and maternity roosts impacted by White-Nose Syndrome.	8.4 Pathogens & Microbes	White-nose syndrome.
1.1 Site/Area Stewardship	Restrict or limit recreational access to known hibernacula (with bat-friendly methods) during the overwintering period.	6.1 Recreational Activities	nan.
		7.3 Other Ecosystem Modifications	nan.
2. Species Management			
2.1 Species Stewardship	Consider implementing and monitoring probiotic treatments at known hibernacula and vaccine treatments (e.g., bat fungal disease immunogen) at known maternity colonies.	8.4 Pathogens & Microbes	White-nose syndrome.
2.1 Species Stewardship	Install artificial roosts (e.g., properly sited bat box).	5.1 Hunting & Collecting Terrestrial Animals	nan.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Conduct education and outreach on the proper use and siting of bat boxes and the value and importance of bats. Work with wildlife control operators to ensure companies adhere to FWP's recommended timing restrictions and methods for bat exclusions outlined in 'Acceptable Management Practices for Bat Control Activities in Structures'.	5.1 Hunting & Collecting Terrestrial Animals	Extermination and/or exclusion from human-made structures using improper timing or methods can result in take or disturbance of bats and bat colonies and lead to habitat loss.

3.1 Outreach & Communications	Promote education and outreach regarding proper use and siting of bat boxes for extreme heat waves and warming temperatures.	11.3 Changes in Temperature Regimes	nan.
3.1 Outreach & Communications	Promote education, outreach, and communication with local caving (e.g., Northern Rocky Mountain Grotto) and climbing (e.g., Climbers for Bat Conservation) communities and land management agencies to encourage adherence to the National White-nose Syndrome Decontamination Protocol when recreating or working in areas that bats frequent.	8.4 Pathogens & Microbes	White-nose syndrome.
3.1 Outreach & Communications	Promote education, outreach, and communication with local caving (e.g., Northern Rocky Mountain Grotto) and climbing (e.g., Climbers for Bat Conservation) communities to encourage members to adhere to National National White-nose Syndrome Decontamination Protocol.	6.1 Recreational Activities	nan.
		7.3 Other Ecosystem Modifications	nan.
5. Livelihood Economic & Moral Incentives			
5.4 Direct Economic Incentives	Provide incentives to landowners to promote ethical exclusions.	5.1 Hunting & Collecting Terrestrial Animals	nan.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Develop best management practices for bat exclusions in Montana.	5.1 Hunting & Collecting Terrestrial Animals	nan.

6.4 Conservation Planning	Follow guidance from the FWP Montana Bat Conservation and Management Plan to limit spread of disease and to conserve bats and their habitats.	8.4 Pathogens & Microbes	White-nose syndrome.
6.4 Conservation Planning	Use appropriate survey methodology and adhere to the Guidelines for the Protection of Bat Roosts and management protocols designated for Townsend's Big-eared Bat (Pierson et al. 1999), as these are also appropriate for Little Brown Myotis, especially at potential hibernacula.	6.1 Recreational Activities	nan.
		7.3 Other Ecosystem Modifications	nan.
6.4 Conservation Planning	Work with state and federal land management agencies regarding potential compensatory mitigation (e.g., habitat conservation plan).	3.3 Renewable Energy	nan.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Amend Montana Code to classify bats as nongame species within the state of Montana.	5.1 Hunting & Collecting Terrestrial Animals	nan.
7.2 Policies & Guidelines	Work with wind energy developers to ensure minimal disturbance to bats. Conduct pre- and post-construction monitoring as recommended by state and federal guidance documents (e.g., 'Recommendations to Reduce Bat Fatalities at Wind Energy Facilities in Montana').	3.3 Renewable Energy	nan.
9. Education & Training			
9.2 Training & Individual Capacity Development	Develop a training program to provide education and technical assistance to landowners and wildlife control operators conducting exclusions for bats.	5.1 Hunting & Collecting Terrestrial Animals	nan.

Black-tailed Prairie Dog Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Treat prairie dog colonies at recovery sites for sylvatic plague by either applying deltamethrin with mechanical sprayers in every burrow, on foot or ATV, or using FipBits or fipronil-treated grain.	8.4 Pathogens & Microbes	Sylvatic plague.
2. Species Management			
2.2 Species Re-Introduction & Translocation	Consider translocating Black-tailed Prairie Dogs to augment colonies, particularly to establish or maintain active ferret recovery sites. Ferret release sites must support >1500 acres of active prairie dog colonies, preferably >4500 acres which can host 30 adult ferrets. Sites with > 15,000 acres can receive > 100 adults.	8.4 Pathogens & Microbes	Sylvatic plague.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Develop K-12 educational programs that identify the unique role of prairie dogs in maintaining prairie ecosystems and providing habitat for other wildlife. Foster appreciation	5.1 Hunting & Collecting Terrestrial Animals	Prairie dog control is a source of direct mortality.

	for this species. Outreach to conservation-minded landowners willing to voluntarily conserve prairie dogs on their property.		
3.1 Outreach & Communications	Develop educational materials that identify the unique role of prairie dogs in maintaining prairie ecosystems and providing habitat for other wildlife species.	1.1 Housing & Urban Areas	Urban, suburban, and ex-urban development.
5. Livelihood Economic & Moral Incentives			
5.4 Direct Economic Incentives	Work with partner agencies and NGOs to seek funding sources for direct payments to landowners with large prairie dog colonies (< 1500 active acres) that are willing to conserve prairie dogs on their lands.	5.1 Hunting & Collecting Terrestrial Animals	Prairie dog control is a source of direct mortality.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Use the Homes on the Range, the Montana Black-footed Ferret Conservation and Management Guidelines, and other tools to prioritize conservation of areas with (potential for) extensive prairie dog colonies. Conserve large tracts of intact native prairie grasslands to further prairie dog conservation and establish Black-footed Ferret recovery sites.	2.1 Annual & Perennial Non-Timber Crops	Conversion of native prairie to croplands eliminates prairie dog colonies, resulting in a lack of prey base and habitat for ferrets.
6.5 Site Infrastructure	Develop prairie dog colonies near urban areas into Watchable Wildlife Areas.	1.1 Housing & Urban Areas	Urban, suburban, and ex-urban development.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Seek authorization to regulate take of prairie dogs where reduction of the prey base could impact ferret recovery.	5.1 Hunting & Collecting Terrestrial Animals	Prairie dog control is a source of direct mortality.

10. Institutional Development			
10.3 Alliance & Partnership Development	Build partnerships with NGOs, tribes, agricultural producers, grazing associations, and agencies to promote habitat conservation programs in areas with (and potential for) extensive prairie dog colonies.	2.1 Annual & Perennial Non-Timber Crops	Conversion of native prairie to croplands eliminates prairie dog colonies, resulting in a lack of prey base and habitat for ferrets.

Canada Lynx Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Consider lynx habitat in proposals for recreation development, especially for proposed high-intensity recreation projects such as ski resorts and high-density trail networks.	6.1 Recreational Activities	High intensity/developed recreation can displace lynx.
6.4 Conservation Planning	Continue to implement lynx protection zones for trapping regulations and continue to update as needed.	5.1 Hunting & Collecting Terrestrial Animals	Mortality and injury from incidental capture from legal trapping. Illegal killing.
6.4 Conservation Planning	Take into consideration high-quality Canada Lynx habitat as a resource value during fire suppression activities and active wildfire management.	7.1 Fire & Fire Suppression	Large scale, high severity wildfires and fire suppression activities can degrade or destroy habitat.
9. Education & Training			

9.2 Training & Individual Capacity Development	Continue to provide and require trapper education courses to educate trappers on how to prevent incidental captures and on best practices in case of incidental capture. Include a summary of species that can and cannot be legally hunted.	5.1 Hunting & Collecting Terrestrial Animals	Mortality and injury from incidental capture from legal trapping. Illegal killing.

Columbia Plateau Pocket Mouse Threats and Conservation Actions

There are no species-specific threats and actions for Columbia Plateau Pocket Mouse. See Chapter 5.4 for HGCN threats and actions.

Fisher Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Require Fisher exclusion devices on Marten traps in the Bitterroot and Cabinet Mountains (and in areas of future reintroduction) to reduce incidental take of Fishers.	5.1 Hunting & Collecting Terrestrial Animals	Direct mortality due to legal trapping. Incidental trapping mortality and/or injuries as bycatch of Marten and Bobcat trapping.

Fringed Myotis Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Consider implementing and monitoring environmental treatments (e.g., UV-C light, PEG 8000). Explore novel habitat treatments (e.g., RNAi). Restrict access or consider timing restrictions to known hibernacula and maternity roosts impacted by White-Nose Syndrome.	12.1 Other	White-nose syndrome may cause significant population declines. Because hibernacula for this species are unknown in Montana, disease transmission and effects may differ and moderate population-level impacts.
1.1 Site/Area Stewardship	Protect known maternity roosts and hibernacula from disturbance (e.g., recreation and energy development).	5.3 Logging & Wood Harvesting	Improper siting and/or timing of timber harvest and prescribed fire potential impacts to maternity roosts, hibernacula, and foraging areas.
1.1 Site/Area Stewardship	Protect known maternity roosts from disturbance (e.g., recreation, energy development). Restrict access to recreational use at known hibernacula during the overwintering period, using bat-friendly methods.	7.3 Other Ecosystem Modifications	Loss of roosts (e.g., closure of mines without bat-friendly gating techniques) or disturbance to roosts (e.g., cave recreation during winter), especially maternity roosts and hibernacula.
1.1 Site/Area Stewardship	Protect known roosts and hibernacula from disturbance associated with new oil and gas development.	3.1 Oil & Gas Drilling	Disturbance (e.g., noise, flaring) to bats during oil and gas drilling and associated new development.
2. Species Management			
2.1 Species Stewardship	Consider implementing and monitoring probiotic treatments at known hibernacula, and vaccine treatments (e.g., bat fungal disease immunogen) at known maternity colonies.	12.1 Other	White-nose syndrome may cause significant population declines. Because hibernacula for this species are unknown in Montana, disease transmission and effects may differ and moderate population-level impacts.

2.1 Species Stewardship	Encourage land management agencies and private development entities to adapt and adhere to recommendations outlined by Bat Conservation International and the White-Nose Syndrome Response Team in 'Forest Management and Bats' when siting and conducting timber management activities.	5.3 Logging & Wood Harvesting	Improper siting and/or timing of timber harvest and prescribed fire potential impacts to maternity roosts, hibernacula, and foraging areas.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Promote education, outreach, and communication with local caving (e.g., Northern Rocky Mountain Grotto) and climbing (e.g., Climbers for Bat Conservation) communities and land management agencies to encourage adherence to the National White-nose Syndrome Decontamination Protocol when recreating or working in areas that bats frequent.	12.1 Other	White-nose syndrome may cause significant population declines. Because hibernacula for this species are unknown in Montana, disease transmission and effects may differ and moderate population-level impacts.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Develop management recommendations and work with local oil and gas developers to minimize disturbance to bats during oil and gas drilling.	3.1 Oil & Gas Drilling	Disturbance (e.g., noise, flaring) to bats during oil and gas drilling and associated new development.
6.4 Conservation Planning	Follow guidance from the FWP Montana Bat Conservation and Management Plan to limit spread of disease and to conserve bats and their habitats.	12.1 Other	White-nose syndrome may cause significant population declines. Because hibernacula for this species are unknown in Montana, disease transmission and effects may differ and moderate population-level impacts.
6.4 Conservation Planning	Use appropriate survey methodology and adhere to the Guidelines for the Protection of	7.3 Other Ecosystem Modifications	Loss of roosts (e.g., closure of mines without bat-friendly gating techniques) or disturbance to roosts (e.g., cave

	Bat Roosts and management protocols designated for Townsend's big-eared bat (Pierson et al. 1999), as these are also appropriate for other cave and mine roosting species, especially at potential winter and maternity roosting habitats.		recreation during winter), especially maternity roosts and hibernacula.
6.4 Conservation Planning	Work with land management agencies regarding the timing, scope, and location of timber harvest activities relative to known roosts, hibernacula, and foraging areas.	5.3 Logging & Wood Harvesting	Improper siting and/or timing of timber harvest and prescribed fire potential impacts to maternity roosts, hibernacula, and foraging areas.
6.4 Conservation Planning	Work with state and federal land management agencies regarding potential compensatory mitigation (e.g., habitat conservation plan).	3.3 Renewable Energy	Potential collisions with wind turbines and other associated development (e.g., power lines). Potential habitat loss due to wind-infrastructure development.
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Work with wind energy developers to ensure minimal disturbance to bats. Conduct pre- and post-construction monitoring as recommended by state and federal guidance documents (e.g., 'Recommendations to Reduce Bat Fatalities at Wind Energy Facilities in Montana').	3.3 Renewable Energy	Potential collisions with wind turbines and other associated development (e.g., power lines). Potential habitat loss due to wind-infrastructure development.

Long-eared Myotis Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			

1. Land/Water Protection			
1.1 Site/Area Stewardship	Consider implementing and monitoring environmental treatments (e.g., UV-C light, PEG 8000). Explore novel habitat treatments (e.g., RNAi). Restrict access or consider timing restrictions to known hibernacula and maternity roosts impacted by White-Nose Syndrome.	12.1 Other	White-nose syndrome may cause significant population declines. Because hibernacula for this species are unknown in Montana, disease transmission and effects may differ and moderate population-level impacts.
1.1 Site/Area Stewardship	Protect known maternity roosts and hibernacula from disturbance (e.g., recreation and energy development).	5.3 Logging & Wood Harvesting	Improper siting and/or timing of timber harvest and prescribed fire potential impacts to maternity roosts, hibernacula, and foraging areas.
1.1 Site/Area Stewardship	Protect known maternity roosts from disturbance (e.g., recreation, energy development). Restrict access to recreational use at known hibernacula during the overwintering period, using bat-friendly methods.	7.3 Other Ecosystem Modifications	Loss of roosts (e.g., closure of mines without bat-friendly gating techniques) or disturbance to roosts (e.g., cave recreation during winter), especially maternity roosts and hibernacula.
1.1 Site/Area Stewardship	Protect known roosts and hibernacula from disturbance associated with new oil and gas development.	3.1 Oil & Gas Drilling	Disturbance (e.g., noise, flaring) to bats during oil and gas drilling and associated new development.
2. Species Management			
2.1 Species Stewardship	Consider implementing and monitoring probiotic treatments at known hibernacula, and vaccine treatments (e.g., bat fungal disease immunogen) at known maternity colonies.	12.1 Other	White-nose syndrome may cause significant population declines. Because hibernacula for this species are unknown in Montana, disease transmission and effects may differ and moderate population-level impacts.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Promote education, outreach, and communication with local caving (e.g., Northern Rocky Mountain Grotto) and	12.1 Other	White-nose syndrome may cause significant population declines. Because hibernacula for this species are unknown in

	climbing (e.g., Climbers for Bat Conservation) communities and land management agencies to encourage adherence to the National White-nose Syndrome Decontamination Protocol when recreating or working in areas that bats frequent.		Montana, disease transmission and effects may differ and moderate population-level impacts.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Develop management recommendations and work with local oil and gas developers to minimize disturbance to bats during oil and gas drilling.	3.1 Oil & Gas Drilling	Disturbance (e.g., noise, flaring) to bats during oil and gas drilling and associated new development.
6.4 Conservation Planning	Follow guidance from the FWP Montana Bat Conservation and Management Plan to limit spread of disease and to conserve bats and their habitats.	12.1 Other	White-nose syndrome may cause significant population declines. Because hibernacula for this species are unknown in Montana, disease transmission and effects may differ and moderate population-level impacts.
6.4 Conservation Planning	Use appropriate survey methodology and adhere to the Guidelines for the Protection of Bat Roosts and management protocols designated for Townsend's big-eared bat (Pierson et al. 1999), as these are also appropriate for other cave and mine roosting species, especially at potential winter and maternity roosting habitats.	7.3 Other Ecosystem Modifications	Loss of roosts (e.g., closure of mines without bat-friendly gating techniques) or disturbance to roosts (e.g., cave recreation during winter), especially maternity roosts and hibernacula.
6.4 Conservation Planning	Work with land management agencies regarding the timing, scope, and location of timber harvest activities relative to known roosts, hibernacula, and foraging areas.	5.3 Logging & Wood Harvesting	Improper siting and/or timing of timber harvest and prescribed fire potential impacts to maternity roosts, hibernacula, and foraging areas.

6.4 Conservation Planning	Work with state and federal land management agencies regarding potential compensatory mitigation (e.g., habitat conservation plan).	3.3 Renewable Energy	Potential collisions with wind turbines and other associated development (e.g., power lines). Potential habitat loss due to wind-infrastructure development.
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Work with wind energy developers to ensure minimal disturbance to bats. Conduct pre- and post-construction monitoring as recommended by state and federal guidance documents (e.g., 'Recommendations to Reduce Bat Fatalities at Wind Energy Facilities in Montana').	3.3 Renewable Energy	Potential collisions with wind turbines and other associated development (e.g., power lines). Potential habitat loss due to wind-infrastructure development.

Long-legged Myotis Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Consider implementing and monitoring environmental treatments (e.g., UV-C light, PEG 8000). Explore novel habitat treatments (e.g., RNAi). Restrict access or consider timing restrictions to known hibernacula and maternity roosts impacted by White-Nose Syndrome.	12.1 Other	White-nose syndrome may cause significant population declines. Because hibernacula for this species are unknown in Montana, disease transmission and effects may differ and moderate population-level impacts.

1.1 Site/Area Stewardship	Protect known maternity roosts and hibernacula from disturbance (e.g., recreation and energy development).	5.3 Logging & Wood Harvesting	Improper siting and/or timing of timber harvest and prescribed fire potential impacts to maternity roosts, hibernacula, and foraging areas.
1.1 Site/Area Stewardship	Protect known maternity roosts from disturbance (e.g., recreation, energy development). Restrict access to recreational use at known hibernacula during the overwintering period, using bat-friendly methods.	7.3 Other Ecosystem Modifications	Loss of roosts (e.g., closure of mines without bat-friendly gating techniques) or disturbance to roosts (e.g., cave recreation during winter), especially maternity roosts and hibernacula.
1.1 Site/Area Stewardship	Protect known roosts and hibernacula from disturbance associated with new oil and gas development.	3.1 Oil & Gas Drilling	Disturbance (e.g., noise, flaring) to bats during oil and gas drilling and associated new development.
2. Species Management			
2.1 Species Stewardship	Consider implementing and monitoring probiotic treatments at known hibernacula, and vaccine treatments (e.g., bat fungal disease immunogen) at known maternity colonies.	12.1 Other	White-nose syndrome may cause significant population declines. Because hibernacula for this species are unknown in Montana, disease transmission and effects may differ and moderate population-level impacts.
2.1 Species Stewardship	Encourage land management agencies and private development entities to adapt and adhere to recommendations outlined by Bat Conservation International and the White-Nose Syndrome Response Team in 'Forest Management and Bats' when siting and conducting timber management activities.	5.3 Logging & Wood Harvesting	Improper siting and/or timing of timber harvest and prescribed fire potential impacts to maternity roosts, hibernacula, and foraging areas.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Promote education, outreach, and communication with local caving (e.g., Northern Rocky Mountain Grotto) and climbing (e.g., Climbers for Bat	12.1 Other	White-nose syndrome may cause significant population declines. Because hibernacula for this species are unknown in Montana, disease transmission and effects may differ and moderate population-level impacts.

	Conservation) communities and land management agencies to encourage adherence to the National White-nose Syndrome Decontamination Protocol when recreating or working in areas that bats frequent.		
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Develop management recommendations and work with local oil and gas developers to minimize disturbance to bats during oil and gas drilling.	3.1 Oil & Gas Drilling	Disturbance (e.g., noise, flaring) to bats during oil and gas drilling and associated new development.
6.4 Conservation Planning	Follow guidance from the FWP Montana Bat Conservation and Management Plan to limit spread of disease and to conserve bats and their habitats.	12.1 Other	White-nose syndrome may cause significant population declines. Because hibernacula for this species are unknown in Montana, disease transmission and effects may differ and moderate population-level impacts.
6.4 Conservation Planning	Use appropriate survey methodology and adhere to the Guidelines for the Protection of Bat Roosts and management protocols designated for Townsend's big-eared bat (Pierson et al. 1999), as these are also appropriate for other cave and mine roosting species, especially at potential winter and maternity roosting habitats.	7.3 Other Ecosystem Modifications	Loss of roosts (e.g., closure of mines without bat-friendly gating techniques) or disturbance to (roosts e.g., cave recreation during winter), especially maternity roosts and hibernacula.
6.4 Conservation Planning	Work with land management agencies regarding the timing, scope, and location of timber harvest activities relative to known roosts, hibernacula, and foraging areas.	5.3 Logging & Wood Harvesting	Improper siting and/or timing of timber harvest and prescribed fire potential impacts to maternity roosts, hibernacula, and foraging areas.
6.4 Conservation Planning	Work with state and federal land management agencies regarding potential	3.3 Renewable Energy	Potential collisions with wind turbines and other associated development (e.g., power lines). Potential habitat loss due to wind-infrastructure development.

	compensatory mitigation (e.g., habitat conservation plan).		
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Work with wind energy developers to ensure minimal disturbance to bats. Conduct pre- and post-construction monitoring as recommended by state and federal guidance documents (e.g., 'Recommendations to Reduce Bat Fatalities at Wind Energy Facilities in Montana').	3.3 Renewable Energy	Potential collisions with wind turbines and other associated development (e.g., power lines). Potential habitat loss due to wind-infrastructure development.

Merriam's Shrew Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Identify lands currently with or highly susceptible to overgrazing and implement educational opportunities and initiatives for landholders most affected.	2.3 Livestock Farming & Ranching	Overgrazing and conversion of native grassland to row crops.

Pallid Bat Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Restrict access, or consider timing restrictions, to known hibernacula and maternity roosts impacted by White-Nose Syndrome.	12.1 Other	Lack of awareness about the susceptibility to, and effects of white-nose syndrome.
1.1 Site/Area Stewardship	Work with Bat Conservation International's Subterranean Team to conduct bat surveys to determine use prior to mine or cave closures, and ensure closures are compatible with bats, as outlined in 'Managing Abandoned Mines for Bats' (Sherwin et al. 2009). Restrict access to recreational use at known hibernacula during the overwintering period, using bat-friendly methods.	7.3 Other Ecosystem Modifications	Loss of potential roosting habitat (e.g., closure of mines without bat-friendly gating techniques) or disturbance to potential roosting habitat(e.g., cave recreation during winter) in caves and mines.
2. Species Management			
2.1 Species Stewardship	Consider bat-friendly designs in infrastructure construction and replacements. Maintain maternity colonies within transportation structures.	4.1 Roads & Railroads	Loss of or disturbance to roosts in transportation structures due to construction or maintenance activities associated with transportation infrastructure.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Use appropriate survey methodology. Adhere to the Guidelines for the Protection of Bat Roosts (American Society of Mammalogists, 1992) and management protocols designated for Townsend's big-eared bat	7.3 Other Ecosystem Modifications	Loss of potential roosting habitat (e.g., closure of mines without bat-friendly gating techniques) or disturbance to potential roosting habitat(e.g., cave recreation during winter) in caves and mines.

	(Pierson et al. 1999), as these are also appropriate for other species, especially at potential winter habitats.		
6.4 Conservation Planning	Work with FWP to ensure bats are considered during the scoping process related to construction and maintenance of transportation infrastructure. Review and follow recommendations outlined in FWP's Recommendations for Bats and Transportation Infrastructure.	4.1 Roads & Railroads	Loss of or disturbance to roosts in transportation structures due to construction or maintenance activities associated with transportation infrastructure.
6.4 Conservation Planning	Work with land management agencies regarding the timing, scope, and location of timber harvest activities relative to known roosts and areas of high bat activity.	5.3 Logging & Wood Harvesting	Loss of roosting habitat due to timber harvest and management in Ponderosa and Juniper forests.

Preble's Shrew Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Promote and develop incentive programs for utilizing land that is already disturbed (row crop fields).	3.1 Oil & Gas Drilling	Altered native vegetation, fragmentation and habitat disturbance of native habitat due to infrastructure.
C. Enabling Conditions Actions			
9. Education & Training			

9.2 Training & Individual Capacity Development	Initiate educational initiatives for the public and professionals to correctly identify invasive species and perform action steps for containment.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive grasses can alter grassland biodiversity and decrease foraging efficiency and access to food resources.

Pygmy Rabbit Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Distribute information to the public about the risk of disease caused by releasing domestic rabbits in the wild.	8.4 Pathogens & Microbes	Outbreaks of tularemia and rabbit hemorrhagic disease virus serotype 2 (RHDV2).
3.1 Outreach & Communications	Educate and engage the public in preventing the spread of invasive species, and encourage reporting to facilitate early detection.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive annual grass species increase fire frequency and intensity leading to habitat loss.
3.1 Outreach & Communications	Inform landowners of the benefits of conifer removal and engage the public in active conifer management efforts.	7.1 Fire & Fire Suppression	Fire suppression has resulted in a fire regime characterized by intense fires that cause loss of low-elevation sagebrush habitat. Fire suppression has allowed for conifer encroachment into higher-elevation sagebrush habitat.
C. Enabling Conditions Actions			
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	If protection from take is necessary, the species could be designated as a species in need of management to prohibit harvest.	5.1 Hunting & Collecting Terrestrial Animals	Hunters intentionally or opportunistically harvesting Pygmy Rabbits.

7.2 Policies & Guidelines	Prevent unintentional spread of the diseases by ensuring that biologists follow decontamination protocols when working with diseased leporids.	8.4 Pathogens & Microbes	Outbreaks of tularemia and rabbit hemorrhagic disease virus serotype 2 (RHDV2).
9. Education & Training			
9.2 Training & Individual Capacity Development	Collaborate with partner agencies and organizations to develop greater capacity to engage in prescribed burning.	7.1 Fire & Fire Suppression	Fire suppression has resulted in a fire regime characterized by intense fires that cause loss of low-elevation sagebrush habitat. Fire suppression has allowed for conifer encroachment into higher-elevation sagebrush habitat.
10. Institutional Development			
10.3 Alliance & Partnership Development	Collaborate with the local weed districts, partner agencies, and NGOs to coordinate invasive species management efforts.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive annual grass species increase fire frequency and intensity leading to habitat loss.
10.3 Alliance & Partnership Development	Continue to support and engage with the Southwestern Montana Sagebrush Partnership in ongoing active conifer management efforts.	7.1 Fire & Fire Suppression	Fire suppression has resulted in a fire regime characterized by intense fires that cause loss of low-elevation sagebrush habitat. Fire suppression has allowed for conifer encroachment into higher-elevation sagebrush habitat.

Silver-haired Bat Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Identify migratory pathways within Montana. Protect known maternity roosts and hibernacula from disturbance (e.g.,	5.3 Logging & Wood Harvesting	Loss of roosting habitat due to timber harvest and management activities.

	recreation, energy development), and implement seasonal timing restrictions.		
1.1 Site/Area Stewardship	Maintain, create, or restore bat foraging and roosting habitat within urban areas. Work with local government and developers to ensure bats are considered during planning processes related to urban development.	1.1 Housing & Urban Areas	Loss of and disruption to foraging and roosting habitat within forests and riparian corridors due to residential and commercial development.
1.1 Site/Area Stewardship	Work with Bat Conservation International's Subterranean Team to conduct bat surveys to determine use prior to mine or cave closures, and ensure closures are compatible with bats, as outlined in 'Managing Abandoned Mines for Bats' (Sherwin et al. 2009). Restrict access to recreational use at known hibernacula during the overwintering period, using bat-friendly methods.	7.3 Other Ecosystem Modifications	Loss of potential roosting habitat (e.g., closure of mines without bat-friendly gating techniques) or disturbance to (e.g., cave recreation during winter) potential winter roosting habitat.
2. Species Management			
2.1 Species Stewardship	Consider bat-friendly designs in infrastructure construction and replacements. Maintain maternity colonies within transportation structures. When roosts are identified, implement timing restrictions to avoid roost disturbance between 15 April and 1 September during activities related to construction and maintenance.	4.1 Roads & Railroads	Loss of or disturbance to roosts in transportation structures due to construction or maintenance activities associated with transportation infrastructure.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Use appropriate survey methodology. Adhere to the Guidelines for the Protection of Bat Roosts (American Society of Mammalogists,	7.3 Other Ecosystem Modifications	Loss of (e.g., closure of mines without bat-friendly gating techniques) or disturbance to (e.g., cave recreation during winter) potential winter roosting habitat.

	1992) and management protocols designated for Townsend's big-eared bat (Pierson et al. 1999), as these are also appropriate for other species, especially at potential winter habitats.		
6.4 Conservation Planning	Work with FWP to ensure bats are considered during the scoping process related to construction and maintenance of transportation infrastructure. Review and follow recommendations outlined in FWP's Recommendations for Bats and Transportation Infrastructure.	4.1 Roads & Railroads	Loss of or disturbance to roosts in transportation structures due to construction or maintenance activities associated with transportation infrastructure.
6.4 Conservation Planning	Work with land management agencies regarding the timing, scope, and location of timber harvest activities relative to known roosts and areas of high bat activity.	5.3 Logging & Wood Harvesting	Loss of roosting habitat due to timber harvest and management activities.
6.4 Conservation Planning	Work with state and federal land management agencies regarding potential compensatory mitigation (e.g., habitat conservation plan).	3.3 Renewable Energy	Populations are heavily impacted by collisions with wind turbines and other associated development (e.g., power lines) in North America; potential habitat loss due to wind-infrastructure development.
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Work with wind energy developers to ensure minimal disturbance to bats. Conduct pre- and post-construction monitoring as recommended by state and federal guidance documents (e.g., 'Recommendations to Reduce Bat Fatalities at Wind Energy Facilities in Montana'). Submit data to the North American Bat Monitoring Program.	3.3 Renewable Energy	Populations are heavily impacted by collisions with wind turbines and other associated development (e.g., power lines) in North America; potential habitat loss due to wind-infrastructure development.

Swift Fox Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Control predators via culling.	8.2 Problematic Native Plants & Animals	Increase in native predator populations reduces the Swift Fox population and limits range expansion.
2.1 Species Stewardship	Control predators via culling. Vaccinate Swift Foxes when trapped or handled for research.	8.4 Pathogens & Microbes	Canine distemper, parvovirus, and rabies infections and outbreaks.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Create and distribute educational materials throughout Montana.	8.4 Pathogens & Microbes	Canine distemper, parvovirus, and rabies infections and outbreaks.
3.1 Outreach & Communications	Develop educational materials and social media campaigns to raise awareness about Swift Fox regulations.	5.1 Hunting & Collecting Terrestrial Animals	Incidental shooting, trapping, and poisoning of Swift Fox.
3.1 Outreach & Communications	Develop programs and educational materials to reduce poisoning and promote safe alternatives to pesticide use.	9.3 Agricultural & Forestry Effluents	Pesticide and rodenticide use reduces prey availability and causes secondary poisoning.
4. Law Enforcement & Prosecution			
4.2 Criminal Prosecution & Conviction	Collect evidence on illegal shooting or trapping and issue citations, so individuals convicted pay fines.	5.1 Hunting & Collecting Terrestrial Animals	Incidental shooting, trapping, and poisoning of Swift Fox.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Develop best management practices for agricultural production in native habitats.	2.1 Annual & Perennial Non-Timber Crops	Habitat loss via conversion to cropland.

5.2 Better Products & Management Practices	Develop best management practices for urban development and landscaping to limit habitat loss and fragmentation.	1.1 Housing & Urban Areas	Habitat loss and fragmentation due to urban, suburban, and exurban development.
5.2 Better Products & Management Practices	Provide access to weed-free hay and native seed mixes for reseeding rangeland.	8.1 Invasive Non-Native/Alien Plants & Animals	Habitat loss/fragmentation from establishment and increase in invasive non-native plant species.
5.4 Direct Economic Incentives	Develop incentives or prizes for native habitat restoration.	2.1 Annual & Perennial Non-Timber Crops	Habitat loss via conversion to cropland.
		3.1 Oil & Gas Drilling	Habitat loss/fragmentation from oil and gas infrastructure.
		3.3 Renewable Energy	Loss of habitat from energy development.
		8.1 Invasive Non-Native/Alien Plants & Animals	Habitat loss/fragmentation from establishment and increase in invasive non-native plant species.
5.4 Direct Economic Incentives	Mitigate habitat loss with monetary incentive credits for off-site habitat protection.	1.1 Housing & Urban Areas	Habitat loss and fragmentation due to urban, suburban, and exurban development.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.3 Land/Water Use Zoning & Designation	Designate an important habitat area (without formal protection) for areas like high quality habitat, den sites, or connectivity corridors that would restrict development.	3.3 Renewable Energy	Loss of habitat from energy development.
6.3 Land/Water Use Zoning & Designation	Designate an important habitat area (without formal protection) for areas like high quality habitat, den sites, or connectivity corridors.	3.1 Oil & Gas Drilling	Habitat loss/fragmentation from oil and gas infrastructure.
6.4 Conservation Planning	Develop a road management plan for areas with high Swift Fox use or known mortalities from collisions.	4.1 Roads & Railroads	Direct mortality from collisions.
6.4 Conservation Planning	Reduce artificial perches for avian predators.	8.2 Problematic Native Plants & Animals	Increase in native predator populations reduces the Swift Fox population and limits range expansion.
7. Legal & Policy Frameworks			

7.1 Laws, Regulations & Codes	Propose new laws for restricting or regulating pesticide/rodenticide use.	9.3 Agricultural & Forestry Effluents	Pesticide and rodenticide use reduces prey availability and causes secondary poisoning.

Townsend's Big-eared Bat Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Protect green field sites or undeveloped land in urban areas. Work with local government and developers to ensure bats are considered during planning processes related to urban development. Maintain, create, or restore bat foraging and roosting habitat within urban areas.	1.1 Housing & Urban Areas	Loss of and disruption to foraging and roosting habitat within forests and riparian corridors due to residential and commercial development.
1.1 Site/Area Stewardship	Protect known maternity roosts and hibernacula from disturbance (e.g., recreation and energy development) and implement seasonal timing and distance restrictions when roosts are identified.	5.3 Logging & Wood Harvesting	Loss of or disturbance to roosting habitat due to timber harvest and management activities.
1.1 Site/Area Stewardship	Work with Bat Conservation International's Subterranean Team to conduct bat surveys to determine use prior to mine or cave closures, and ensure closures are compatible with bats, as outlined in 'Managing Abandoned Mines for Bats' (Sherwin et al. 2009). Restrict access to recreational use at known hibernacula and significant maternity roosts	7.3 Other Ecosystem Modifications	Loss of roosting habitat (e.g., closure of mines without bat-friendly gating techniques) or disturbance to roosting habitat (e.g., cave recreation).

	during seasons while they are in use, using bat-friendly methods.		
2. Species Management			
2.1 Species Stewardship	Consider bat-friendly designs in infrastructure construction and replacements. Maintain maternity colonies within transportation structures. When roosts are identified, implement timing restrictions to avoid roost disturbance between 15 April and 1 September during activities related to construction and maintenance.	4.1 Roads & Railroads	Loss of or disturbance to roosts in transportation structures due to construction or maintenance activities associated with transportation infrastructure.
2.1 Species Stewardship	Install artificial roosts (e.g., properly sited bat box).	5.1 Hunting & Collecting Terrestrial Animals	Extermination and/or exclusion from human-made structures using improper timing or methods can result in take or disturbance of bats and bat colonies and lead to habitat loss.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Promote education and outreach about the proper use and siting of bat boxes, and to increase tolerance of bats. Work with wildlife control operators to ensure companies adhere to FWP's recommended timing restrictions and methods for bat exclusions, as outlined in 'Acceptable Management Practices for Bat Control Activities in Structures'.	5.1 Hunting & Collecting Terrestrial Animals	Extermination and/or exclusion from human-made structures using improper timing or methods can result in take or disturbance of bats and bat colonies and lead to habitat loss.
5. Livelihood Economic & Moral Incentives			
5.4 Direct Economic Incentives	Provide incentives to landowners to promote ethical exclusions.	5.1 Hunting & Collecting Terrestrial Animals	Extermination and/or exclusion from human-made structures using improper timing or methods can result in take or disturbance of bats and bat colonies and lead to habitat loss.

C. Enabling Conditions Actions

6. Conservation Designation & Planning

6.4 Conservation Planning	Adhere to the 'Guidelines for the Protection of Bat Roosts' (American Society of Mammalogists, 1992) and management protocols designated for Townsend's big-eared bat (Pierson et al. 1999).	7.3 Other Ecosystem Modifications	Loss of (e.g., closure of mines without bat-friendly gating techniques) or disturbance to roosting habitat (e.g., cave recreation).
6.4 Conservation Planning	Develop best management practices for bat exclusions in Montana.	5.1 Hunting & Collecting Terrestrial Animals	Extermination and/or exclusion from human-made structures using improper timing or methods can result in take or disturbance of bats and bat colonies and lead to habitat loss.
6.4 Conservation Planning	Work with FWP to ensure bats are considered during the scoping process related to construction and maintenance of transportation infrastructure. Review and follow recommendations outlined in FWP's Recommendations for Bats and Transportation Infrastructure.	4.1 Roads & Railroads	Loss of or disturbance to roosts in transportation structures due to construction or maintenance activities associated with transportation infrastructure.
6.4 Conservation Planning	Work with land management agencies regarding the timing, scope, and location of timber harvest activities relative to known roosts and areas of high bat activity.	5.3 Logging & Wood Harvesting	Loss of or disturbance to roosting habitat due to timber harvest and management activities.
6.4 Conservation Planning	Work with state and federal land management agencies regarding potential compensatory mitigation (e.g., habitat conservation plan).	3.3 Renewable Energy	Potential collisions with wind turbines and other associated development (e.g., power lines). Potential habitat loss due to wind-infrastructure development.

7. Legal & Policy Frameworks

7.1 Laws, Regulations & Codes	Amend Montana Code to classify bats as nongame species within the state of Montana.	5.1 Hunting & Collecting Terrestrial Animals	Extermination and/or exclusion from human-made structures using improper timing or methods can result in take or disturbance of bats and bat colonies and lead to habitat loss.

7.2 Policies & Guidelines	Work with wind energy developers to ensure minimal disturbance to bats. Conduct pre- and post-construction monitoring as recommended by state and federal guidance documents (e.g., 'Recommendations to Reduce Bat Fatalities at Wind Energy Facilities in Montana').	3.3 Renewable Energy	Potential collisions with wind turbines and other associated development (e.g., power lines). Potential habitat loss due to wind-infrastructure development.
9. Education & Training			
9.2 Training & Individual Capacity Development	Develop a training program to provide education and technical assistance to landowners and wildlife control operators conducting exclusions for bats.	5.1 Hunting & Collecting Terrestrial Animals	Extermination and/or exclusion from human-made structures using improper timing or methods can result in take or disturbance of bats and bat colonies and lead to habitat loss.

Western Pygmy Shrew Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
C. Enabling Conditions Actions			
9. Education & Training			
9.2 Training & Individual Capacity Development	Initiate educational initiatives for the public and professionals to correctly identify invasive species and perform action steps for containment.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive grasses can alter grassland biodiversity and decrease foraging efficiency and access to food resources.

Wolverine Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Develop a multi-state conservation strategy to maintain genetic connectivity of Wolverines in the lower 48 states and with Canada.	1.1 Housing & Urban Areas	Competitors that thrive near human developments, such as Coyotes, can negatively influence Wolverine occupancy. Human development can fragment habitat and impede gene flow in Wolverines. Human infrastructure and associated domestic animals, such as dogs, can cause Wolverines to avoid the area and can lead to habitat loss or modification.
6.4 Conservation Planning	Ensure modeled future refugia are protected from projected increased recreation.	11.3 Changes in Temperature Regimes	Decrease and shift in snowpack distribution and character could result in diminished competitive advantage with other more adaptable predators. Decrease in snow-covered areas may concentrate winter recreation, resulting in a stronger impact on wolverine occupancy and production Reduction of snowpack across the landscape could result in increased over-snow recreation in areas of future refugia. Increased temperatures may decrease snowpacks and snowpack distribution, decreasing denning habitat. Warming temperatures and resulting decreased snowpack can possibly decrease shelf life of cached food.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Propose mandatory trap check intervals in Wolverine habitat. Support regulations that require mitigation of non-target capture of the federally listed Canada Lynx, including the prohibition of wolf snares on public lands in lynx protected zones, much of which overlaps with Wolverine habitat in Montana. Support the mandatory education course for	5.1 Hunting & Collecting Terrestrial Animals	Incidental take of Wolverines during legal trapping activities.

	trappers, checking wolf traps every 48 hours, using minimum wolf trap pan tension of 10 pounds, restricting land use of conibear traps, and using snare height of 18 inches.		

Yuma Myotis Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Consider implementing and monitoring environmental treatments (e.g., UV-C light, PEG 8000). Explore novel habitat treatments (e.g., RNAi). Restrict access or consider timing restrictions to known hibernacula and maternity roosts impacted by White-Nose Syndrome.	8.4 Pathogens & Microbes	White-nose syndrome.
1.1 Site/Area Stewardship	Restrict or limit access to known hibernacula, with bat-friendly methods, within Montana to recreational use during the overwintering period.	6.1 Recreational Activities	nan.
		7.3 Other Ecosystem Modifications	Loss of hibernacula (e.g., closure of mines without bat-friendly gating techniques) or disturbance to hibernacula (e.g., winter caving).
2. Species Management			
2.1 Species Stewardship	Consider implementing and monitoring probiotic treatments at known hibernacula, and vaccine treatments (e.g., bat fungal	8.4 Pathogens & Microbes	White-nose syndrome.

	disease immunogen) at known maternity colonies.		
2.1 Species Stewardship	Install artificial roosts (e.g., properly sited bat box).	5.1 Hunting & Collecting Terrestrial Animals	Extermination and/or exclusion from human-made structures using improper timing or methods can result in take or disturbance of bats and bat colonies and lead to habitat loss.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Promote education and outreach about the proper use and siting of bat boxes, and to increase tolerance of bats. Work with wildlife control operators to ensure companies adhere to FWP's recommended timing restrictions and methods for bat exclusions, as outlined in 'Acceptable Management Practices for Bat Control Activities in Structures'.	5.1 Hunting & Collecting Terrestrial Animals	Extermination and/or exclusion from human-made structures using improper timing or methods can result in take or disturbance of bats and bat colonies and lead to habitat loss.
3.1 Outreach & Communications	Promote education and outreach regarding proper use and siting of bat boxes due to extreme heat waves and warming temps.	11.3 Changes in Temperature Regimes	Negative impacts to survival and/or reproduction due to climate change-driven processes such as warming temperatures, extreme weather events (e.g., heat-induced pup die offs at maternity colonies) and drought (e.g., less surface water availability).
3.1 Outreach & Communications	Promote education, outreach, and communication with local caving (e.g., Northern Rocky Mountain Grotto) and climbing (e.g., Climbers for Bat Conservation) communities and land management agencies to encourage adherence to the National White-nose Syndrome Decontamination Protocol when recreating or working in areas that bats frequent.	8.4 Pathogens & Microbes	White-nose syndrome.

3.1 Outreach & Communications	Promote education, outreach, and communication with local caving (e.g., Northern Rocky Mountain Grotto) and climbing (e.g., Climbers for Bat Conservation) communities to encourage members to adhere to National National White-nose Syndrome Decontamination Protocol.	6.1 Recreational Activities	nan.
		7.3 Other Ecosystem Modifications	Loss of hibernacula (e.g., closure of mines without bat-friendly gating techniques) or disturbance to hibernacula (e.g., winter caving).
5. Livelihood Economic & Moral Incentives			
5.4 Direct Economic Incentives	Provide incentives to landowners to promote ethical exclusions.	5.1 Hunting & Collecting Terrestrial Animals	Extermination and/or exclusion from human-made structures using improper timing or methods can result in take or disturbance of bats and bat colonies and lead to habitat loss.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Develop best management practices for bat exclusions in Montana.	5.1 Hunting & Collecting Terrestrial Animals	Extermination and/or exclusion from human-made structures using improper timing or methods can result in take or disturbance of bats and bat colonies and lead to habitat loss.
6.4 Conservation Planning	Follow guidance from the FWP Montana Bat Conservation and Management Plan to limit spread of disease and to conserve bats and their habitats.	8.4 Pathogens & Microbes	White-nose syndrome.
6.4 Conservation Planning	Use appropriate survey methodology and adhere to the Guidelines for the Protection of Bat Roosts and management protocols designated for Townsend's Big-eared Bat (Pierson et al. 1999), as these are also appropriate for Little Brown Myotis, especially at potential hibernacula.	6.1 Recreational Activities	nan.
		7.3 Other Ecosystem Modifications	Loss of hibernacula (e.g., closure of mines without bat-friendly gating techniques) or disturbance to hibernacula (e.g., winter caving).
7. Legal & Policy Frameworks			

7.1 Laws, Regulations & Codes	Amend Montana Code to classify bats as nongame species within the state of Montana.	5.1 Hunting & Collecting Terrestrial Animals	Extermination and/or exclusion from human-made structures using improper timing or methods can result in take or disturbance of bats and bat colonies and lead to habitat loss.
9. Education & Training			
9.2 Training & Individual Capacity Development	Develop a training program to provide education and technical assistance to landowners and wildlife control operators conducting exclusions for bats.	5.1 Hunting & Collecting Terrestrial Animals	Extermination and/or exclusion from human-made structures using improper timing or methods can result in take or disturbance of bats and bat colonies and lead to habitat loss.

Eastern Red Bat Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Identify migratory pathways within Montana.	5.3 Logging & Wood Harvesting	Loss of roosting habitat due to timber harvest and management activities.
1.1 Site/Area Stewardship	Protect green field sites or undeveloped land in urban areas. Work with local government and developers to ensure bats are considered during planning processes related to urban development. Maintain, create, or restore bat foraging and roosting habitat within urban areas.	1.1 Housing & Urban Areas	Loss of and disruption to foraging and roosting habitat within forests and riparian corridors due to residential and commercial development.
1.2 Ecosystem & Natural Process (Re)Creation	Work with Irrigation Districts, Water Right holders, DNRC, and NRCS to explore changes in timing and amounts of instream flows (e.g., Arctic Grayling in the Big Hole	7.2 Dams & Water Management / Use	Changes in hydrologic cycles (e.g., overbank flows) resulting in loss of cottonwood galleries or changes in riparian corridors.

	example) to facilitate cottonwood regeneration.		
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Work with land management agencies regarding the timing, scope, and location of timber harvest activities relative to known roosts and areas of high bat activity.	5.3 Logging & Wood Harvesting	Loss of roosting habitat due to timber harvest and management activities.
6.4 Conservation Planning	Work with state and federal land management agencies regarding potential compensatory mitigation (e.g., habitat conservation plan).	3.3 Renewable Energy	Populations are heavily impacted by collisions with wind turbines and other associated development (e.g., power lines) in North America; potential habitat loss due to wind-infrastructure development.
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Work with wind energy developers to ensure minimal disturbance to bats. Conduct pre- and post-construction monitoring as recommended by state and federal guidance documents.	3.3 Renewable Energy	Populations are heavily impacted by collisions with wind turbines and other associated development (e.g., power lines) in North America; potential habitat loss due to wind-infrastructure development.

Northern Hoary Bat Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Identify migratory pathways within Montana. Protect known maternity roosts and	5.3 Logging & Wood Harvesting	Loss of roosting habitat due to timber harvest and management activities.

	hibernacula from disturbance (e.g., recreation, energy development), and implement seasonal timing restrictions.		
1.1 Site/Area Stewardship	Maintain, create, or restore bat foraging and roosting habitat within urban areas. Work with local government and developers to ensure bats are considered during planning processes related to urban development.	1.1 Housing & Urban Areas	Loss of and disruption to foraging and roosting habitat within forests and riparian corridors due to residential and commercial development.
2. Species Management			
2.1 Species Stewardship	Consider bat-friendly designs in infrastructure construction and replacements. Maintain maternity colonies within transportation structures. When roosts are identified, implement timing restrictions to avoid roost disturbance between 15 April and 1 September during activities related to construction and maintenance.	4.1 Roads & Railroads	Loss of or disturbance to roosts in transportation structures due to construction or maintenance activities associated with transportation infrastructure.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Work with FWP to ensure bats are considered during the scoping process related to construction and maintenance of transportation infrastructure. Review and follow recommendations outlined in FWP's Recommendations for Bats and Transportation Infrastructure.	4.1 Roads & Railroads	Loss of or disturbance to roosts in transportation structures due to construction or maintenance activities associated with transportation infrastructure.
6.4 Conservation Planning	Work with land management agencies regarding the timing, scope, and location of timber harvest activities relative to known roosts and areas of high bat activity.	5.3 Logging & Wood Harvesting	Loss of roosting habitat due to timber harvest and management activities.

6.4 Conservation Planning	Work with state and federal land management agencies regarding potential compensatory mitigation (e.g., habitat conservation plan).	3.3 Renewable Energy	Populations are heavily impacted by collisions with wind turbines and other associated development (e.g., power lines) in North America; potential habitat loss due to wind-infrastructure development.
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Work with wind energy developers to ensure minimal disturbance to bats. Conduct pre- and post-construction monitoring as recommended by state and federal guidance documents.	3.3 Renewable Energy	Populations are heavily impacted by collisions with wind turbines and other associated development (e.g., power lines) in North America; potential habitat loss due to wind-infrastructure development.

Hoary Marmot Threats and Conservation Actions

Threats and actions for Hoary Marmot will be included in the final version of the 2025 SWAP.

Meadow Jumping Mouse Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.2 Ecosystem & Natural Process (Re)Creation	Identify key sites and implement mitigations that protect natural water sources in these areas.	7.2 Dams & Water Management / Use	Altering surface water (surface irrigation, re-routing water sources, etc.) for livestock or agriculture could negatively impact the species, given preference for grassland sites whose structure is influenced by the presence of water. The draining of wetlands and using dams to reduce natural annual flooding. Use of stock tanks may not be negative and may

			reduce pressure in riparian areas. Loss of forest and shrub cover in riparian areas due to changes in annual flooding from water management.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.3 Land/Water Use Zoning & Designation	Designate important habitat within development areas.	1.1 Housing & Urban Areas	Degradation and loss of grassland habitat adjacent to water features due to subdevelopment.
9. Education & Training			
9.2 Training & Individual Capacity Development	Initiate educational initiatives for the public and professionals to correctly identify invasive species and perform action steps for containment.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive grasses can alter grassland biodiversity and decrease foraging efficiency and access to food resources.
9.2 Training & Individual Capacity Development	Work with developers to cluster infrastructure and roads, and avoid key habitat areas.	1.1 Housing & Urban Areas	Degradation and loss of grassland habitat adjacent to water features due to subdevelopment.
10. Institutional Development			
10.1 Internal Organizational Management & Administration	Update subdevelopment working guidelines and develop into formal FWP recommendations.	1.1 Housing & Urban Areas	Degradation and loss of grassland habitat adjacent to water features due to subdevelopment.

North American Porcupine Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			

3.1 Outreach & Communications	Conduct an education campaign to inform residents of Montana about the imperiled status of porcupines west of the Continental Divide, their value to the ecosystem, their natural history, and how to protect property from porcupines.	1.1 Housing & Urban Areas	Homeowners may kill porcupines as pests or incidentally with rodenticides. Residential encroachment can result in habitat loss.
3.1 Outreach & Communications	Conduct an education campaign to inform residents of Montana about the imperiled status of porcupines west of the Continental Divide, their value to the ecosystem, their natural history, and the statewide impact of indiscriminate killing.	4.1 Roads & Railroads	Direct mortality along major roadways. Habitat fragmentation caused by major roadways. Prevalence of forest service roads results in increased mortality due to indiscriminate killing of porcupines by recreationalists.
3.1 Outreach & Communications	Conduct an educational campaign to educate Montana residents on the natural history, status, and vulnerability of porcupine populations to human-caused mortality.	5.1 Hunting & Collecting Terrestrial Animals	Foresters and landowners using rodenticides to kill porcupines and other rodents. Indiscriminate killing by forest industry personnel, homeowners, and recreationists.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Work with land management agencies to identify priority areas that would provide potential climate refugia for porcupines.	11.3 Changes in Temperature Regimes	More frequent droughts can result in low quality or reduced availability of high-protein summer forage. Range expansion of predators due to reduced winter severity.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Ban the use of anti-coagulating rodenticide state wide.	1.1 Housing & Urban Areas	Homeowners may kill porcupines as pests or incidentally with rodenticides. Residential encroachment can result in habitat loss.
7.1 Laws, Regulations & Codes	Prohibit the killing of porcupines west of the Continental Divide without a permit.	5.1 Hunting & Collecting Terrestrial Animals	Foresters and landowners using rodenticides to kill porcupines and other rodents. Indiscriminate killing by forest industry personnel, homeowners, and recreationists.

Prairie Shrew Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
2. Species Management			
2.1 Species Stewardship	Identify lands currently or highly susceptible to be overgrazed and implement educational opportunities for landholders.	2.3 Livestock Farming & Ranching	Overgrazing and conversion of native grassland to row crops.

North American Water Vole Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Maintain a well-distributed and connected network of occupied patches of high-quality habitat.	11.4 Changes in Precipitation & Hydrological Regimes	Decrease in snowpack leading to desiccation of alpine wet meadows and alpine streams. Drought.
B. Behavioral Change/Threat Reduction			
4. Law Enforcement & Prosecution			
4.1 Detection & Arrest	Fully enforce state- and county-level streamside protection laws and encourage reporting of violations.	2.3 Livestock Farming & Ranching	Overgrazing of riparian areas can degrade foraging and breeding habitat through loss of vegetation in the short-term and geomorphic changes to streams in the long-term (e.g., incision, over-widening). Livestock may compact stream banks and trample vegetative cover.

Red-tailed Chipmunk Threats and Conservation Actions

There are no species-specific threats and actions for Red-tailed Chipmunk. See Chapter 5.4 for HGCN threats and actions.

Sagebrush Vole Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Identify lands currently or highly susceptible to be overgrazed and implement educational opportunities for landholders.	2.3 Livestock Farming & Ranching	Altered native vegetation and reduced grass/forb diversity from overgrazing.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Provide access to weed-free hay and native seed mixes for reseeding rangeland.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive plant species altering native plant biodiversity and decreasing foraging efficiency and availability.
5.4 Direct Economic Incentives	Create tax incentives or compensation to promote conservation actions or prizes for conservation work that improves or restores native habitat.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive plant species altering native plant biodiversity and decreasing foraging efficiency and availability.
5.4 Direct Economic Incentives	Provide compensation or prizes for agricultural operations using wildlife-friendly alternatives to pesticides.	9.3 Agricultural & Forestry Effluents	Exposure to legacy and currently used pesticides in agricultural systems, runoff, and ground contamination deplete invertebrate prey species.
5.4 Direct Economic Incentives	Provide compensation or prizes for conservation actions that conserve or restore native habitat.	3.3 Renewable Energy	Fragmentation and reduced habitat quality due to renewable energy infrastructure.

C. Enabling Conditions Actions			
9. Education & Training			
9.2 Training & Individual Capacity Development	Initiate educational initiatives for the public and professionals to correctly identify invasive species and perform action steps for containment.	8.1 Invasive Non-Native/Alien Plants & Animals	Invasive plant species altering native plant biodiversity and decreasing foraging efficiency and availability.

Plains Hog-nosed Snake Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Establish an outreach program on the importance and value of snakes in the ecosystem, their role in reducing rodent numbers, the challenges they face with high road mortality, and the importance of den and nest sites. Include snake identification tips.	4.1 Roads & Railroads	Roads and associated infrastructure contribute to habitat fragmentation and direct mortalities.
		5.1 Hunting & Collecting Terrestrial Animals	Persecution from misidentification with other snakes (e.g., rattlesnakes) or general fear or hatred of snakes. Collection for pet trade.
5. Livelihood Economic & Moral Incentives			
5.3 Market-Based Incentives	Market wildlife-friendly beef and beef-associated crops.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can result in habitat loss. Pesticides can impact the species and its amphibian prey base.
5.4 Direct Economic Incentives	Provide tax incentive to maintain rangeland over conversion to cropland. Work with NRCS and USFWS for private land incentives.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can result in habitat loss. Pesticides can impact the species and its amphibian prey base.
C. Enabling Conditions Actions			

6. Conservation Designation & Planning			
6.2 Easements & Resource Rights	Conserve areas identified as 'high importance' for Plains Hog-nosed Snake and amphibian populations through establishment of conservation leases and/or easements.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can result in habitat loss. Pesticides can impact the species and its amphibian prey base.
		3.1 Oil & Gas Drilling	Development of oil and gas and associated infrastructure can result in habitat degradation and fragmentation.
		3.3 Renewable Energy	The footprint from renewable energy and associated infrastructure can result in habitat degradation and fragmentation.
6.4 Conservation Planning	Develop a management plan for reptile conservation that includes guidelines for road management on public lands and updated recommendations for mitigating impacts of development in Montana.	3.1 Oil & Gas Drilling	Development of oil and gas and associated infrastructure can result in habitat degradation and fragmentation.
		3.3 Renewable Energy	The footprint from renewable energy and associated infrastructure can result in habitat degradation and fragmentation.
		4.1 Roads & Railroads	Roads and associated infrastructure contribute to habitat fragmentation and direct mortalities.
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Regulate the collection and harvest of rare snakes through permits to prevent population declines. Provide policies or guidelines to minimize construction of new roads and decommission unneeded roads where applicable during the breeding season.	3.1 Oil & Gas Drilling	Development of oil and gas and associated infrastructure can result in habitat degradation and fragmentation.
		3.3 Renewable Energy	The footprint from renewable energy and associated infrastructure can result in habitat degradation and fragmentation.
		5.1 Hunting & Collecting Terrestrial Animals	Persecution from misidentification with other snakes (e.g., rattlesnakes) or general fear or hatred of snakes. Collection for pet trade.
9. Education & Training			
9.1 Formal Education	Introduce conservation focused classes in agricultural majors.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can result in habitat loss. Pesticides can impact the species and its amphibian prey base.
9.2 Training & Individual Capacity Development	Host workshops on the use of conservation tools for interested agricultural producers (could be modeled on private timber workshops).	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can result in habitat loss. Pesticides can impact the species and its amphibian prey base.

Smooth Greensnake Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	When hibernacula are identified, provide protective measures to mitigate disturbance and prevent destruction of the site.	1.1 Housing & Urban Areas	Urban and ex-urban expansion can cause habitat loss.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Establish an outreach program on the importance and value of snakes in the ecosystem and the challenges they face with high road mortality.	4.1 Roads & Railroads	Roads and associated infrastructure contribute to habitat fragmentation and direct mortalities.
3.1 Outreach & Communications	Establish an outreach program on the importance and value of snakes in the ecosystem, their role in reducing rodent numbers, and the importance of den and nest sites. Include snake identification tips.	5.1 Hunting & Collecting Terrestrial Animals	Persecution from misidentification with other snakes (e.g., rattlesnakes) or general fear or hatred of snakes. Collection for pet trade.
5. Livelihood Economic & Moral Incentives			
5.3 Market-Based Incentives	Market wildlife-friendly beef and beef-associated crops.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.
5.4 Direct Economic Incentives	Provide tax incentive to maintain rangeland over conversion to cropland. Work with NRCS and USFWS for private land incentives.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.

C. Enabling Conditions Actions

6. Conservation Designation & Planning

6.2 Easements & Resource Rights	Conserve areas identified as 'high importance' for Smooth Greensnake and amphibian populations through establishment of conservation leases and/or easements.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.
		3.1 Oil & Gas Drilling	Oil and gas development and associated infrastructure can lead to habitat degradation and fragmentation.
		7.2 Dams & Water Management / Use	Draining of wetlands for cultivation or development alters the hydrological regime.
6.2 Easements & Resource Rights	Conserve areas identified as 'high importance' for Smooth Greensnake populations through establishment of conservation leases and/or easements.	1.1 Housing & Urban Areas	Urban and ex-urban expansion can cause habitat loss.
6.4 Conservation Planning	Develop a management plan for reptile conservation that includes guidelines for road management on public lands.	4.1 Roads & Railroads	Roads and associated infrastructure contribute to habitat fragmentation and direct mortalities.
6.4 Conservation Planning	Develop a management plan for reptile conservation that includes updated recommendations for mitigating impacts of development in MT.	3.1 Oil & Gas Drilling	Oil and gas development and associated infrastructure can lead to habitat degradation and fragmentation.
		3.3 Renewable Energy	Renewable energy development and associated infrastructure can leave a footprint that degrades or fragments habitat.

7. Legal & Policy Frameworks

7.2 Policies & Guidelines	Provide policies or guidelines to minimize construction of new roads and decommission unneeded roads where applicable during the active season.	3.1 Oil & Gas Drilling	Oil and gas development and associated infrastructure can lead to habitat degradation and fragmentation.
		3.3 Renewable Energy	Renewable energy development and associated infrastructure can leave a footprint that degrades or fragments habitat.
7.2 Policies & Guidelines	Regulate the collection and harvest of rare snakes through permits to prevent population declines.	5.1 Hunting & Collecting Terrestrial Animals	Persecution from misidentification with other snakes (e.g., rattlesnakes) or general fear or hatred of snakes. Collection for pet trade.

9. Education & Training

9.1 Formal Education	Introduce conservation focused classes in agricultural majors.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.

9.2 Training & Individual Capacity Development	Host workshops on the use of conservation tools for interested agricultural producers (could be modeled on private timber workshops).	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.
10. Institutional Development			
10.3 Alliance & Partnership Development	Facilitate partnerships with local groups (e.g., Conservation Districts, MSU Extension, NRCS) to promote good cropland stewardship practices.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.

Western Milksnake Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Establish an outreach program on the importance and value of snakes in the ecosystem and their role in reducing rodent numbers. Include snake identification tips.	4.1 Roads & Railroads	Roads and associated infrastructure contribute to habitat fragmentation and direct mortalities.
		5.1 Hunting & Collecting Terrestrial Animals	Persecution from misidentification with other snakes (e.g., rattlesnakes) or general fear or hatred of snakes. Collection for pet trade.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.2 Easements & Resource Rights	Conserve areas identified as 'high importance' for Western Milksnake populations through establishment of conservation leases and/or easements.	1.1 Housing & Urban Areas	Urban and ex-urban expansion can cause habitat loss.
		3.1 Oil & Gas Drilling	Oil and gas development and associated infrastructure can lead to habitat degradation and fragmentation.

		3.3 Renewable Energy	Renewable energy development and associated infrastructure can leave a footprint that degrades or fragments habitat.
6.4 Conservation Planning	Develop a management plan for reptile conservation that includes guidelines for road management on public lands and updated recommendations for mitigating impacts of development in Montana.	3.1 Oil & Gas Drilling	Oil and gas development and associated infrastructure can lead to habitat degradation and fragmentation.
		3.3 Renewable Energy	Renewable energy development and associated infrastructure can leave a footprint that degrades or fragments habitat.
		4.1 Roads & Railroads	Roads and associated infrastructure contribute to habitat fragmentation and direct mortalities.
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Develop a management plan for reptile conservation that includes guidelines for road management on public lands. Provide policies or guidelines to minimize construction of new roads and decommission unneeded roads where applicable during the breeding season. Regulate the collection and harvest of rare species through permits to prevent population declines.	3.1 Oil & Gas Drilling	Oil and gas development and associated infrastructure can lead to habitat degradation and fragmentation.
		3.3 Renewable Energy	Renewable energy development and associated infrastructure can leave a footprint that degrades or fragments habitat.
		4.1 Roads & Railroads	Roads and associated infrastructure contribute to habitat fragmentation and direct mortalities.
		5.1 Hunting & Collecting Terrestrial Animals	Persecution from misidentification with other snakes (e.g., rattlesnakes) or general fear or hatred of snakes. Collection for pet trade.

Greater Short-horned Lizard Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	When hibernacula or concentrated populations are identified, provide protective	1.1 Housing & Urban Areas	Urban and ex-urban expansion can cause habitat loss.

	measures to mitigate disturbance and prevent destruction of the site.		
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Establish an outreach program on the impacts of non-native plant species (e.g., Yellow Sweetclover) on native grasslands.	8.1 Invasive Non-Native/Alien Plants & Animals	The establishment and increase of invasive non-native plants can lead to habitat loss and fragmentation.
3.1 Outreach & Communications	Establish an outreach program on the importance and value of lizards in the ecosystem, their role in reducing insect numbers, and the importance of occupied sites and leaving lizards where they were found (e.g., 'Take only pictures' slogan).	5.1 Hunting & Collecting Terrestrial Animals	Persecution from misidentification with other reptiles (e.g., rattlesnakes) or general fear or hatred of reptiles. Collection for pet trade.
3.1 Outreach & Communications	Establish an outreach program on the importance and value of reptiles in the ecosystem and the challenges they face with high road mortality.	4.1 Roads & Railroads	Roads and associated infrastructure contribute to habitat fragmentation and direct mortalities.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Remove Yellow Sweetclover from dryland pasture mixes, provide access to native seed mixes for reseeding rangeland, and provide access to weed-free hay.	8.1 Invasive Non-Native/Alien Plants & Animals	The establishment and increase of invasive non-native plants can lead to habitat loss and fragmentation.
5.3 Market-Based Incentives	Market wildlife-friendly beef and beef-associated crops.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.
5.4 Direct Economic Incentives	Develop incentives or prizes for native habitat restoration.	8.1 Invasive Non-Native/Alien Plants & Animals	The establishment and increase of invasive non-native plants can lead to habitat loss and fragmentation.
5.4 Direct Economic Incentives	Provide tax incentive to maintain rangeland over conversion to cropland. Work with NRCS and USFWS for private land incentives.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.

C. Enabling Conditions Actions

6. Conservation Designation & Planning

6.2 Easements & Resource Rights	Conserve areas identified as 'high importance' for Greater Short-horned Lizard populations through establishment of conservation leases and/or easements.	1.1 Housing & Urban Areas	Urban and ex-urban expansion can cause habitat loss.
		2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.
		3.1 Oil & Gas Drilling	Oil and gas development and associated infrastructure can lead to habitat degradation and fragmentation.
6.4 Conservation Planning	Develop a management plan for reptile conservation that includes guidelines for road management on public lands.	4.1 Roads & Railroads	Roads and associated infrastructure contribute to habitat fragmentation and direct mortalities.
6.4 Conservation Planning	Develop a management plan for reptile conservation that includes updated recommendations for mitigating impacts of development in MT.	3.1 Oil & Gas Drilling	Oil and gas development and associated infrastructure can lead to habitat degradation and fragmentation.
		3.3 Renewable Energy	Renewable energy development and associated infrastructure can leave a footprint that degrades or fragments habitat.
6.4 Conservation Planning	Prioritize habitat restoration projects that would benefit Greater Short-horned Lizards in important habitat areas such as population connectivity corridors or sites with concentrated populations (e.g., Pryor Mountain population).	8.1 Invasive Non-Native/Alien Plants & Animals	The establishment and increase of invasive non-native plants can lead to habitat loss and fragmentation.

7. Legal & Policy Frameworks

7.2 Policies & Guidelines	Provide policies or guidelines to minimize construction of new roads and decommission unneeded roads where applicable during the active season.	3.1 Oil & Gas Drilling	Oil and gas development and associated infrastructure can lead to habitat degradation and fragmentation.
		3.3 Renewable Energy	Renewable energy development and associated infrastructure can leave a footprint that degrades or fragments habitat.
7.2 Policies & Guidelines	Regulate the collection and harvest of native lizards through permits to prevent population declines.	5.1 Hunting & Collecting Terrestrial Animals	Persecution from misidentification with other reptiles (e.g., rattlesnakes) or general fear or hatred of reptiles. Collection for pet trade.

9. Education & Training

9.1 Formal Education	Introduce conservation focused classes in agricultural majors.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.
9.2 Training & Individual Capacity Development	Host workshops on the use of conservation tools for interested agricultural producers (could be modeled on private timber workshops).	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.
9.2 Training & Individual Capacity Development	Initiate educational initiatives for the public and professionals to correctly identify invasive species and perform action steps for containment.	8.1 Invasive Non-Native/Alien Plants & Animals	The establishment and increase of invasive non-native plants can lead to habitat loss and fragmentation.
10. Institutional Development			
10.3 Alliance & Partnership Development	Facilitate partnerships with local groups (e.g., Conservation Districts, MSU Extension, NRCS) to promote good cropland stewardship practices.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.

Northern Alligator Lizard Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate the public on the impacts of free-ranging domestic and feral animals on wildlife.	1.1 Housing & Urban Areas	Development of valley bottom habitat into housing and urban areas leads to habitat fragmentation and destruction. Domestic and feral cats and dogs, stemming from urban development, can predate on the species.

Snapping Turtle Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Build artificial nest mounds to replace nesting habitat lost to cropping. Provide connectivity between nest areas and other habitats. Protect nest habitat and deter turtle use of agricultural sites for nesting.	2.1 Annual & Perennial Non-Timber Crops	Plowed fields may act as habitat sinks by attracting turtles to unsuitable sites for nesting. Early or frequent pasture and hayfield cutting or mowing can destroy nests and cause adult mortality.
1.1 Site/Area Stewardship	Close and limit access to nesting sites using signs when appropriate during the breeding season.	6.1 Recreational Activities	Motorboat collisions can cause injury or mortality. ATV use can destroy nests. Bycatch by furbearer trappers can cause injury or mortality.
1.1 Site/Area Stewardship	Through subdivisions developers and neighborhood associations in areas inhabited by Snapping Turtles, raise awareness to residents that turtles may be seen crossing roads and that domestic pets and fencing may impact reproduction. Consider building artificial nest mounds to replace nesting habitat lost to development.	1.1 Housing & Urban Areas	Dredging, channelization, and the removal of riparian vegetation can impact nesting and foraging habitats. Construction site earth mounds can create habitat sinks when used for nesting. Pets and increased numbers of mesopredators can destroy eggs and nests. Lack of connectivity of aquatic areas within at least 500 m can lead to habitat fragmentation. Fencing can hinder turtle movement.
1.1 Site/Area Stewardship	Use fish/turtle screens to protect Snapping Turtles from getting trapped and dying. Consider turtle passage and entrainment issues when engineering irrigation infrastructure.	7.2 Dams & Water Management / Use	Dams can create genetic bottlenecks by fragmenting populations, decrease habitat heterogeneity, and alter habitats. Large irrigation canals result in entrainment, mortality, and transport away from the home range. Low head irrigation barriers prevent connectivity. Intake pipes or grates for irrigation can entrap turtles and cause mortality.
B. Behavioral Change/Threat Reduction			

3. Awareness Raising			
3.1 Outreach & Communications	Educate ranching communities and municipalities on the effects of ecosystem modifications.	7.3 Other Ecosystem Modifications	Overgrazing and lack of woody debris in creeks can lead to riparian habitat degradation. Beaver extermination or removal results in a lack of woody debris in creeks and can lead to cooler temperatures and higher flows. Perched culverts in creeks force turtles to walk around, often on roads where roadkill occurs.
3.1 Outreach & Communications	Establish an outreach program on the importance and value of snapping turtles and the harm caused by unremoved hooks.	5.4 Fishing & Harvesting Aquatic Resources	Incidental capture and release by anglers with hook still attached or ingestion of hooks can cause injury or mortality.
3.1 Outreach & Communications	Establish an outreach program on the importance and value of snapping turtles and undisturbed breeding sites.	6.1 Recreational Activities	Motorboat collisions can cause injury or mortality. ATV use can destroy nests. Bycatch by furbearer trappers can cause injury or mortality.
3.1 Outreach & Communications	Establish an outreach program to convey the importance and value of snapping turtles and dispel common myths about the species.	1.1 Housing & Urban Areas	Dredging, channelization, and the removal of riparian vegetation can impact nesting and foraging habitats. Construction site earth mounds can create habitat sinks when used for nesting. Pets and increased numbers of mesopredators can destroy eggs and nests. Lack of connectivity of aquatic areas within at least 500 m can lead to habitat fragmentation. Fencing can hinder turtle movement.
		2.1 Annual & Perennial Non-Timber Crops	Plowed fields may act as habitat sinks by attracting turtles to unsuitable sites for nesting. Early or frequent pasture and hayfield cutting or mowing can destroy nests and cause adult mortality.
3.1 Outreach & Communications	Establish an outreach program to convey the importance and value of snapping turtles and dispel common myths about the species. Suggest voluntary reporting or limiting of harvest.	5.1 Hunting & Collecting Terrestrial Animals	Overharvest of Snapping Turtles for local or international commercial meat consumption. Persecution due to perceived threat. Removal in areas where they are not thought to be “native”. Collection for pets/trophies. Commercialization of Snapping Turtles for harvesting. Low reproductive potential.
3.1 Outreach & Communications	Implement education programs on integrated pest management strategies to reduce use of pesticides and herbicides.	9.1 Household Sewage & Urban Waste Water	Water pollution from urban wastewater, treatment plants, and golf courses. Pollutants, including POPs, PFAS, PAHs, and heavy metals. Bioaccumulation, maternal transfer of

			contaminants to eggs, deformities in hatchlings, and declines in egg viability, hatchling fitness, and navigation abilities. Loss of prey. Dietary shifts, deterioration in body condition, and disease susceptibility.
3.1 Outreach & Communications	Place turtle crossing signage in areas identified as road collision hotspots.	4.1 Roads & Railroads	Collisions with vehicles, including when nesting on roadsides or trying to access nest sites or thermal areas. Even a slight increase in adult female mortality can cause population decline. Habitat fragmentation.
3.1 Outreach & Communications	Reduce use of pesticides and herbicides through education about integrated pest management strategies.	9.3 Agricultural & Forestry Effluents	Irrigation discharges to creeks, inputs of nutrients and toxins, increased flows, and increased erosion. Accumulation of contaminants in body fat, muscle tissue, liver, and eggs.
3.1 Outreach & Communications	Use best practices for irrigation structures to reduce wildlife mortality.	7.2 Dams & Water Management / Use	Dams can create genetic bottlenecks by fragmenting populations, decrease habitat heterogeneity, and alter habitats. Large irrigation canals result in entrainment, mortality, and transport away from the home range. Low head irrigation barriers prevent connectivity. Intake pipes or grates for irrigation can entrap turtles and cause mortality.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.4 Conservation Planning	Evaluate the impacts of Beaver Dam Analogs in relation to snapping turtle habitat.	7.3 Other Ecosystem Modifications	Overgrazing and lack of woody debris in creeks can lead to riparian habitat degradation. Beaver extermination or removal results in a lack of woody debris in creeks and can lead to cooler temperatures and higher flows. Perched culverts in creeks force turtles to walk around, often on roads where roadkill occurs.
6.5 Site Infrastructure	Install signage at fishing access sites to build awareness about important turtle breeding habitat and how to mitigate impacts during nesting season.	6.1 Recreational Activities	Motorboat collisions can cause injury or mortality. ATV use can destroy nests. Bycatch by furbearer trappers can cause injury or mortality.

6.5 Site Infrastructure	Install signage at fishing access sites to build awareness regarding the ingestion of hooks by turtles from catch and release and encourage anglers to remove hooks before releasing turtles.	5.4 Fishing & Harvesting Aquatic Resources	Incidental capture and release by anglers with hook still attached or ingestion of hooks can cause injury or mortality.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Implement reporting requirements for harvest and incidental capture to understand potential impacts on subpopulations.	5.4 Fishing & Harvesting Aquatic Resources	Incidental capture and release by anglers with hook still attached or ingestion of hooks can cause injury or mortality.
7.2 Policies & Guidelines	Using other states as models, create policies to limit harvest and make harvest reporting mandatory.	5.1 Hunting & Collecting Terrestrial Animals	Overharvest of Snapping Turtles for local or international commercial meat consumption. Persecution due to perceived threat. Removal in areas where they are not thought to be “native”. Collection for pets/trophies. Commercialization of Snapping Turtles for harvesting. Low reproductive potential.

Spiny Softshell Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Close and limit access to nesting sites using signs when appropriate during the breeding season.	6.1 Recreational Activities	Human disturbance on nesting sandbars and gravel bars, including use of ATVs in the river corridor, can cause nest abandonment, nest destruction, and attract predators. Motorboats used for recreation can cause injury.
1.1 Site/Area Stewardship	Control non-native vegetation on alluvial bars and remove vegetation at known large nest aggregation sites.	8.1 Invasive Non-Native/Alien Plants & Animals	Non-native vegetation encroachment on sandbars can decrease nesting and basking habitat.

1.1 Site/Area Stewardship	Remove and manage vegetation encroachment on sandbars, gravel bars and islands that are identified as important nesting sites for Spiny Softshell Turtles.	7.2 Dams & Water Management / Use	Flow management on dammed rivers impacts the availability of nesting habitat, the timing and duration of nesting and incubation (impacting emergence rates and nest success), and can flood nests. Dams can decrease habitat heterogeneity and create genetic bottlenecks by fragmenting populations. Irrigation canals and infrastructure (e.g., head gates, intake pipes) can result in entrainment, mortality, and barriers to connectivity.
		8.2 Problematic Native Plants & Animals	Vegetation encroachment on sandbars can decrease nesting and basking habitat.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate farmers on best management practices and reducing the use of pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Herbicide/pesticide runoff can cause direct and indirect impacts to turtle populations.
3.1 Outreach & Communications	Establish an outreach program on the importance and value of Spiny Softshell turtles and undisturbed breeding sites.	6.1 Recreational Activities	Human disturbance on nesting sandbars and gravel bars, including use of ATVs in the river corridor, can cause nest abandonment, nest destruction, and attract predators. Motorboats used for recreation can cause injury.
3.1 Outreach & Communications	Establish an outreach program on the importance and value of Spiny Softshell turtles in the wild.	5.1 Hunting & Collecting Terrestrial Animals	Collection of individuals for pet trade or as personal pets. Overharvest for local or international commercial meat consumption. Mortalities from anglers perceiving the species as a nuisance.
3.1 Outreach & Communications	Establish an outreach program on the importance and value of snapping turtles and the harm caused by unremoved hooks.	5.4 Fishing & Harvesting Aquatic Resources	Incidental capture and release by anglers with hook still attached or ingestion of hooks can cause injury or mortality.
5. Livelihood Economic & Moral Incentives			
5.2 Better Products & Management Practices	Limit use of persistent organic pollutants (POPs) and work with industry to reduce leaching of wastewater and chemicals into rivers.	9.1 Household Sewage & Urban Waste Water	Water pollution from urban waste water, including wastewater treatment plants and golf courses.

5.2 Better Products & Management Practices	Limit use of persistent organic pollutants (POPs).	4.2 Utility & Service Lines	Direct and indirect mortality (evidence of weakened immune system) from catastrophic spills (e.g., oil) related to infrastructure in and near rivers.
		9.2 Industrial & Military Effluents	Direct and indirect mortality (evidence of weakened immune system) from pollutants (e.g., PFAS) from industrial sources near rivers.
5.2 Better Products & Management Practices	Promote the use of fish/turtle screens on irrigation infrastructure to minimize entrainment issues and the use of bypass structures on impoundments (e.g., fish ladders for turtles).	7.2 Dams & Water Management / Use	Flow management on dammed rivers impacts the availability of nesting habitat, the timing and duration of nesting and incubation (impacting emergence rates and nest success), and can flood nests. Dams can decrease habitat heterogeneity and create genetic bottlenecks by fragmenting populations. Irrigation canals and infrastructure (e.g., head gates, intake pipes) can result in entrainment, mortality, and barriers to connectivity.
5.3 Market-Based Incentives	Provide monetary incentives or a cost-share program to landowners to promote use of screens on irrigation structures.	7.2 Dams & Water Management / Use	Flow management on dammed rivers impacts the availability of nesting habitat, the timing and duration of nesting and incubation (impacting emergence rates and nest success), and can flood nests. Dams can decrease habitat heterogeneity and create genetic bottlenecks by fragmenting populations. Irrigation canals and infrastructure (e.g., head gates, intake pipes) can result in entrainment, mortality, and barriers to connectivity.
5.4 Direct Economic Incentives	Provide compensation or tax incentives to reduce use of herbicides and pesticides or use environmentally-friendly products.	9.3 Agricultural & Forestry Effluents	Herbicide/pesticide runoff can cause direct and indirect impacts to turtle populations.

C. Enabling Conditions Actions

6. Conservation Designation & Planning

6.5 Site Infrastructure	Install signage at fishing access sites to build awareness about important turtle breeding habitat and how to mitigate impacts during nesting season.	6.1 Recreational Activities	Human disturbance on nesting sandbars and gravel bars, including use of ATVs in the river corridor, can cause nest abandonment, nest destruction, and attract predators. Motorboats used for recreation can cause injury.

6.5 Site Infrastructure	Install signage at fishing access sites to build awareness and encourage anglers to remove hooks and release turtles.	5.1 Hunting & Collecting Terrestrial Animals	Collection of individuals for pet trade or as personal pets. Overharvest for local or international commercial meat consumption. Mortalities from anglers perceiving the species as a nuisance.
		5.4 Fishing & Harvesting Aquatic Resources	Incidental capture and release by anglers with hook still attached or ingestion of hooks can cause injury or mortality.
7. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Implement reporting requirements for harvest and incidental capture to understand potential impacts on subpopulations.	5.4 Fishing & Harvesting Aquatic Resources	Incidental capture and release by anglers with hook still attached or ingestion of hooks can cause injury or mortality.
7.1 Laws, Regulations & Codes	Pass laws/bills to minimize the use of pesticides and ban highly toxic pesticides.	9.3 Agricultural & Forestry Effluents	Herbicide/pesticide runoff can cause direct and indirect impacts to turtle populations.
7.2 Policies & Guidelines	Establish motorboat restrictions during the breeding season.	6.1 Recreational Activities	Human disturbance on nesting sandbars and gravel bars, including use of ATVs in the river corridor, can cause nest abandonment, nest destruction, and attract predators. Motorboats used for recreation can cause injury.
7.2 Policies & Guidelines	Regulate and limit the collection and harvest of Spiny Softshell turtles and other Species of Greatest Conservation Need through permits to prevent population declines.	5.1 Hunting & Collecting Terrestrial Animals	Collection of individuals for pet trade or as personal pets. Overharvest for local or international commercial meat consumption. Mortalities from anglers perceiving the species as a nuisance.
7.2 Policies & Guidelines	Restrict permitting for gravel pits in areas identified as important breeding habitat for the species.	3.2 Mining & Quarrying	Gravel mining or extraction from the river corridor can destroy nesting habitat.
9. Education & Training			
9.2 Training & Individual Capacity Development	Provide guidance or training to permitted mining/quarrying operators on how to avoid impacting important breeding habitat for the species.	3.2 Mining & Quarrying	Gravel mining or extraction from the river corridor can destroy nesting habitat.
9.2 Training & Individual Capacity Development	Provide technical assistance to landowners on how to install screens on irrigation	7.2 Dams & Water Management / Use	Flow management on dammed rivers impacts the availability of nesting habitat, the timing and duration of nesting and

	structures to minimize impacts to riverine turtles.		incubation (impacting emergence rates and nest success), and can flood nests. Dams can decrease habitat heterogeneity and create genetic bottlenecks by fragmenting populations. Irrigation canals and infrastructure (e.g., head gates, intake pipes) can result in entrainment, mortality, and barriers to connectivity.
9.2 Training & Individual Capacity Development	Train oil/chemical spill response personnel how to assess impacts to herpetofauna.	4.2 Utility & Service Lines	Direct and indirect mortality (evidence of weakened immune system) from catastrophic spills (e.g., oil) related to infrastructure in and near rivers.

Western Skink Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Implement education and outreach campaigns in agricultural communities about the importance of maintaining native plant cover, natural rock cover, and the ecosystem-wide benefits of regenerative agriculture (i.e., reducing reliance on pesticides and herbicides).	2.3 Livestock Farming & Ranching	Conversion of native rangelands to croplands removes or degrades habitat through increased vegetation cover, removal of rocky substrates, sod-busting, and introduction of pesticides, herbicides, and fertilizers.
3.1 Outreach & Communications	Implement education and outreach campaigns to garner awareness and appreciation for Montana's lizards, focusing on habitat, the timing and locations where people may impact the species, and the	1.1 Housing & Urban Areas	Increased development of western Montana intermountain valley grasslands and foothills impacts habitat through removal of rocks, native ground cover, and vegetation. It may also sever connectivity between populations and increase predation and disturbance by native predators attracted to

	impacts of free-ranging domestic and feral animals on wildlife.		human developments (e.g., corvids, mesocarnivores) and non-native predators (e.g., outdoor cats, dogs).
3.1 Outreach & Communications	Implement outreach and education campaigns targeted towards landowners about alternative options for pest control (e.g., native predators) and weed control (e.g., regenerative agriculture) to reduce reliance on pesticides and herbicides.	9.3 Agricultural & Forestry Effluents	Use of pesticides and herbicides reduces prey base (i.e., invertebrates), particularly in grassland and open-forested foothill habitats.

Northern Rubber Boa Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Educate the public on the impacts of free-ranging domestic and feral animals on wildlife.	1.1 Housing & Urban Areas	Development of valley bottom habitat into housing and urban areas leads to habitat fragmentation and destruction. Domestic and feral cats and dogs, stemming from urban development, can predate on the species.

Prairie Rattlesnake Threats and Conservation Actions

Action Classification	Action	Threat Classification	Threat
A. Target Restoration/Stress Reduction Actions			

1. Land/Water Protection			
1.1 Site/Area Stewardship	When hibernacula are identified, provide protective measures to mitigate disturbance and prevent destruction of the site.	1.1 Housing & Urban Areas	Urban and ex-urban expansion can cause habitat loss.
B. Behavioral Change/Threat Reduction			
3. Awareness Raising			
3.1 Outreach & Communications	Establish an outreach program on the importance and value of snakes in the ecosystem and the challenges they face with high road mortality.	4.1 Roads & Railroads	Roads and associated infrastructure contribute to habitat fragmentation and direct mortalities.
3.1 Outreach & Communications	Establish an outreach program on the importance and value of snakes in the ecosystem, their role in reducing rodent numbers, and the importance of den and nest sites. Include snake identification tips.	5.1 Hunting & Collecting Terrestrial Animals	Persecution from general fear or hatred of snakes. Collection for pet trade.
5. Livelihood Economic & Moral Incentives			
5.3 Market-Based Incentives	Market wildlife-friendly beef and beef-associated crops.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.
5.4 Direct Economic Incentives	Provide tax incentive to maintain rangeland over conversion to cropland. Work with NRCS and USFWS for private land incentives.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.
C. Enabling Conditions Actions			
6. Conservation Designation & Planning			
6.2 Easements & Resource Rights	Conserve areas identified as 'high importance' for Prairie Rattlesnake and amphibian populations through establishment of conservation leases and/or easements.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.
		3.1 Oil & Gas Drilling	Oil and gas development and associated infrastructure can lead to habitat degradation and fragmentation.
6.2 Easements & Resource Rights	Conserve areas identified as 'high importance' for Prairie Rattlesnake	1.1 Housing & Urban Areas	Urban and ex-urban expansion can cause habitat loss.

	populations through establishment of conservation leases and/or easements.		
6.4 Conservation Planning	Develop a management plan for reptile conservation that includes guidelines for road management on public lands.	4.1 Roads & Railroads	Roads and associated infrastructure contribute to habitat fragmentation and direct mortalities.
6.4 Conservation Planning	Develop a management plan for reptile conservation that includes updated recommendations for mitigating impacts of development in MT.	3.1 Oil & Gas Drilling	Oil and gas development and associated infrastructure can lead to habitat degradation and fragmentation.
		3.3 Renewable Energy	Renewable energy development and associated infrastructure can leave a footprint that degrades or fragments habitat.
7. Legal & Policy Frameworks			
7.2 Policies & Guidelines	Provide policies or guidelines to minimize construction of new roads and decommission unneeded roads where applicable during the active season.	3.1 Oil & Gas Drilling	Oil and gas development and associated infrastructure can lead to habitat degradation and fragmentation.
		3.3 Renewable Energy	Renewable energy development and associated infrastructure can leave a footprint that degrades or fragments habitat.
7.2 Policies & Guidelines	Regulate the collection and harvest of native snakes through permits to prevent population declines.	5.1 Hunting & Collecting Terrestrial Animals	Persecution from general fear or hatred of snakes. Collection for pet trade.
9. Education & Training			
9.1 Formal Education	Introduce conservation focused classes in agricultural majors.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.
9.2 Training & Individual Capacity Development	Host workshops on the use of conservation tools for interested agricultural producers (could be modeled on private timber workshops).	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.
10. Institutional Development			
10.3 Alliance & Partnership Development	Facilitate partnerships with local groups (e.g., Conservation Districts, MSU Extension, NRCS) to promote good cropland stewardship practices.	2.1 Annual & Perennial Non-Timber Crops	Conversion to cropland can cause habitat loss.

5.6 Terrestrial Invertebrate SGCN Threats and Conservation Actions

Actions for the conservation of terrestrial invertebrate Species of Greatest Conservation Need (SGCN) are provided below, along with their corresponding threats, organized by the Conservation Measures Partnership Threats and Actions classification systems (Version 2.0, Salafsky et al. 2008, Appendix F).

Action Classification	Action	Threat Classification	Threat
A. TARGETED RESTORATION/STRESS REDUCTION ACTIONS			
1. Land/Water Protection			
1.1 Site/Area Stewardship	Reduce light pollution; identify incentives and BMPs for industries, municipalities, and individuals to adopt nighttime artificial light minimization practices and infrastructure to reduce effects on invertebrates. Implement outreach campaigns about negative effects of light pollution.	1.1 Housing and Urban Areas 1.2 Commercial and Industrial Areas 1.3 Tourism and Recreation Areas	Light pollution affects behavior and reproduction of nocturnal insects and facilitates intergrading and competition between diurnal/crepuscular invertebrates and nocturnal invertebrates.
1.1 Site/Area Stewardship	Use Integrated Weed Management approaches to addressing infestations of invasive plants, targeting areas with the best chance of recovery and long-term maintenance of restored condition.	8.1 Invasive Non-native/Alien Species	Noxious weeds and other undesirable plants degrade or replace native plant communities invertebrate SGCN rely on.
1.2 Ecosystem & Natural Process (Re)Creation	Create areas with intact, native plant communities that include abundant floral resources for pollinators across public and private lands to create, maintain, and enhance habitat connectivity.	1.1 Housing and Urban Areas 1.2 Commercial and Industrial Areas	Lack of knowledge of important habitat characteristics for invertebrate SGCN. Historic and/or current land management practices that do not support or facilitate pollinator/invertebrate habitats.

		2.1 Annual and Perennial Non-Timber Crops 2.3 Livestock Farming and Ranching 4.1 Roads and Railroads 5.3 Logging and Wood Harvesting 7.3 Other Ecosystem Modifications	Lack of incentives to manage landscapes for pollinator/invertebrate habitat.
1.1 Site/Area Stewardship	Reduce the frequency, adjust the timing, and reduce the width of mowing along roads to establish pollinator corridors in road right-of-ways, especially along roads with lower traffic volumes.	4.1 Roads and Railroads	Mowing can degrade habitat and/or directly kill invertebrates.
1.2 Ecosystem & Natural Process (Re)Creation	Provide habitat heterogeneity for generalist and specialist species that includes flowers during the entire growing season, overwintering habitat, downed woody debris, and nesting habitat.	7.3 Other Ecosystem Modifications	Degradation and loss of native plant communities causes declines of many invertebrate species and diminishing of ecosystem function.
1.1 Site/Area Stewardship	Plant native seed mixes along county and state roads and engage with federal partners to incorporate native seed mixes into federal roads projects in the state.	4.1 Roads and Railroads 4.2 Utility and Service Lines	Roads and other transportation infrastructure degrade or remove habitat. Areas along roads and around other publicly funded infrastructure projects are undervalued and underused as potential habitat for invertebrates.

	Develop and implement strategic goals related to maintenance of desired vegetation along roadways and other public areas. Develop native seed mixes (especially low-growing, drought resistant species) for use along roadways and in other state-level infrastructure projects that involve seeding. Low-growing, drought-tolerant species can reduce fire risk along roads and maintain views for drivers which can lead to reduced need for mowing.		
1.2 Ecosystem & Natural Process (Re)Creation	Promote and incentivize grazing practices that support healthy native plant communities and soil health, such as incorporating rest and grazing rotation strategies as appropriate given the ecological setting of the site and local conditions.	2.3 Livestock Farming and Ranching	Overgrazing of rangelands results in degradation or loss of invertebrate habitat (e.g., soil compaction, introduction/spread of invasive plant species, overuse of herbicides and pesticides).
1.2 Ecosystem & Natural Process (Re)Creation	Include high-nutrition and medicinal flowers that benefit the greatest number of pollinators during grassland restoration projects.	6.3 Work and Other Activities 7.4 Removing/Reducing Human Maintenance	Restoration seed mixes are often generic and not tailored to the restoration site which can lead to homogenization of restored habitats.
1.2 Ecosystem & Natural Process (Re)Creation	Incentivize or otherwise encourage municipalities and communities to maintain, acquire, and/or improve greenspaces, especially wet areas, springs, seeps, or waterbodies, that	1.1 Housing and Urban Areas 1.2 Commercial and Industrial Areas	Undeveloped spaces in urban areas are seen as unimportant to ecosystem health or too small to be ecologically valuable. Individuals and businesses do not feel their efforts contribute to large conservation goals/outcomes.

	provide habitats for invertebrates by incorporating native plants and other habitat features.		
B. BEHAVIORAL CHANGE/THREAT REDUCTION			
2. Awareness Raising			
1.1 Site/Area Stewardship 3.1 Outreach & Communications	Plant native plant gardens at schools, state agency buildings, parks, and other public spaces to support native pollinators and other insects and to provide demonstration areas for the benefits of native plants (e.g., SGCN habitat, water conservation, weed control) and how they can be used in landscaping. Encourage native plantings on private lands as well.	1.1 Housing and Urban Areas 1.2 Commercial and Industrial Areas 1.3 Tourism and Recreation Areas	Horticultural plants often provide little or no habitat for native invertebrates, including pollinators.
3.1 Outreach & Communications	Create an awareness campaign and outreach materials on Artificial Lights at Night (ALAN); their effects on invertebrates, wildlife, and the human environment; and strategies/policies to minimize light pollution.	1.1 Housing and Urban Areas 1.2 Commercial and Industrial Areas 1.3 Tourism and Recreation Areas	Light pollution affects behavior and reproduction of nocturnal insects and facilitates intergrading and competition between diurnal/crepuscular invertebrates and nocturnal invertebrates.
3.1 Outreach & Communications	Provide information to applicators on the types of adjuvants that inadvertently cause harm to insects and pollinators and alternatives to their use.	9.3 Agricultural and Forestry Effluents	Adjuvants in pesticide applications are often exacerbating the lethality or harm to pollinators and other invertebrates.
3.1 Outreach & Communications	Develop and distribute outreach materials on the ecological and societal consequences of pesticides so that consumers, gardeners, and land managers can be more aware of	9.3 Agricultural and Forestry Effluents	Use of pesticides, especially those containing neonicotinoids, are indiscriminate in their impacts on invertebrates.

	their negative impacts and options for alternatives for pest control.		
3.1 Outreach & Communications	Develop and distribute outreach materials on the importance of dead plant material (e.g., snags, leaf litter, dead stems) to invertebrates and ways to incorporate dead plant material into land management.	1.1 Housing and Urban Areas 1.2 Commercial and Industrial Areas 1.3 Tourism and Recreation Areas	Dead plant material is largely viewed as a negative thing and is quickly and systematically removed from parks, lawns, gardens, and other parts of public and private lands.
3.1 Outreach & Communications	Develop and distribute outreach materials on the impacts of apiaries on native pollinator populations and where apiaries are appropriate to minimize negative effects.	8.1 Invasive Non-native/Alien Species	Native pollinators face competition for floral resources from apiaries located in wild lands.
3.1 Outreach & Communications	Develop and implements a Pollinator Day program for schools to teach the importance of pollinators and invertebrates to students of all ages. Work with grade schools, high schools, and universities, to incorporate entomology into course curriculums throughout students' educational tracks.	7.4 Removing/Reducing Human Maintenance	Importance of native plant and invertebrate communities is not adequately taught in school curriculum given its importance to environmental and human health.
3. Law Enforcement & Prosecution			
4.3 Non-Criminal Legal Action	Fully enforce and encourage reporting of violations of existing weed-free hay regulations.	8.1 Invasive Non-native/Alien Species	Noxious weed infestations degrade or displace native vegetation in wild lands.
4. Livelihood, Economic & Moral Incentives			
3.1 Outreach & Communications	Offer free native seeds and seed mixes for gardeners. Collaborate with Montana Native Seed Network to distribute native seed mixes and	7.4 Removing/Reducing Human Maintenance	Lack of access to, or awareness of, native seed resources for creating, maintaining, and enhancing pollinator and invertebrate habitats.

5.2 Better Products & Management Practices	conduct outreach about the benefits of native plants to wildlife and humans. Encourage development of local community “seed libraries” that include native plant seeds.		
5.2 Better Products & Management Practices	Support research, development, and distribution of alternative products and methods for pest control.	9.3 Agricultural and Forestry Effluents	Use of pesticides, especially those containing neonicotinoids, are indiscriminate in their impacts on invertebrates.
5.4 Direct Economic Incentives	Create initiatives to encourage agencies, organizations, companies, and individuals to plant native flowers, maintain messy yards, and provide invertebrate nesting habitat in urban areas.	7.4 Removing/Reducing Human Maintenance	Lack of awareness around the benefits of native plant gardening, as well as lack of available native plant materials, reduces participation in native plant restoration and gardening.
3.1 Outreach & Communications 5.4 Direct Economic Incentives	Develop and distribute outreach materials on the ecological and societal consequences of turf-grass lawns (e.g., poor wildlife habitat, drought exacerbation, reductions in pollinators and their ecosystem services). Create a promote incentive programs to convert lawn grasses to pollinator-friendly lawns and landscapes.	8.1 Invasive Non-native/Alien Species	Monoculture lawns are an ecological dead zone and require large amounts of water resources to maintain.
5.4 Direct Economic Incentives	Create cost-share programs to incentivize landowners to plant native floral resources and create, maintain, and enhance habitat heterogeneity.	8.1 Invasive Non-native/Alien Species	Monoculture lawns and/or weed patches are considered easier to maintain or are considered “lost causes”, resulting in lack of native plant communities and perpetuation of habitat degradation.

5.4 Direct Economic Incentives	Incentivize adoption of lighting infrastructure and practices that minimize Artificial Lights at Night (ALAN) by municipalities and industries. Create outreach campaigns identifying ecological benefits and cost-saving benefits of reducing light use at night.	1.1 Housing and Urban Areas 1.2 Commercial and Industrial Areas 1.3 Tourism and Recreation Areas	Light pollution affects behavior and reproduction of nocturnal insects and facilitates intergrading and competition between diurnal/crepuscular invertebrates and nocturnal invertebrates.
C. ENABLING CONDITION ACTIONS			
5. Conservation Designation & Planning			
6.1 Protected Area Designation or Acquisition	Use land acquisitions to conserve native vegetation communities, open spaces, and connectivity between patches of intact, native habitats. Identify invertebrate/pollinator biodiversity hotspots on the landscape and designate them as such through land-use and resource planning efforts (e.g., SWAP revisions, Wildlife Management Area management plans, county open lands planning).	1.1 Housing and Urban Areas 1.2 Commercial and Industrial Areas 1.3 Tourism and Recreation Areas	Human development and land-use changes remove or degrade habitat for invertebrates.
6.2 Easements & Resource Rights	Use conservation easements and habitat leases to conserve high-value habitats for invertebrates.	1.1 Housing and Urban Areas 1.2 Commercial and Industrial Areas 2.1 Annual and Perennial Non-Timber Crops	Human development and land-use changes remove or degrade habitat for invertebrates.

		2.3 Livestock Farming and Ranching 4.1 Roads and Railroads 5.3 Logging and Wood Harvesting 7.3 Other Ecosystem Modifications	
6.4 Conservation Planning	Incorporate invertebrate/pollinator conservation in management plans for public lands and for species-specific plans, especially charismatic species such as greater sage grouse, mule deer, elk, bears, etc.	6.3 Work and Other Activities 7.4 Removing/Reducing Human Maintenance	Current species-specific management plans overlook the importance of invertebrates as a food source and as indicators of habitat conditions.
6. Legal & Policy Frameworks			
7.1 Laws, Regulations & Codes	Create legislation or work with agencies to create regulations to prioritize weed-free forage products for livestock.	8.1 Invasive Non-native/Alien Species	Noxious weed infestations in wild lands such as designated Wilderness Areas cause degradation or loss of habitat for invertebrates.
7.1 Laws, Regulations & Codes	Collaborate with beekeeping organizations and get involved with the apiary permitting process to identify appropriate apiary locations to minimize impacts on native pollinators (USDA 2015).	8.1 Invasive Non-native/Alien Species	Honeybee hives on the landscape create competition for resources with native invertebrates.

	Create regulations requiring a system for tracking locations of honeybee hives.		
7.1 Laws, Regulations & Codes	Support local, national, and/or international efforts to ban or limit the use of pesticides containing neonicotinoids. Create a policy requiring nurseries and greenhouses to publicly disclose their use of neonicotinoids and other pesticides.	8.1 Invasive Non-native/Alien Species	Use of pesticides, especially those containing neonicotinoids, are indiscriminate in their impacts on invertebrates.
7. Research & Monitoring			
<i>See forthcoming chapter for research and monitoring related conservation actions.</i>			
8. Education & Training			
9.2 Training and Individual Capacity Building	Develop and distribute outreach materials and strategies for the public about healthy gardening, the importance of invertebrates, the ecological and societal consequences of monocultures, how to maintain a messy yard that benefits invertebrates, the how and why of reducing light pollution, and the differences between honeybees and native bees.	7.4 Removing/Reducing Human Maintenance	Lack of capacity and knowledge around how residential landscapes can provide high-quality habitat for native pollinators and other invertebrates leads to ecological deserts in urban areas.
10.1 Internal Organizational Management & Administration 10.2 External Organizational	Maintain and continually update a pollinator list serve to facilitate coordination and collaboration, share new science and resources, and develop/distribute outreach materials and plans.	6.3 Work and Other Activities	Lack of communication between managing agencies around how to support pollinators and native invertebrates.

Development & Support			
10.1 Internal Organizational Management & Administration	Facilitate data sharing agreements and develop database storage locations that can be accessed across agencies and organizations.	6.3 Work and Other Activities	Information relevant to invertebrate conservation and management from university researchers and others is not made readily available to those who can best use it, largely due to lack of funding.
10.2 External Organizational Development & Support			
10.3 Alliance & Partnership Development			
9.2 Training and Individual Capacity Building	Increase citizen and community engagement in monitoring and surveying work (e.g., Montana Bumble Bee Atlas).	6.3 Work and Other Activities	Limited numbers of personnel available to perform surveys for SGCN, identify and map important plant communities, and other actions to help conserve invertebrates.
9.2 Training and Individual Capacity Building	Develop and conduct professional trainings and scaling-up programs to incorporate invertebrate conservation into more natural resource restoration and management positions (e.g., ReWild). Work with universities to prioritize and promote programs that result in well-trained invertebrate researchers and taxonomists	6.3 Work and Other Activities 7.4 Removing/Reducing Human Maintenance	Lack of personnel to spread the word about the benefits of native plants and conduct projects that restore, maintain, and enhance native plant communities.
9.2 Training and Individual Capacity Building	Outreach to a variety of groups including agricultural producers, green industry, home gardeners, natural resource agency staff, and	7.4 Removing/Reducing Human Maintenance	Landowners and land managers of all kinds and with all sizes of land ownership do not have the botanical or entomological knowledge to manage

	business owners on the benefits of native plants for invertebrates and how native plantings benefit humans and wildlife and can reduce maintenance needs.		their lands in ways that benefit invertebrates and other wildlife.
5.2 Better Products & Management Practices	Work with businesses selling plants, seeds, and gardening supplies to develop labeling programs to put information on products touting their benefits (or negative effects) on food, water, and shelter for invertebrates.	7.4 Removing/Reducing Human Maintenance	Consumers at garden centers, nurseries, and greenhouses are not provided adequate information on the ecological consequences of their decisions about what plants and gardening tools/infrastructure to buy and use on their land.
9. Institutional Development			
10.2 External Organizational Development & Support 10.4 Financing Conservation	Create and adequately fund invertebrate conservation and management programs in state and federal agencies and add staff positions dedicated to plants and invertebrates to facilitate within-agency and across-agency coordination and collaboration. Look for and act on opportunities to incorporate plants and invertebrates into species restoration and management plans, land management plans, and other planning/guidance documents. Coordinate with USFWS to implement Conservation Assessment & Strategies (CAS) to assist in precluding proposed and candidate invertebrate species from listing under the ESA.	6.3 Work and Other Activities 7.4 Removing/Reducing Human Maintenance	State and federal agencies do not invest enough staff time and funding towards native plant restoration and maintenance and invertebrate conservation. Game animals and more charismatic fauna get lots of attention from the public, and funding decision reflect this bias. However, game animals are dependent on bottom-up trophic interactions that should be a top priority in their long-term conservation and management.

	Increased funding for extension services and outreach from state and federal agencies and universities to help private landowners better manage native habitat and associated invertebrates.		

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5.6 Aquatic Invertebrate SGCN Profiles with Threats and Conservation Actions

Actions for the conservation of aquatic invertebrate Species of Greatest Conservation Need (SGCN) are provided below, along with their corresponding threats, organized by the Conservation Measures Partnership Threats and Actions classification systems (Version 2.0, Salafsky et al. 2008, Appendix F).

Threats and conservation actions for two mayflies: Shortface Lanx (<i>Fisherola nuttalli</i>) and <i>Baetisca columbiana</i> , both aquatic invertebrate Species of Greatest Conservation Need that inhabit large rivers in western Montana.			
Action Classification	Action	Threat Classification	Threat
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for large, cold-water rivers west of the Continental Divide in Montana.	2.3 - Livestock Farming & Ranching	Sediment and nutrient inputs due to livestock grazing in the riparian zone can add excess silt to waterways, cause harmful algae blooms, and increase water temperatures.
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand demographic and genetic trends especially upstream and downstream of major dams.	7.2 - Dams & Water Management/Use	Hydroelectric dam projects around the lower Clark Fork River ecosystem may affect water quantity or quality in habitats used by these species.
5.2 Better Products & Management Practices	Promote the adoption of flow regimes that mimic natural flow regimes through reservoirs to reduce risk to these species' populations and prevent siltation.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for large, cold-water rivers west of the Continental Divide in Montana.	9.3 - Agricultural & Forestry Effluents	Agricultural practices such as orchard runoff and fertilizer use lead to nutrient enrichment. Water quality is reduced due to pulp mill effluents, metal smelting residues and discharges, and other sources.
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for	11 - Climate Change & Severe Weather	Increasing temperatures and drought can increase irrigation withdrawals and reduce stream flows leading to associated negative impacts.

	large, cold-water rivers west of the Continental Divide in Montana.		

Threats and conservation actions for a cave-obligate isopod (*Salmasellus steganothrix*), and an amphipod associated with glaciers (*Stygobromus glacialis*), both aquatic invertebrate Species of Greatest Conservation Need in Montana within and adjacent to Glacier National Park.

Action Classification	Action	Threat Classification	Threat
8.1 Basic Research & Status Monitoring	Limited information on cave and subterranean species and habitat exists, especially as it pertains to population numbers and distribution of these species. Monitor extant populations to understand habitat specificity as well as demographic and genetic trends.	6 - Human Intrusions & Disturbance	Physical habitat destruction or organism death by human disturbances such as spelunking or cave exploration.
2.1 Species Stewardship	Pursue cave and groundwater protection and/or restoration actions that can improve known populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for cave and subterranean ecosystems in Montana.		
8.1 Basic Research & Status Monitoring	Limited information on cave and subterranean species and habitat exists, especially as it pertains to population numbers and distribution of these species. Monitor extant populations to understand habitat specificity as well as demographic and genetic trends.	11 - Climate Change & Severe Weather	Small population sizes and isolation of populations across high-elevation, cave and subterranean aquatic ecosystems that may provide little thermal refuge from increasing temperatures.

8.2 Evaluation, Effectiveness Measures & Learning	Monitor occupied habitat changes and address climate impacts through adaptive management as necessary.		
2.1 Species Stewardship	Pursue cave and groundwater protection and/or restoration actions that can improve known populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for cave and subterranean ecosystems in Montana.		

Threats and conservation actions for the three mayflies: Pacific Flat-headed Mayfly (*Ironodes nitidus*), *Cinygmula gartrelli*, and *Cinygmula kootenai*, all aquatic invertebrate Species of Greatest Conservation Need that inhabit forested streams in Montana.

Action Classification	Action	Threat Classification	Threat
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	2.3 - Livestock Farming & Ranching	Sediment input due to livestock grazing in the riparian zone on USFS or BLM grazing parcels can add excess silt to waterways, cause harmful algae blooms, and increase water temperatures.
5.2 Better Products & Management Practices	Promote the adoption of BMPs for livestock use in high-risk headwater stream areas to reduce risk to small populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for Northern and Middle Rocky Mountain streams containing SGCN in western Montana.		
8.1 Basic Research &	Monitor extant populations to understand habitat requirements as	5.3 - Logging & Wood Harvesting	Small population sizes and reduced resiliency leads to risk of catastrophic extirpation events due to

Status Monitoring	well as demographic and genetic trends.		sedimentation from logging operations in headwater forested streams.
1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements in previously logged or burned areas that will protect headwater stream riparian buffers.		
2.1 Species Stewardship	Pursue forest restoration actions that can improve populations.		
5.2 Better Products & Management Practices	Promote the adoption of BMPs for logging in high-risk headwater stream areas to reduce risk to small populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for Northern and Middle Rocky Mountain streams containing SGCN in western Montana.		
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	11 - Climate Change & Severe Weather	Small population sizes and isolation of populations in forested headwater streams that may provide little thermal refugia from increasing temperatures.
8.2 Evaluation, Effectiveness Measures & Learning	Monitor occupied habitat changes and address climate impacts through adaptive management as necessary.		
5.2 Better Products & Management Practices	Promote the adoption of BMPs for resource extraction in high-risk headwater stream areas to reduce risk to small populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for Northern and Middle Rocky Mountain streams containing SGCN in western Montana.		

Threats and conservation actions for nine Mayflies and one Psammophilous Dragonfly: *Anaetris eximia*, *Ametropus neavei*, *Homoeoneuria alleni*, *Lachlania saskatchewanensis*, *Macdunnoa nipawinia*, *Anepeorus rusticus*, *Heptagenia whitingi*, *Raptoheptagenia cruentata*, and *Stylurus intricatus*, all aquatic invertebrate Species of Greatest Conservation Need that inhabit large, warm-water rivers in the prairies of Montana.

Action Classification	Action	Threat Classification	Threat
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	3 - Energy Production & Mining	Catastrophic events from oil and gas extraction operations may lead to extirpation due to small population sizes, reduced redundancy, and reduced resiliency.
2.1 Species Stewardship	Pursue restoration actions and in-stream water use that can improve populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for large prairie rivers in Montana.		
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	7.2 - Dams & Water Management/Use	Water Development Projects around large prairie river ecosystems inhabited by these species may affect water quantity and/or quality.
1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements in irrigation diversion areas that will protect stream riparian buffers and return more water to the river.		
2.1 Species Stewardship	Pursue restoration actions and in-stream water use that can improve populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for large prairie rivers in Montana.		

8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	2.3 - Livestock Farming & Ranching 9.3 - Agricultural & Forestry Effluents	Heavy nutrient loads, siltation, and pulses of highly conductive discharge water from livestock grazing (i.e., salts) reduce or degrade habitat.
1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements in livestock use areas that will protect stream riparian buffers.		
2.1 Species Stewardship	Pursue restoration actions and in-stream water use that can improve populations.		
5.2 Better Products & Management Practices	Promote the adoption of BMPs in livestock use areas to reduce risk to populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for large prairie rivers in Montana.		
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	3.1 - Oil & Gas Drilling	Oil/gas production discharges reduce or degrade habitat.
5.2 Better Products & Management Practices	Promote the adoption of BMPs in oil and gas effluent areas to reduce risk to populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for large prairie rivers in Montana.		
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	11 - Climate Change & Severe Weather	Increasing temperatures and potential for droughts increases irrigation withdrawals in large eastern Montana prairie rivers leading to higher water temperatures, reduced flow, and other associated negative impacts to aquatic life.

1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements in livestock use areas or diversion areas that will protect stream riparian buffers and return more water to the river.		
2.1 Species Stewardship	Pursue restoration actions and in-stream water use that can improve populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for large prairie rivers in Montana.		

Threats and conservation actions for two springsnails: *Pyrgulopsis blainica* and *Pyrgulopsis bedfordensis*, both aquatic invertebrate Species of Greatest Conservation Need in Montana.

Action Classification	Action	Threat Classification	Threat
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	1 - Residential & Commercial Development	Development around inhabited spring ecosystems may affect water quantity or quality.
1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements around spring ecosystems that will protect riparian buffers.	7.2 - Dams & Water Management/Use	
8.2 Evaluation, Effectiveness Measures & Learning	Evaluate success of riparian habitat improvements on population size or reproductive capacity.		
5.2 Better Products & Management Practices	Promote the adoption of BMPs for development in and around high-risk spring areas to reduce risk to small populations.		

6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for spring ecosystems in Montana.		
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	2.3 - Livestock Farming & Ranching	Sediment and nutrient inputs due to livestock grazing in the riparian zone can add excess silt to waterways, cause harmful algae blooms, and increase water temperatures.
1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements around spring ecosystems that will protect riparian buffers.		
8.2 Evaluation, Effectiveness Measures & Learning	Evaluate success of riparian habitat improvements on population size or reproductive capacity.		
5.2 Better Products & Management Practices	Promote the adoption of BMPs for livestock use in high-risk spring areas to reduce risk to small populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for spring ecosystems in Montana.		
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	11 - Climate Change & Severe Weather	Isolation of populations without redundancy in small sections of springs that may provide little thermal refugia from increasing temperatures or climate instability.
1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements around spring ecosystems that will protect riparian buffers.		
8.2 Evaluation, Effectiveness Measures & Learning	Evaluate success of riparian habitat improvements on population size or reproductive capacity.		

5.2 Better Products & Management Practices	Promote the adoption of BMPs for livestock, logging, or developments in and around high-risk spring areas to reduce risk to small populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for spring ecosystems in Montana.		

Threats and conservation actions for two dragonflies: Eastern Ringtail (*Erpetogomphus designates*) and Western Pondhawk (*Erythemis collocata*), both aquatic invertebrate Species of Greatest Conservation Need that inhabit warm-water springs in Montana.

Action Classification	Action	Threat Classification	Threat
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	1 - Residential & Commercial Development	Development of and around inhabited spring ecosystems may affect water quantity or quality.
1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements around spring ecosystems that will protect riparian buffers.	7.2 - Dams & Water Management/Use	
8.2 Evaluation, Effectiveness Measures & Learning	Evaluate success of habitat improvements on population size or reproductive capacity.		
5.2 Better Products & Management Practices	Promote the adoption of BMPs for livestock and human use around high-risk spring areas to reduce risk to small invertebrate populations.		

6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for spring ecosystems in Montana.		
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	11 - Climate Change & Severe Weather	Isolation of populations without redundancy in small sections of springs that may provide little thermal refugia from increasing temperatures or climate instability.
1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements around these spring ecosystems that will protect stream riparian buffers		
8.2 Evaluation, Effectiveness Measures & Learning	Evaluate success of habitat improvements on population size or reproductive capacity.		
5.2 Better Products & Management Practices	Promote the adoption of BMPs for livestock and human use around high-risk spring areas to reduce risk to small invertebrate populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for spring ecosystems in Montana.		

Threats and conservation actions for two stoneflies: *Lednia tumana*, *Zapada glacier* and *Zapada cordillera*, and three caddisflies: *Rhyacophila ebria*, *Rhyacophila gemona*, and *Rhyacophila glaciera*, all aquatic invertebrate Species of Greatest Conservation Need that are associated with glaciers and large, semi-permanent snowfields in Montana.

Action Classification	Action	Threat Classification	Threat
8.1 Basic Research &	Monitor extant populations to understand habitat requirements as		Small population sizes and isolation of populations across high-elevation, glacier streams that may

Status Monitoring	well as demographic and genetic trends.	11 - Climate Change & Severe Weather	provide little thermal refugia from increasing temperatures.
8.2 Evaluation, Effectiveness Measures & Learning	Monitor occupied habitat changes and address climate impacts through adaptive management as necessary.		

Threats and conservation actions for Rocky Mountain Capshell (*Acroloxus coloradensis*), an aquatic invertebrate Species of Greatest Conservation Need found in small alpine lakes of Glacier National Park in Montana.

Action Classification	Action	Threat Classification	Threat
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	6 - Human Intrusions & Disturbance	Physical habitat destruction or organism death by human disturbances such as stacking rocks or recreating along the shoreline of alpine lakes.
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	11 - Climate Change & Severe Weather	Small population sizes and isolation of populations in a few high elevation lakes that may provide little thermal refugia from increasing temperatures.
8.2 Evaluation, Effectiveness Measures & Learning	Monitor changes to occupied habitat and address climate impacts through adaptive management as necessary.		

Threats and conservation actions for five stoneflies: Hooked Snowfly (*Isocapnia crinite*), Springs Stripetail (*Isoperla petersoni*), Giant Needlfly (*Megaleuctra stigmata*), Mission Mountains Snowfly (*Sasquacapnia missiona*), and Columbian Snowfly (*Utacapnia Columbiana*), all aquatic invertebrate Species of Greatest Conservation Need that inhabit cold-water forested streams in Montana.

Action Classification	Action	Threat Classification	Threat
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	5.3 - Logging & Wood Harvesting	Small population sizes and reduced resiliency leads to risk of catastrophic extirpation events due to sedimentation from logging operations in headwater forested streams.
8.2 Evaluation, Effectiveness Measures & Learning	Monitor occupied habitat changes and address forest management plans and climate impacts through adaptive management as necessary.		
1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements in previously logged or burned areas that will protect headwater stream riparian buffers.		
5.2 Better Products & Management Practices	Promote the adoption of BMPs for logging in high-risk headwater stream areas to reduce risk to small populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for cold-water forested streams in Montana.		
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	11 - Climate Change & Severe Weather	Small population sizes and isolation of populations in forested headwater streams that may provide little thermal refugia from increasing temperatures.
8.2 Evaluation, Effectiveness Measures & Learning	Monitor changes to occupied habitat and address forest management plans and climate impacts through adaptive management as necessary.		

1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements in previously logged or burned areas that will protect headwater stream riparian buffers		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for cold-water forested streams in Montana.		

Threats and conservation actions for two freshwater sponges: <i>Ephydatia cooperensis</i> and <i>Heteromeyenia baileyi</i> , both aquatic invertebrate Species of Greatest Conservation Need in Montana.			
Action Classification	Action	Threat Classification	Threat
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	1 - Residential & Commercial Development	Development around lake ecosystems that may affect water quantity or quality and/or construction that may physically alter or remove habitat (e.g., removal of log or stump ‘hazards’ near docks).
1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements around lake ecosystems that will protect shoreline riparian buffers.		
8.2 Evaluation, Effectiveness Measures & Learning	Evaluate success of riparian habitat improvements on population size or reproductive capacity.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for natural lake ecosystems in Montana.		
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	6 - Human Intrusions & Disturbance	Physical habitat destruction or organism death by human disturbances such as motorboats, scraping of logs and boat docks by ropes, and/or wading and recreating in shallow lake margins.

1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements around lake ecosystems that will protect shoreline riparian buffers.		
8.2 Evaluation, Effectiveness Measures & Learning	Evaluate success of riparian habitat improvements on population size or reproductive capacity.		
5.2 Better Products & Management Practices	Promote the adoption of 'no wake' zones in high-risk sponge habitat areas to reduce risk to attached benthic or structural populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for natural lake ecosystems in Montana.		
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	7.2 - Dams & Water Management/Use	Development around inhabited lake ecosystems may affect water quantity or quality.
1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements around lake ecosystems that will protect shoreline riparian buffers.		
8.2 Evaluation, Effectiveness Measures & Learning	Evaluate success of riparian habitat improvements on population size or reproductive capacity.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for natural lake ecosystems in Montana.		
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	11 - Climate Change & Severe Weather	Isolation of populations without redundancy in a small number of lakes may provide little refugia from increasing temperatures or climate instability.

1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements around lake ecosystems that will protect shoreline riparian buffers.		
8.2 Evaluation, Effectiveness Measures & Learning	Evaluate success of riparian habitat improvements on population size or reproductive capacity.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for natural lake ecosystems in Montana.		

Threats and conservation actions for two species of damselfly: Prairie Bluet (*Coenagrion angulatum*) and Subarctic Bluet (*Coenagrion interrogatum*), both aquatic invertebrate Species of Greatest Conservation Need that inhabit wetlands in Montana.

Action Classification	Action	Threat Classification	Threat
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	1 - Residential & Commercial Development	Development around inhabited wetland ecosystems may affect water quantity or quality.
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for protecting priority, high-biodiversity wetland ecosystems in Montana.		
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	2.3 - Livestock Farming & Ranching	Sediment and nutrient inputs and habitat destruction due to livestock grazing in the riparian zone can add excess silt to waterways, cause harmful algae blooms, and increase water temperatures.

1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements in previously grazed areas that will protect wetland riparian buffers.		
5.2 Better Products & Management Practices	Promote the adoption of BMPs for grazing in high-risk wetland areas to reduce risk to small populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for protecting priority, high-biodiversity wetland ecosystems in Montana.		
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	5.3 – Logging & Wood Harvesting	Logging and associated road building and road can add excess silt to waterways and increase water temperatures.
1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements in previously logged or burned areas that will protect wetland riparian buffers.		
5.2 Better Products & Management Practices	Promote the adoption of BMPs for logging in high-risk wetland areas to reduce risk to small populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for protecting priority, high-biodiversity wetland ecosystems in Montana.		
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	11 - Climate Change & Severe Weather	Small population sizes and isolation of populations without redundancy in a small number of suitable wetlands may provide little refugia from increasing temperatures or climate instability.

8.2 Evaluation, Effectiveness Measures & Learning	Monitor changes to occupied habitat and address climate impacts through adaptive management as necessary.		
1.2 Ecosystem & Natural Process (Re)Creation	Pursue restoration and habitat improvements in previously grazed, logged, or burned areas that will protect wetland riparian buffers.		
5.2 Better Products & Management Practices	Promote the adoption of BMPs for grazing and logging in high-risk wetland areas to reduce risk to small populations.		
6.4 Conservation Planning	Develop a comprehensive, cooperative conservation strategy for protecting priority, high-biodiversity wetland ecosystems in Montana.		

Threats and conservation actions for a mayfly (<i>Parameletus columbiae</i>), and a caddisfly (<i>Arctopora salmon</i>), both aquatic invertebrate Species of Greatest Conservation Need that inhabit wetlands in Glacier National Park in Montana.			
Action Classification	Action	Threat Classification	Threat
8.1 Basic Research & Status Monitoring	Monitor extant populations to understand habitat requirements as well as demographic and genetic trends.	11 - Climate Change & Severe Weather	Small population sizes and isolation of populations in high-elevation wetlands that may provide little thermal refugia from increasing temperatures.
8.2 Evaluation, Effectiveness Measures & Learning	Monitor changes to occupied habitat and address climate impacts through adaptive management as necessary.		

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CHAPTER 6:

FOCAL AREAS

Montana's 2015 SWAP identified 257 aquatic focal areas and 116 terrestrial focal areas spread across the state. Focal areas were meant to guide attention to specific geographical areas of Montana that have a high number of HGCN and SGCN to help focus conservation efforts in areas with the highest need and the best potential return on conservation investments. We are currently developing new methods to identify focal areas for the 2025 SWAP, and we anticipate a new list of focal areas will be completed by October 2026. We will add the new focal areas to the 2025 SWAP through a minor revision and will notify our partners when the new version is available. In the meantime, we encourage partners to continue using the focal areas in the 2015 SWAP until new focal areas are complete.

For the 2025 SWAP, we are developing a suite of focal areas maps that are focused on conservation actions that can be taken to address threats to HGCN. We will do this by integrating spatial distribution maps for SGCN and HGCN to find areas of HGCN with relatively high numbers of SGCN. Then, we will select the top actions to address threats to those HGCN that can be mapped using remote sensing and refine the combined SGCN and HGCN maps based on those actions. The result will be focal areas that highlight where specific conservation actions should be undertaken on the landscape to have the biggest positive impact on the largest number of SGCN.

The new focal areas will present a continuous gradient of the level of impact to SGCN and HGCN across the state, instead of portraying explicit focal area zones as was done in the 2015 SWAP. By taking this approach, partners that work within a specific jurisdiction in the state can still identify the most impactful places to implement a conservation action to benefit SGCN and HGCN, even if those places may not be the most impactful in the context of the whole state. Additionally, presenting focal areas on a continuous gradient will enable focal areas to be integrated with other spatial datasets that estimate habitat threat severity, long-term habitat viability, or conservation opportunities, such as the [Montana Beaver Restoration Tool](#) (MacFarlane et al. 2017), models of [riparian refugia quality](#) (Szcodronski et al. 2024), or [sagebrush conversion risk](#) models (Bedrosian et al. 2024).

Our new approach to focal areas is fitting for Montana where half (48%) of all the conservation actions identified for species were related to habitat stewardship. To complete this new analysis, we first need time to process 6,000 conservation actions that were identified as part of the 2025 SWAP revision and create the links between HGCN, SGCN, and their associated threats and actions. Focal areas are one of the most used portions of the SWAP by our partners for identifying important areas for conservation work, and this new approach will incorporate all the feedback we got during the development of

the SWAP and present it in a way that fosters on-the-ground action to focus limited habitat conservation and restoration investments. Throughout the process of developing focal areas, we will solicit and include partner feedback to make sure the focal areas make sense to those that will use them the most.

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CHAPTER 7:

ECOSYSTEM ENGINEERS

7.1 Introduction

FWP emphasizes conservation actions for Habitats of Greatest Conservation Need (HGCN) because creating, maintaining, and enhancing high-quality habitat addresses key threats to many Species of Greatest Conservation Need (SGCN) at once. Similarly, FWP recognizes that single-species management can also address conservation threats to many SGCN at once. This is especially true for species commonly referred to as “ecosystem engineers.”

Ecosystem engineers are species that dramatically alter their environment to suit their needs, and those changes can be positive or negative for different species, or for biodiversity in general (Jones et al. 1997). The term “ecosystem engineer” is often used synonymously with “keystone species”, though keystone species are considered to have an entirely positive influence on biodiversity by creating conditions that allow for certain plant and animals species to exist and/or thrive in an area where they may not otherwise (Power et al. 1996, Kotliar 2000). For the SWAP, we use the term “ecosystem engineer” to highlight the important role these species play in modifying the landscape, but all the ecosystem engineers in this chapter are also considered keystone species.

In Montana, we have a wide range of plant and animal species that are, or could be, considered ecosystem engineers. In this State Wildlife Action Plan (SWAP), we are focusing on a subset of ecosystem engineers whose activities can modify habitat to benefit a relatively large number of SGCN. Those ecosystem engineers are the North American beaver (*Castor canadensis*), woodpeckers, and prairie dogs (*Cynomys* spp.). The North American beaver is classified as a furbearer in Montana, while several woodpeckers and both white-tailed and black-tailed prairie dogs are classified as SGCN.

Projects, policies, and education around conserving and enhancing populations of these ecosystem engineers are effective ways to address multiple threats to many SGCN and HGCN. These are considered top-priority conservation actions that FWP and its partners should focus on in implementing the 2025 SWAP.

7.2 North American Beaver

Beavers (*Castor canadensis*) dramatically modify their environment through harvesting vegetation, digging tunnels and channels, and building dams. These activities can be a highly beneficial, if not essential, disturbance in the streams, rivers, and lakes beavers

occupy. Dam building is especially beneficial, as beaver dams raise water tables, recharge groundwater, and reconnect degraded streams to their floodplains (Naiman et al. 1988, Wohl 2019, 2021). The impacts of thousands of beaver dams across a watershed can greatly enhance natural water storage and dampen annual hydrographs, providing water resources for wildlife and humans later into the summer and fall (Wohl 2019, 2021). Restoring beavers to areas of their former range is considered one of the most important actions humans can take to mitigate negative impacts from excessive flooding, severe wildfire, and drought (Beechie et al. 2013, Fairfax and Whittle 2020, Thompson et al. 2021, Jordan and Fairfax 2022, Wohl 2024).

Beavers are not only beneficial for the ecosystem services they can provide on the landscape, they also create and maintain diverse stream-wetland corridors that provide resources for dozens of species across Montana, including many SGCN (Ritter et al. 2023). In 2022, biologists with FWP and the Montana Natural Heritage Program (MTNHP) conducted a literature review and expert analysis on the impacts of beaver activity on the 128 SGCN identified in the 2015 SWAP (Ritter et al. 2023). The results of this analysis, summarized in Table 20, reveal that beaver activity can be a significant benefit to the majority of terrestrial SGCN in the state. While aquatic SGCN are much more complicated in terms of the effects of beaver activity, in the right situations there are substantial benefits to aquatic SGCN as well. It is important to note that beaver activity was not assessed to be entirely negative for any SGCN in Montana other than western pearlshell mussels (*Margaritifera falcata*). A full list of SGCN from the 2015 SWAP that can benefit from beaver activity is provided in Table 21.

Table 20. Overview of the impacts of beaver activity on SGCN from the 2015 SWAP based on an analysis included in Ritter et al. (2023).

SGCN	Total SGCN	SGCN that overlap with beavers	Positive effects of beaver activity	Negative effects of beaver activity	Positive or negative effects depending on context
Terrestrial	106	62	53	0	9
Aquatic	22	11	0	0	6*
Total	128	73	53	0	15

*For five aquatic SGCN, there was too little information on the effects of beaver activity on the species to classify impacts.

Table 21. List of SGCN from the 2015 SWAP that can benefit from beaver activity in Montana.

Species Group	Common Name	Scientific Name	Level of Impact
Amphibians	Great Plains Toad	<i>Anaxyrus cognatus</i>	High positive impact

Amphibians	Idaho Giant Salamander	<i>Dicamptodon aterrimus</i>	Low positive or negative impact depending on context
Amphibians	Northern Leopard Frog	<i>Lithobates pipiens</i>	High positive impact
Amphibians	Western Toad	<i>Anaxyrus boreas</i>	High positive impact
Birds	Alder Flycatcher	<i>Empidonax alnorum</i>	High positive impact
Birds	American Bittern	<i>Botaurus lentiginosus</i>	Moderate positive impact
Birds	American White Pelican	<i>Pelecanus erythrorhynchos</i>	Low positive impact
Birds	Baird's Sparrow	<i>Centronyx bairdii</i>	Low positive impact
Birds	Black Swift	<i>Cypseloides niger</i>	Low positive impact
Birds	Black Tern	<i>Chlidonias niger</i>	Low positive impact
Birds	Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	Moderate positive or negative impact depending on context
Birds	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	Moderate positive impact
Birds	Black-necked Stilt	<i>Himantopus mexicanus</i>	Low positive impact
Birds	Bobolink	<i>Dolichonyx oryzivorus</i>	Low positive impact
Birds	Brewer's Sparrow	<i>Spizella breweri</i>	Low positive impact
Birds	Brown Creeper	<i>Certhia americana</i>	Low positive or negative impact depending on context
Birds	Burrowing Owl	<i>Athene cunicularia</i>	Low positive impact
Birds	Common Loon	<i>Gavia immer</i>	Moderate positive impact
Birds	Great Blue Heron	<i>Ardea herodias</i>	High positive impact
Birds	Great Gray Owl	<i>Strix nebulosa</i>	Low positive impact
Birds	Greater Sage-Grouse	<i>Centrocercus urophasianus</i>	High positive impact
Birds	Harlequin Duck	<i>Histrionicus histrionicus</i>	Moderate positive or negative impact depending on context
Birds	Horned Grebe	<i>Podiceps auritus</i>	Low positive or negative impact depending on context
Birds	LeConte's Sparrow	<i>Ammodramus leconteii</i>	Moderate positive or negative impact depending on context
Birds	Lewis's Woodpecker	<i>Melanerpes lewis</i>	Moderate positive impact

Birds	Loggerhead Shrike	<i>Lanius ludovicianus</i>	Low positive impact
Birds	Long-billed Curlew	<i>Numenius americanus</i>	Low positive impact
Birds	Nelson's Sparrow	<i>Ammospiza nelsoni</i>	Moderate positive impact
Birds	Northern Hawk Owl	<i>Surnia ulula</i>	Moderate positive impact
Birds	Pacific Wren	<i>Troglodytes pacificus</i>	Moderate positive impact
Birds	Peregrine Falcon	<i>Falco peregrinus</i>	Low positive impact
Birds	Pileated Woodpecker	<i>Dryocopus pileatus</i>	Moderate positive impact
Birds	Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	Moderate positive or negative impact depending on context
Birds	Sedge Wren	<i>Cistothorus platensis</i>	Moderate positive impact
Birds	Sharp-tailed Grouse	<i>Tympanuchus phasianellus</i>	Low positive impact
Birds	Trumpeter Swan	<i>Cygnus buccinator</i>	High positive impact
Birds	Veery	<i>Catharus fuscescens</i>	High positive impact
Birds	White-faced Ibis	<i>Plegadis chihi</i>	Low positive impact
Birds	Whooping Crane	<i>Grus americana</i>	Low positive impact
Birds	Yellow Rail	<i>Coturnicops noveboracensis</i>	Moderate positive or negative impact depending on context
Birds	Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	Moderate positive or negative impact depending on context
Fish	Arctic Grayling	<i>Thymallus arcticus</i>	High positive or negative impact depending on context
Fish	Bull Trout	<i>Salvelinus confluentus</i>	High positive or negative impact depending on context
Fish	Columbia River Redband Trout	<i>Oncorhynchus mykiss gairdneri</i>	Moderate positive or negative impact depending on context
Fish	Iowa Darter	<i>Etheostoma exile</i>	Moderate positive or negative impact depending on context
Fish	Northern Pearl Dace	<i>Margariscus nachtriebi</i>	Moderate positive or negative impact depending on context
Fish	Northern Redbelly Dace	<i>Chrosomus eos</i>	Moderate positive or negative impact depending on context
Fish	Northern Redbelly X Finescale Dace	<i>Chrosomus eos x Chrosomus neogaeus</i>	Moderate positive or negative impact depending on context

Fish	Pygmy Whitefish	<i>Prosopium coulteri</i>	Low positive or negative impact depending on context
Fish	Shortnose Gar	<i>Lepisosteus platostomus</i>	Low positive impact
Fish	Spoonhead Sculpin	<i>Cottus ricei</i>	Low positive or negative impact depending on context
Fish	Torrent Sculpin	<i>Cottus rhotheus</i>	Moderate positive or negative impact depending on context
Fish	Trout-perch	<i>Percopsis omiscomaycus</i>	Moderate positive or negative impact depending on context
Fish	Westslope Cutthroat Trout	<i>Oncorhynchus clarkii lewisi</i>	High positive or negative impact depending on context
Fish	Yellowstone Cutthroat Trout	<i>Oncorhynchus clarkii bouvieri</i>	High positive or negative impact depending on context
Mammals	Arctic Shrew	<i>Sorex arcticus</i>	Low positive impact
Mammals	Canada Lynx	<i>Lynx canadensis</i>	Low positive impact
Mammals	Eastern Red Bat	<i>Lasiurus borealis</i>	Moderate positive impact
Mammals	Fisher	<i>Pekania pennanti</i>	Low positive impact
Mammals	Fringed Myotis	<i>Myotis thysanodes</i>	High positive impact
Mammals	Grizzly Bear	<i>Ursus arctos</i>	Moderate positive impact
Mammals	Hoary Bat	<i>Lasiurus cinereus</i>	High positive impact
Mammals	Little Brown Myotis	<i>Myotis lucifugus</i>	High positive impact
Mammals	Northern Bog Lemming	<i>Synaptomys borealis</i>	Moderate positive impact
Mammals	Northern Myotis	<i>Myotis septentrionalis</i>	Moderate positive or negative impact depending on context
Mammals	Pallid Bat	<i>Antrozous pallidus</i>	High positive impact
Mammals	Spotted Bat	<i>Euderma maculatum</i>	High positive impact
Mammals	Townsend's Big-eared Bat	<i>Corynorhinus townsendii</i>	High positive impact
Mammals	Western Pygmy Shrew	<i>Sorex hoyi</i>	Low positive impact
Mammals	Wolverine	<i>Gulo gulo</i>	Low positive impact
Reptiles	Plains Hog-nosed Snake	<i>Heterodon nasicus</i>	Moderate positive impact
Reptiles	Smooth Greensnake	<i>Opheodrys vernalis</i>	Moderate positive impact
Reptiles	Snapping Turtle	<i>Chelydra serpentina</i>	High positive impact

Reptiles	Spiny Softshell	<i>Apalone spinifera</i>	High positive impact

The impacts of beaver activity on plants and invertebrates were not evaluated as part of this effort. However, many studies have documented increased plant and invertebrate diversity and abundance in beaver-modified habitats, both at the scale of a single beaver colony and at the scale of an entire stream drainage (see reviews in Rosell et al. 2005, Muller-Schwarze 2011, and Rosell and Campbell-Palmer 2022). Therefore, it is reasonable to expect that some plant and invertebrate SGCN could benefit from beaver-modified habitats on the landscape. This is an area for future research and monitoring work.

Threats and Conservation Actions

High-quality riparian and wetland habitats can be maintained and enhanced by beaver activity, but beavers can also restore degraded habitats, and they can do it faster and cheaper than humans working alone (Pollock et al. 2014, 2017, Wheaton et al. 2019). “Beaver restoration” is an umbrella term encompassing all aspects of restoring beavers to areas of their former range and helping people address human-beaver conflicts. FWP published a comprehensive white paper on beaver restoration in 2023 (Ritter et al. 2023), and readers of the SWAP are encouraged to consult this document to learn more about conservation actions and management strategies for beavers in Montana.

Beavers are not considered at-risk in Montana, and their populations appear to be healthy in suitable habitats, though no statewide monitoring of populations occurs currently. The primary threats to beavers in Montana are disease, predation (including trapping by humans), and removal of beavers due to conflicts with human infrastructure and land uses. However, none of these threats are expected to cause a state-level population decline, though certain drainages may be negatively affected. Instead, the main limiting factor for beavers in Montana is historical loss of suitable habitat due to land use changes and stream degradation (Wohl 2021). These impacts have greatly reduced the extent of suitable streams where beavers can not only occupy the area, but remain in place long enough to bring about their beneficial effects on water storage, floodplain connectivity, and wildlife habitat.

Beavers are capable of breeding profusely and occupying available habitat rapidly (Muller-Schwarze 2011). So, even though their primary limiting factor is degraded habitat, they are also powerful agents of stream restoration (Pollock et al. 2014, 2017). A top conservation action for beavers is to identify those areas where relatively small investments in stream restoration can allow beavers to move in, take over the restoration work, and perpetuate those restoration investments into the future (Ritter et al. 2023). Expanding the distribution and connectedness of beaver populations across Montana’s landscapes is an effective way to achieve landscape-scale stream restoration and bolster natural water storage.

The activities of beavers can cause major conflicts with humans, so beaver-human conflict resolution is another key conservation action to increase tolerance for beavers on the landscape and maintain connectivity between sub-populations. Beaver-human conflict resolution can take many forms, and may include:

- Lethal trapping of conflict beavers during regular furbearer trapping season or through FWP's beaver damage permit system.
- Installation of non-lethal beaver conflict resolution devices such as culvert fences, pond levelers, and tree wrapping (Shockey 2024a, 2024b).
- Capturing beavers from conflict situations and transplanting them into areas of their historical range.
- Deterrent measures such as electric fencing, motion-detecting floodlights, and fladry.
- Education about the benefits of beavers for situations where the beavers are not causing damage but are perceived as a negative influence on stream systems.

Attitudes and opinions about beavers vary widely across the social spectrum in Montana, and myths about beavers and their impacts on the environment persist in many communities. Outreach and communication about beavers is another essential conservation action for reaping the benefits of beaver-modified habitats in Montana. This can include, but is not limited to, workshops, trainings, educational materials, and presentations on (1) the benefits of beavers to humans and wildlife, (2) lethal and non-lethal solutions for beaver-human conflicts, (3) restoration techniques to encourage beaver colonization, and (4) the role of trapping in beaver restoration and management.

7.3 Woodpeckers

In forested areas of Montana, numerous SGCN as well as other wildlife species rely on cavities in standing live or dead trees for nesting, cover, and thermoregulation. Many of these species are considered “secondary cavity nesters,” meaning they are not capable of excavating a cavity themselves and are therefore reliant on “primary cavity nesters” to excavate cavities for them. Across North America, including Montana, woodpeckers fill the role as these primary cavity nesters (Hardin et al. 2020). Woodpeckers use their strong beaks and associated musculature to bore holes through the sapwood of trees to excavate chambers in the internal heartwood. The heartwood of trees is more susceptible to heart-rot fungi than sapwood, and so the sapwood provides a strong entryway to the cavity while the softer heartwood can be excavated to form the internal chamber.

In Montana, primary cavity nesting woodpeckers occupy a wide range of forested habitats from ponderosa pine savannahs to river-bottom cottonwood galleries to recently burned

forests. In all these habitats, their cavity excavating abilities modify the habitat in such a way that certain wildlife species would not be able to survive and thrive without the woodpeckers' efforts. All of Montana's woodpecker species can be considered primary cavity nesters, though some species have unique life history characteristics that make them especially adept at ecosystem engineering. For example, black-backed woodpeckers specialize in excavating cavities in standing dead trees in recently burned forests and may be the only species capable of excavating cavities in fire-hardened wood for many years after a burn. Pileated woodpeckers are Montana's biggest and strongest woodpeckers and can excavate particularly large nest cavities that may be used by fishers or as roost sites for colonies of bats. Red-headed woodpeckers and sapsuckers are found in riparian areas throughout eastern Montana and are the key primary cavity nesters in less heavily forested parts of the state.

The cavities woodpeckers create can be used by dozens of species over their lifespan. These cavities can remain on the landscape and available for species to use anywhere from a single breeding season to many decades. Woodpecker cavities provide resources for over 30 different wildlife species in Montana, including 18 SGCN from the 2025 Montana SWAP (Bonar 2000, Aubry and Raley 2002, Baumgardt et al. 2004, Bull and Jackson 2020; Table 22).

Table 22. List of SGCN in the 2025 SWAP that can benefit from primary cavity excavating woodpeckers in Montana.

Species Group	Common Name	Scientific Name	SGCN Rank
Bird	Boreal Chickadee	<i>Poecile hudsonicus</i>	S3
Bird	Boreal Owl	<i>Aegolius funereus</i>	S3S4
Bird	Brown Creeper	<i>Certhia americana</i>	S3
Bird	Eastern Screech-Owl	<i>Megascops asio</i>	S3S4
Bird	Flammulated Owl	<i>Psiloscoops flammeolus</i>	S3B
Bird	Lewis's Woodpecker	<i>Melanerpes lewis</i>	S2B
Bird	Western Screech-owl	<i>Megascops kennicottii</i>	S3S4
Mammal	Eastern Red Bat	<i>Lasiurus borealis</i>	S3
Mammal	Fisher	<i>Pekania pennanti</i>	S3
Mammal	Fringed Myotis	<i>Myotis thysanodes</i>	S3
Mammal	Hoary Bat	<i>Lasiurus cinereus</i>	S3B
Mammal	Little Brown Myotis	<i>Myotis lucifugus</i>	S3
Mammal	Long-eared Myotis	<i>Myotis evotis</i>	S3
Mammal	Long-legged Myotis	<i>Myotis volans</i>	S3
Mammal	Northern Myotis	<i>Myotis septentrionalis</i>	S1S2
Mammal	Pallid Bat	<i>Antrozous pallidus</i>	S3
Mammal	Silver-haired Bat	<i>Lasionycteris noctivagans</i>	S4
Mammal	Yuma Myotis	<i>Myotis yumanensis</i>	S3

The impacts of woodpeckers on plants and invertebrates were not evaluated as part of this effort. It is likely that woodpecker activity in Montana may have significant impacts on invertebrates, as they are the primary food source for woodpeckers and large numbers of invertebrates take advantage of the same decaying wood that woodpeckers use for foraging and cavity excavation. It is unlikely that woodpeckers substantially affect any plant SGCN. Whether or not woodpeckers in Montana impact plant or invertebrate SGCN is unclear, and this is an area for ongoing research and monitoring.

Threats and Conservation Actions

In this SWAP, six woodpeckers are classified as SGCN (Lewis's Woodpecker, Black-backed Woodpecker, Pileated Woodpecker, Red-headed Woodpecker, Red-naped Sapsucker, and Williamson's Sapsucker). These woodpeckers occupy and modify a wide range of habitats, so threats and conservation actions for these ecosystem engineers are well-covered within the individual species threats and actions accounts in Chapter 5.

7.4 Prairie Dogs

Prairie dogs (*Cynomys* spp.) create unique habitat conditions in and around their colonies through the excavation of extensive burrow networks and the grazing of vegetation (Kotliar 2000). Many other species, including SGCN, key in on prairie dog colonies to take advantage of the array of resources they provide (Adams 2021 and Table 23). The burrows prairie dogs create facilitate soil turnover and increase permeability of the soil to precipitation (Davidson et al. 2012, Sierra-Corona et al. 2015). These burrows are also used by many other species for nesting, foraging, and cover (Davidson et al. 2012, Adams 2021). Through grazing, prairie dogs maintain short vegetation communities that allow them to see over long distances in flat terrain. This grazing pressure creates and maintains unique plant communities, increases forage quality, increases invertebrate abundance and diversity, and prevents encroachment by shrubs (Coppock et al. 1983, Whicker and Detling 1988, Davidson et al. 2012, Adams 2021). Prairie dogs can be highly abundant where they are allowed to maintain colonies, and they provide a rich food resource for many species of raptors and terrestrial carnivores (Davidson et al. 2012).

Threats and Conservation Actions

Prairie dog colonies are spread throughout the eastern part of Montana but represent a fraction of their former range. Burrowing by prairie dogs is disruptive to many human land uses, especially agriculture, and so they have been removed from large portions of their historical range. This represents a conservation threat to prairie dogs, but also to the SGCN that take advantage of prairie dog colonies. Removal by humans, alongside disease and predation, have led to both species of prairie dogs in Montana being classified as SGCN

Therefore, threats and conservation actions are described in the white-tailed prairie dog and black-tailed prairie dog sections of Chapter 5.

Table 23. List of SGCN in the 2025 SWAP that can benefit from prairie dog activity in Montana.

Species Group	Common Name	Scientific Name	SGCN Rank
Amphibian	Great Plains Toad	<i>Anaxyrus cognatus</i>	S2
Amphibian	Plains Spadefoot	<i>Spea bombifrons</i>	S4
Bird	Burrowing Owl	<i>Athene cunicularia</i>	S3B
Bird	Ferruginous Hawk	<i>Buteo regalis</i>	S3B
Bird	Golden Eagle	<i>Aquila chrysaetos</i>	S3
Bird	Long-billed Curlew	<i>Numenius americanus</i>	S3B
Bird	Mountain Plover	<i>Charadrius montanus</i>	S2B
Bird	Prairie Falcon	<i>Falco mexicanus</i>	S4
Mammal	Black-footed Ferret	<i>Mustela nigripes</i>	S1
Mammal	Fringed Myotis	<i>Myotis thysanodes</i>	S3
Mammal	Hoary Bat	<i>Lasiurus cinereus</i>	S3B
Mammal	Little Brown Myotis	<i>Myotis lucifugus</i>	S3
Mammal	Merriam's Shrew	<i>Sorex merriami</i>	S3
Mammal	Preble's Shrew	<i>Sorex preblei</i>	S3
Mammal	Swift Fox	<i>Vulpes velox</i>	S3
Reptile	Greater Short-horned Lizard	<i>Phrynosoma hernandesi</i>	S3
Reptile	Plains Hog-nosed Snake	<i>Heterodon nasicus</i>	S2
Reptile	Prairie Rattlesnake	<i>Crotalus viridis</i>	S4
Reptile	Western Milksnake	<i>Lampropeltis gentilis</i>	S2

The impacts of prairie dogs on plants and invertebrates were not evaluated as part of this effort. However, many studies have documented increased plant and invertebrate diversity and abundance in and around prairie dog colonies (Coppock et al. 1983, Weltzin et al. 1997, Davidson et al. 2012, Adams 2021). Therefore, it is reasonable to assume that some plant and invertebrate SGCN could benefit from prairie dog habitat modifications in Montana.

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CHAPTER 8:

WILDLIFE CONNECTIVITY

Ecological connectivity (or simply “connectivity”) refers to the capacity of landscapes and seascapes to allow species to move freely and for ecological processes to function unimpeded (UNEP 2019). Connectivity is fundamental for biodiversity conservation in an era of accelerating environmental change (Heller and Zavaleta 2009). As the landscape becomes increasingly fragmented, maintaining or restoring connectivity allows species to move safely between intact habitats to access necessary resources on a daily, seasonal, and annual basis. Over extended periods, connectivity maintains genetic diversity by preventing populations from becoming isolated and allows species to shift their ranges to track suitable conditions in response to changing environmental conditions (Tabor et al. 2014).

Increasing human population and associated infrastructure development and expansion alongside land conversion are growing threats to natural movement routes for wildlife. Barriers to movement and resulting loss of connectivity vary by species, but common barriers include linear infrastructure like roadways and fencing; other human structures such as buildings, dams, powerlines, and energy facilities; cross-boundary management and conservation issues that can be at the international scale for some species; and habitat fragmentation resulting from agricultural production and other human-related land-use changes. The loss of connectivity due to habitat fragmentation poses serious risks to wildlife populations (Ghoddousi et al. 2021). Wildlife populations become isolated, leading to increased competition for resources, inbreeding, increased risk of density-dependent diseases, and higher mortality rates. Disrupted movement patterns also force wildlife into human-dominated landscapes, escalating conflicts between people and animals and creating serious safety issues along transportation corridors.

Montana’s Species of Greatest Conservation Need (SGCN) depend on connected landscapes across multiple spatial scales and habitat types for migration, dispersal, seasonal foraging, and reproduction. For nongame wildlife, connectivity needs range from a few meters to several kilometers, depending on their mobility and habitat use. Many species have small home ranges but need connections between habitat patches to avoid inbreeding. Nongame animals often exist in metapopulations—partially isolated groups connected through dispersal. Their movements may span long distances, linking between protected areas, riparian corridors, or wetland networks. Maintaining these connections supports recolonization after local extinctions, which is critical for population persistence in patchy or disturbed landscapes.

Most non-avian nongame species have lower mobility than wide-ranging mammals and can be highly affected by roads, fences, or minor development barriers (Cushman 2006).

Some organisms, such as amphibians, reptiles, and aquatic invertebrates, need access to different habitats throughout their life cycle, like wetlands, streams, and adjacent uplands (Semlitsch and Bodie 2003). Others, including rodents and insects with limited range, need continuous cover to move safely, while some rely on highly specific and often rare or declining habitat types. Avian nongame species are much more mobile but face increasing threats from the expansion of towers, tall buildings, airports and associated plane traffic, and other infrastructure. Avian species are also affected more broadly by increasing sound and light pollution and ongoing habitat loss and degradation. At the local scale, many forest, grassland, shrubland, and riparian bird species need contiguous or closely spaced habitat patches to move safely, especially during breeding and post-breeding dispersal. Many avian species migrate at a continental scale, emphasizing the need for full life-cycle species conservation that may cross state and international boundaries.

Connectivity conservation involves mitigating the barriers to species movement and maintaining and restoring landscape features, such as corridors or linkage areas, that facilitate species movement (Tabor et al. 2014). Ensuring connectivity for Montana's nongame species requires attention to multiple spatial scales and habitats. Strategies to conserve connectivity for nongame species include but are not limited to:

1. Protecting and restoring critical corridors and specific habitat types.
2. Collaborating with transportation and land-use planning entities to reduce barriers.
3. Integrating connectivity considerations into project review and funding decisions.

Generally, strategies should include protecting lands that include intact habitats consisting of elevation gradients, diverse vegetation structure, functional disturbance regimes, a high proportion of native plant communities, topographic diversity, and water availability.

To address barriers such as roads, creating new structures such as culverts or tunnels, or modifying existing drainage structures with dry shelves and fencing, can provide safe passage for smaller species, in addition to larger-scale crossings for larger species (Huijser et al. 2022). Creating protective cover habitat to avoid predation and maintain foraging routes or habitat niches (e.g., moisture and light regimes) is important for some species. Windbreaks or riparian strips can serve as movement corridors in developed areas and agricultural landscapes. Nongame wildlife and their habitats, and particularly, SGCN and Habitats of Greatest Conservation Need (HGCN), should be intentionally included in connectivity mapping and prioritization efforts that influence management decisions. Continuous engagement and collaboration with state and federal agencies is important to ensure projects and planning are complementary.

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CHAPTER 9:

WILDLIFE DISEASE

Work on the wildlife disease chapter was supported through funding by the U.S. Geological Survey North Central Climate Adaptation Science Center. We would like to thank subject matter experts for their time and expertise in reviewing the wildlife disease profiles for this chapter.

9.1 Introduction

Infectious disease can present a notable and complex threat to wildlife survival, population resilience, and susceptibility to other stressors^{1,2}. Impacts of disease on wildlife populations range widely, from relatively mild effects like reduced fitness or occasional deaths to more substantial effects like mass mortality events, population declines, and even population extinctions¹. Healthy wildlife populations can often persist with pathogens or recover quickly after outbreaks through adaptive measures, such as developing immunity or tolerance to a disease³. Moreover, disease outbreaks often fade out over time as the number of susceptible hosts declines⁴. Thus, not all diseases cause long-term population declines, and disease is rarely the sole driver of species endangerment⁵.

Yet, there are important exceptions in which disease can lead to significant and lasting impacts in wildlife populations. Diseases like white-nose syndrome, chytridiomycosis, and avian malaria have caused high-profile, widespread declines and even extinctions⁶⁻⁸. In populations that are already imperiled due to other factors, disease can act as an additional stressor that disrupts recovery efforts or causes further reduction in numbers. In addition, small or isolated populations, such as those of imperiled species or populations involved in recovery programs, are less resilient to disease^{9,10}. These populations may have low genetic diversity and reduced ability to develop immunity, and geographic isolation can prevent population recovery following outbreaks¹. Diseases can impact populations rapidly if outbreaks cause mass mortalities. Alternatively, impacts can play out over many years (and in less visible ways), if disease persists as an underlying stressor that suppresses population growth rates or increases overall vulnerability to other threats³. In sum, although the magnitude of direct and indirect effects of disease are variable, diseases can be a relevant threat to the conservation and recovery of imperiled wildlife, including Montana's Species of Greatest Conservation Need (SGCN).

Characterizing the distribution and impact of wildlife diseases is a significant challenge, and it is not always clear when and where disease management strategies are needed¹¹. The impacts of disease can be highly variable across populations and through time. For example, changes in the environment or the presence of additional stressors like drought

or habitat loss can enhance disease transmission or worsen disease outcomes¹². The location of disease outbreaks can also be unpredictable. Climate variability, species range expansions, biodiversity loss, habitat change, and human activities (e.g., agriculture, recreation, transportation) can alter the distribution of hosts and pathogens, leading to introductions of pathogens to novel locations^{12–15}. Larger impacts are expected when wildlife are exposed to new pathogens to which they lack immunity, a pattern that is increasing in frequency. Novel disease threats are expected to emerge over the coming decades, and may occur with little warning^{2,14}.

Not only are disease distributions rapidly changing, but management is also challenged by significant uncertainty about the impacts of disease on wildlife populations. Disease surveillance can be costly and laborious, and few diseases are routinely monitored, leaving major gaps in knowledge about the geographic extent of wildlife diseases¹⁶. In addition, long-term impacts of diseases on wildlife populations are often difficult to assess because monitoring data on wildlife abundance is limited, especially for SGCN. Without information on the distribution of disease, the susceptibility of different wildlife species, and population impacts, it is difficult to identify the locations or populations in most need of management intervention¹⁷. Moreover, management strategies for wildlife diseases are limited, and commonly used interventions from human health or veterinary sectors rarely apply to wildlife populations¹⁷. Limited information and tools can inhibit preparedness for disease outbreaks and lead to delays in action during critical windows for managing wildlife disease outbreaks^{18,19}.

This chapter aims to improve preparedness for wildlife health challenges by summarizing relevant information on 20 infectious diseases that may impact Montana's SGCN, including (1) potential wildlife species affected, (2) disease biology, risk factors, and potential impacts, (3) current knowledge about the disease's distribution in Montana, and (4) the potential for future disease spread. For each disease, a list of potential conservation actions supported by scientific research is provided, with the key caveat that interventions to limit wildlife disease are highly context-specific and, in some cases, techniques may be in the early stages of development.

9.2 Methods

Generating a Candidate Disease List

A list of high-priority infectious diseases that impact or could impact Montana's SGCN was generated using expert elicitation and targeted searches of the nationwide wildlife mortality database, Wildlife Health Information Sharing Partnership Event Reporting System (WHISPers)²⁰. We searched the WHISPers database to identify diseases that have caused mortalities in Montana's SGCN since 1980. To conduct expert elicitation, we held workshops with wildlife health experts (n = 19) from Montana and surrounding states.

Participants were asked to identify relevant diseases across distinct vertebrate taxa including amphibians, reptiles, fish, mammals, and birds. The workshop also focused on discussing potential climate impacts on wildlife diseases and how to best compile conservation actions and assess disease threats in the face of uncertainty and rapidly changing conditions. This process generated an initial list of 48 diseases of potential relevance for Montana (Table 26). We could not thoroughly review all 48 diseases, so we selected a subset of 20 diseases that we designated as “high priority” to be reviewed for Montana’s State Wildlife Action Plan (SWAP). We prioritized diseases that affected multiple SGCN, were identified as important by multiple experts, and were involved in mortality events in the WHISPers database. We also ensured that the list of high-priority diseases included diseases of fish, mammal, bird, and herptile species.

Literature Review and Synthesis

A targeted literature review was conducted for the 19 diseases designated as high priority for Montana’s SGCN. Searches were performed using the scientific databases PubMed, Google Scholar, and Scopus. Initial search terms consisted of each pathogen’s name (including synonyms or alternative scientific names) in combination with terms such as “wildlife,” “free-ranging,” or “wild.” If needed, searches were further refined with additional keywords such as “management,” “Montana,” or “climate.” Articles were included in the review if they demonstrated regional relevance within or around Montana, described impacts to wildlife at the individual or population level, or addressed key topics such as disease management strategies, climate sensitivity, host breadth, or vector dynamics. Articles were excluded from review if the study focused primarily on impacts to domestic species or humans, diagnostics, evolutionary dynamics, or surveillance studies outside region of interest. Findings from literature review were synthesized into disease summaries highlighting the pathogen and disease’s ecology, host breadth (in Montana), disease drivers, impact, known presence in Montana, climate sensitivity, conservation actions, and knowledge gaps.

Host breadth is summarized in a table at the top of each disease’s summary and was characterized by grouping species into four categories based on their susceptibility to disease impacts and conservation status within Montana:

1. **SGCN with Known Impacts:** Montana SGCN species (S1-S3) for which disease has been documented to cause negative health outcomes, such as clinical illness, mortality, population declines, or mass mortality events.
2. **SGCN Susceptible to Infection:** Montana SGCN species that are known to become infected with the pathogen but negative impacts have not been observed. This is either because species are asymptomatic or resistant to disease, or because the effects of the disease have not yet been quantified or observed in that species. These species could potentially become impacted by the disease or could serve as reservoir hosts or asymptomatic carriers.

3. **SGCN Potentially Susceptible:** Montana SGCN species in which infection has yet to be documented but are potentially susceptible based on evidence and taxonomic relatedness from known infected species. Species in this category highlight important data gaps in assessing potential risk to species of conservation concern.
4. **Other Susceptible Montana Species:** Montana species classified as S4 or higher or broad taxonomic groups that are known or suspected to be susceptible to infection. These species/groups may experience clinical disease or act as carriers and are important to consider due to their potential influence on disease distribution, transmission dynamics, and spillover to SGCN.

Disease drivers represent major ecological or anthropogenic factors that influence disease epidemiology and impact to wildlife¹². Factors provided were well established in literature or recommended by subject matter experts. We highlight the major disease drivers in order to help identify environments or populations that may be particularly at risk and to provide potential management targets by emphasizing the factors that heighten disease occurrence, transmission, and severity.

Following completion of literature review and synthesis, each disease summary was reviewed by two subject matter experts to ensure information was both accurate and current.

Disease Threat Assessment

We developed a scoring system to evaluate the level of threat each disease represented for Montana's SGCN (Table 24). The level of disease threat was a combination of scores across five categories: (1) population impact, (2) relevance to Montana, (3) host range, (4) timing, and (5) climate sensitivity. These categories were adapted from previously established conservation ranking systems and addressed the scope, severity, and timing of each disease threat²¹⁻²³. Scores of 0 through 5 were applied (e.g., 5 being most severe) for each category. When there was uncertainty or lack of information within a category, we used a range (minimum, maximum) of scores to capture the current state of knowledge. Impact, relevance, and host breadth were weighted higher than climate sensitivity and timing, as recommended by experts participating in our workshop. The total score for each disease, representing its level of threat was: $Total\ score = 3 \times impact + 2 \times relevance + 2 \times host\ breadth + climate + timing$. Where uncertainty was present, we performed this calculation using the minimum score for each category and maximum score, and then took the median. Diseases could receive a final score between 9 and 45. We present the threat ranking for the 20 diseases in Figure 2.

Conservation Actions

We conducted literature review of wildlife disease management literature, other State Wildlife Action Plans, and research on specific diseases to identify a list of conservation

actions that apply to wildlife diseases. Conservation actions were grouped into four broad categories:

1. **Prevention:** preventative measures aimed at reducing the likelihood of introduction of disease into species, populations, or locations
2. **Disease Management:** actions focused on reducing the prevalence or severity of infectious disease within affected populations
3. **Species and Habitat Management:** actions that promote overall species or population health, abundance, distribution, and adaptive capacity to disease by reducing other stressors or improving habitat
4. **Surveillance and Monitoring:** monitoring strategies and surveillance tools that improve the ability to detect outbreaks and prioritize disease management

Actions provided in the disease summaries represent possible interventions to be considered on a case-by-case basis. While these actions are supported by literature and have been reviewed by subject matter experts, selection and implementation of actions will be based on a range of criteria, such as feasibility, goals, available resources, expertise, and expected impact²⁴. In many cases, research on efficacy of certain actions is lacking or information pertaining to a disease or affected population is limited. In addition, as information related to a disease or at-risk population emerges and/or conditions change, management strategies will need the ability to adapt. Using adaptive management frameworks will increase the capacity and ability to respond to shifting conditions.

Novel disease threats that have not been identified in the SWAP may emerge over the next decade and may impact Montana's SGCN. Conservation actions listed in Table 25 and the following pages may apply to these novel, still-unknown diseases, and managers can consider referencing actions from this chapter as starting points for identifying salient management interventions.

9.3 Conclusions

This chapter provides an overview of the key diseases of concern for Montana's nongame wildlife and highlights opportunities to improve and sustain wildlife health through targeted disease management. Review of wildlife disease threats for Montana revealed multiple gaps in knowledge and critical research needs that are consistent with broader challenges in wildlife disease management. These include a lack of data on host (particularly SGCN) susceptibility to certain diseases, uncertainties regarding the distribution and population impacts of diseases within Montana, and limited knowledge of how disease extent may change in the future. We were able to identify a wide range of potential conservation actions for wildlife diseases; however, many of these actions have not been extensively implemented in wildlife populations, nor has their effectiveness been rigorously examined.

Overall, continued collaboration, research, and the adoption of adaptive management approaches will be key in addressing rapidly changing wildlife disease challenges and safeguarding the health of Montana's wildlife.

The determinants of healthy wildlife populations are complex and influenced not only by the presence or absence of disease, but by multiple other factors like resource availability, social structure, environmental conditions, and other stressors²⁵. Consequently, wildlife health can be supported by a diversity of conservation actions that target multiple aspects of wildlife population resilience (as noted in other sections of the SWAP) and not just through actions that reduce the presence of pathogens. While certain actions, such as minimizing the spread and introduction of novel infectious diseases and improving the resilience of wildlife populations, are generally good practice, other interventions, such as environmental treatments, vaccinations, or pharmaceuticals, may only be necessary in limited contexts^{17,24}. Although the following pages provide a list of potential conservation actions relevant to each disease, not all outbreaks or instances of wildlife disease will require intervention. How can managers identify those contexts where these conservation actions are needed? While increased disease surveillance may seem like the obvious answer, it is often resource-intensive, and surveillance programs or effective techniques are rare in wildlife. Population monitoring (i.e., to track abundance and distribution) may help identify specific locations where declines due to disease have occurred and where disease control efforts or further information on disease is most needed, along with supporting other management goals. Therefore, we emphasize that broader efforts to monitor and conserve imperiled populations are critical to addressing disease threats¹⁷.

Table 24. Rubric used to evaluate degree of threat represented by each disease. We modified NatureServe's Threat categories (Scope, Severity, and Timing) to apply to wildlife diseases and added a fifth category pertaining to future spread from climate variability (Climate Risk). The total risk score was computed as: 3 x (population impact) + 2 x (relevance to Montana) + 2 x (host range) + 1 x (outbreak timing) + 1 x (climate risk). Diseases could receive a final score between 9 and 45.

1. Population Impact (SEVERITY)		Weight: 3x
<i>Description: the magnitude of negative health outcomes associated with disease</i>		Score
Extreme	Associated with major population declines or extirpations across numerous populations	5
Serious	Associated with population declines in at least some locations/populations	4
Moderate	Capable of causing periodic mass mortalities	3
Slight	Causes disease with fitness effects and occasional mortality, but rarely impacts population scale	2
Neutral	Pathogen appears commensal, no impact typically	1
2. Relevance to Montana (GEOGRAPHIC SCOPE)		Weight: 2x
<i>Description: the disease's distribution in Montana</i>		Score

Pervasive	Disease is common in Montana wildlife; disease is widespread in many areas where SGCN are known to occupy; evidence of high rate of disease spread within Montana.	5
Large	Disease occurs in multiple, large, geographically distinct areas throughout Montana but is not widespread across all SOC habitat.	4
Restricted	Disease has been observed occasionally in Montana wildlife or domestic species with limited spread.	3
Small	Disease isolated to one location within Montana or is currently not present in Montana but is observed in neighboring states with potential to spread to Montana.	2
Not locally present	Pathogen is present in the U.S. or rapidly emerging worldwide but is not found in Montana or surrounding states; spread to Montana is plausible.	1
Negligible	Pathogen is not present in US; conditions in Montana are likely to limit pathogen presence.	0
3. Host Range (SCOPE IN WILDLIFE)		Weight: 2x
<i>Description: the number of species affected by the disease (lower range: species affected by the disease; upper range: species potentially susceptible to the disease)</i>		Score
>10 SGCN affected and multiple taxa are affected and at least 10 non-SGCN are affected		5
>10 SGCN affected and either multiple taxa are affected or at least 10 non-SGCN are also affected		4
>10 SGCN affected		3
5-10 SGCN affected		2
1-5 SGCN affected		1
No SGCN affected		0
4. Outbreak Timing (TIMING)		Weight: 1x
<i>Description: the potential length of an outbreak and likelihood of reoccurrence (i.e., how long and how often an agency might expect to manage the disease threat)</i>		Score
Extreme	Epizootic outbreaks are already occurring/expected to occur within the next decade and may last multiple years.	5
High	Epizootic outbreaks occur regularly but do not last multiple years OR disease may persist as enzootic for multiple years.	4
Moderate	Sporadic outbreaks are likely to occur multiple times per decade but are short lived.	3
Low	Outbreaks occur only sporadically and may occur only 1-2x over the next few decades.	2
Insignificant	Threat is in the past and unlikely to return.	1
5. Climate Risk		Weight: 1x
<i>Description: the likelihood of disease expansion or increased severity under changing climate conditions</i>		Score
High	Disease is known to be expanding due to climate change, with increasing risk in Montana.	5
Serious	Disease is known to be highly sensitive to climate change; impacts in Montana unknown.	4
Moderate	Disease has traits making it climate-sensitive, but relationships have not been well quantified or rigorously examined.	3
Slight	Disease has few or no traits that are climate-sensitive; however, impacts from climate change or susceptible species may lead to disease expansion.	2

Neutral/Potential Benefit	Disease has no theorized or plausible relationship with any climate variables or pathogen distribution, or disease severity is likely to decrease due to climate change.	1

Table 25. General conservation actions for wildlife disease threats, grouped into four broad categories. These represent general approaches that could apply to a broad range of wildlife health challenges, including emerging threats that have not yet been identified.

Prevention	
Biosafety	Develop and/or maintain disease-specific biosafety or decontamination protocols for fieldwork and animal handling activities to limit risk of disease spread or introduction. Promote and enforce similar protocols for public. Implement policies that limit introduction pathways (e.g., limits on use of certain baits).
Regulating Access	Restrict or minimize human activity in areas where disease is present (to avoid further spread), or in high-priority habitats (e.g., refugia, breeding sites) where introduction of disease would be highly detrimental.
Readiness	Develop outbreak response and management plans and identify proactive measures that can be implemented in advance of disease arrival.
Collaboration with other agencies	Partner with other state and federal agencies (e.g., Montana Department of Public Health and Human Services, Montana Department of Livestock, U.S. Department of Agriculture, etc.) to develop One Health approaches for disease monitoring, prevention, and management (e.g., live animal/animal product imports, zoonotic disease control, domestic-wildlife spillover).
Collaboration with private stakeholders	Collaborate with private stakeholder groups (e.g., producers, landowners) to determine best practices for promoting wildlife health while safeguarding stakeholder interests (e.g., limiting contact between domestics and wildlife, minimizing vector habitat).
Public education and engagement	Develop public awareness campaigns that educate the public (or key audiences like hunters, anglers, or birders) on important aspects of disease (e.g., how disease is spread and signs of infection).
Vaccination (prevention)	If vaccines are available, vaccinate high-priority populations to prevent disease in wildlife. This can include vaccination in domestic animals (to reduce spillover to wildlife) or vaccination of wildlife being captured, translocated, captive bred, or released.
Movement restrictions/reduce spillover	Restrict movement or release of infected individuals or reservoir species (e.g., captive wildlife, domestic animals) that may introduce or spread pathogen in the environment.
Disease Management	
Environmental modifications/treatments	Apply treatments or modify environment to interrupt transmission or directly eradicate pathogen (e.g., dewatering contaminated wetlands, application of insecticides, chemical decontamination).
Host pharmaceutical interventions (disease response)	Use wildlife vaccinations or other pharmaceutical interventions to reduce or treat disease during outbreak events (e.g., oral vaccination baits in prairie dogs, antifungal treatment in amphibians) in cases where vulnerable populations are threatened.
Population management	Limit opportunities for disease transmission by lowering animal contact rates (e.g., by conducting population culls in reservoir populations or removing attractants that concentrate individuals).
Species and Habitat Management	

Promotion of species/population resilience	Improve the abundance, distribution, and adaptive capacity for wildlife populations impacted by disease through actions that enhance habitat quality, connectivity, or availability, or that reduce additional stressors. Actions targeted to promote evolution of host resistance or tolerance to disease.
Surveillance and Monitoring	
Disease surveillance	Collect surveillance data to understand disease occurrence and severity and to help prioritize management interventions. This can include participation in national surveillance programs, partnering with existing research programs, encouraging public participation in passive surveillance efforts, or conducting opportunistic or targeted testing programs. Explore methods to improve sampling efficiency, diagnostics, and/or analysis of surveillance data.
Wildlife population monitoring	Conduct population monitoring in areas currently affected by disease or at risk of disease emergence; monitor for mortality events that might indicate a disease outbreak. Encourage public engagement to monitor for unusual mortality events.

Table 26. Infectious diseases identified as potential threats to Montana’s SGCN. We conducted a literature review and synthesis of the diseases that affected SGCN and were considered the most impactful by wildlife disease experts (marked with an asterisk). Diseases are organized by pathogen type.

Disease (and associated terms)	Pathogen name(s)	Taxa affected
Bacterial		
Botulism*	<i>Clostridium botulinum</i>	Avian; mammal
Avian salmonellosis*	<i>Salmonella enterica</i>	Avian; mammal
Sylvatic plague*	<i>Yersinia pestis</i>	Mammal
Tularemia* (rabbit fever)	<i>Francisella tularensis</i>	Mammal
Bacterial kidney disease*	<i>Renibacterium salmonarium</i>	Fish
Avian cholera*	<i>Pasteurella multocida</i>	Avian
Bacterial coldwater disease	<i>Flavobacterium psychrophilum</i>	Fish
Columnaris (cottonmouth)	<i>Flavobacterium columnare</i>	Fish
House finch eye disease (Mycoplasmal conjunctivitis)	<i>Mycoplasma gallisepticum</i>	Avian
Tuberculosis	<i>Mycobacterium spp.</i>	Avian; fish; mammal
Furunculosis	<i>Aeromonas salmonicida</i>	Fish
Clostridiosis	<i>Clostridium spp.</i>	Avian
Brucellosis	<i>Brucella abortus</i>	Mammal
Anthrax	<i>Bacillus anthracis</i>	Mammal

Fungal

Chytridiomycosis* (amphibian chytrid fungus)	<i>Batrachochytrium dendrobatidis</i>	Amphibian
White-nose syndrome*	<i>Pseudogymnoascus destructans</i>	Mammal
Snake fungal disease*	<i>Ophidiomyces ophiodiicola</i>	Reptile
Salamander chytridiomycosis* (salamander chytrid fungus)	<i>Batrachochytrium salamandrivorans</i>	Amphibian
Aspergillosis	<i>Aspergillus spp.</i>	Avian
Saprolegniosis (water molds)	Multiple (<i>Saprolegnia</i> , <i>Achyla</i> , <i>Leptolegnia</i> and <i>Aphanomyces spp.</i>)	Amphibian; fish
Heterosporosis	<i>Heterosporis spp.</i>	Fish

Viral

West Nile virus*	West Nile Virus	Avian; mammal
Highly pathogenic avian influenza*	H5N1	Avian; mammal
Canine distemper*	<i>Morbillivirus canis</i>	Mammal
Iridovirus diseases* (including ranaviruses)	Multiple (Sturgeon Iridovirus, Missouri River Sturgeon Iridovirus, Ambystoma Tigrinum Virus, Frog Virus 3, Largemouth Bass Virus)	Fish; amphibian; reptile
Rabbit hemorrhagic disease*	Rabbit Hemorrhagic Disease Virus	Mammal
Viral hemorrhagic septicemia*	Viral Hemorrhagic Septicemia Virus	Fish
Infectious hematopoietic necrosis	Infectious Hematopoietic Necrosis Virus	Fish
Infectious pancreatic necrosis	Infectious Pancreatic Necrosis Virus	Fish
Avian pox	Avipoxvirus	Avian
Avian Avulaviruses (Newcastle disease, paramyxoviruses)	Avian avulavirus-1, Pigeon paramyxovirus	Avian
Eastern equine encephalitis	Eastern Equine Encephalitis Virus	Avian; mammal
Rabies	Rabies virus	Mammal
Severe acute respiratory syndrome	SARS-CoV-2 and other coronaviruses	Mammal; avian
Inclusion body disease/hepatitis	Columbid Herpesvirus-1, pigeon herpesvirus	Avian
Bovine viral diarrhea	Bovine Viral Diarrhea Virus	Mammal
Feline viral diseases (multiple)	Feline Leukemia Virus, Feline Immunodeficiency Virus, Feline Panleukopenia Virus	Mammal

Flavivirus diseases (multiple)	<i>Flavivirus spp.</i>	Avian; Mammal

Other (arthropod, protozoan, trematode, and myxozoan parasites and prions)

Whirling disease*	<i>Myxobolus cerebralis</i>	Fish
Proliferative kidney disease*	<i>Tetracapsuloides bryosalmonae</i>	Fish
Avian trematodiasis*	<i>Cyathocotyle bushiensis</i> , <i>Sphaeridiotrema globulus</i> , <i>Sphaeridiotrema pseudoglobulus</i> , and <i>Leyogonimus polyoon</i>	Avian
Sarcoptic mange (scabies)	<i>Sarcoptes scabiei</i>	Mammal
Chronic wasting disease	Chronic wasting disease	Mammal
Trichomoniasis	<i>Trichomonas gallinae</i>	Avian
Toxoplasmosis	<i>Toxoplasma gondii</i>	Avian
Sarcocystosis (e.g., rice breast disease)	<i>Sarcocystis spp.</i>	Avian; mammal
Nanophyetiasis (e.g., salmon poisoning disease)	<i>Nanophyetus spp.</i>	Amphibian; fish; mammals
Ulcerative dermal necrosis	Unknown disease agent	Fish

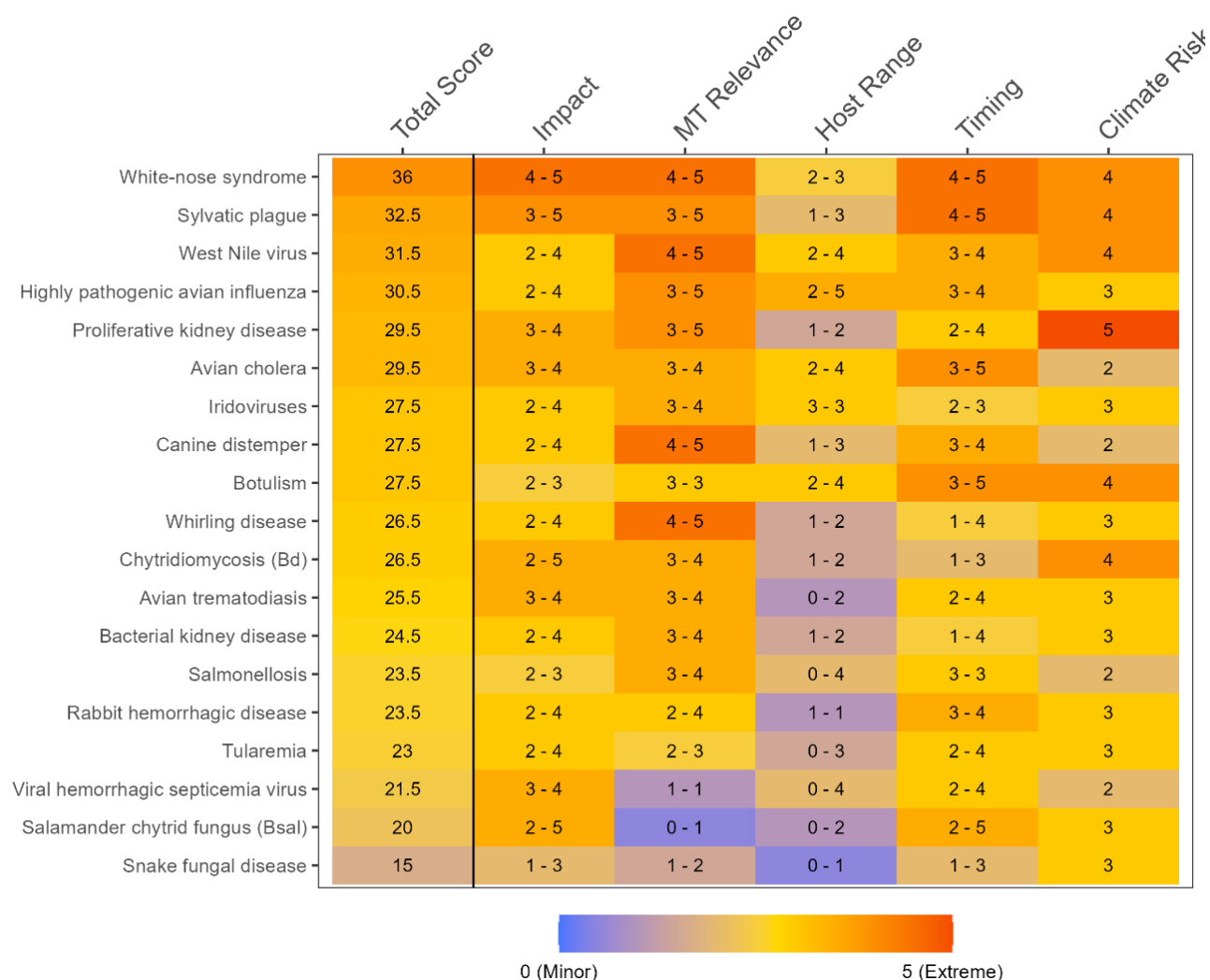


Figure 2. Ranking of wildlife disease threats for Montana’s SGCN, ordered from highest (top) to lowest threat (bottom). Number ranges are given where there was uncertainty. Diseases could receive a final score between 9 and 45.

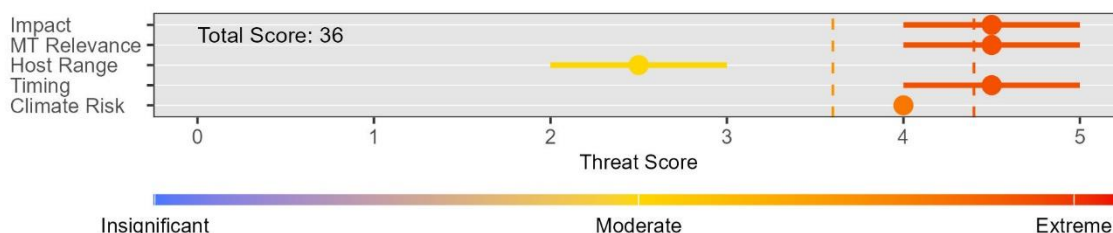
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9.4 Wildlife Disease Profiles

White-nose Syndrome



SGCN with Known Impacts^{1,2}

Little Brown Myotis
Northern Myotis
Yuma Myotis
Fringed Myotis
Long-eared Myotis
Long-legged Myotis

SGCN Susceptible to Infection¹²

Eastern Red Bat
Pallid Bat
Silver-haired Bat
Townsend's Big-eared Bat

Other Susceptible Montana Species^{1,2}

Big Brown Bat*
California Myotis
Western Small-footed Myotis

*Susceptible to WNS with known impacts

Drivers

- Hibernation conditions (temperature, humidity)²
- Roosting and social behavior²
- Fungal load and prevalence³
- Colony size²⁻⁴
- Species composition within hibernacula²
- Anthropogenic activities (e.g., cave visitation)²⁻⁴

Background

White-nose syndrome (WNS) is a fungal skin disease of hibernating bats that has had devastating impacts since its North American emergence in New York in 2006⁴. It is caused by the fungus *Pseudogymnoascus destructans* (Pd), which infects bats during fall and winter months. Bats are exposed through direct contact with contaminated surfaces or other infected bats². Infection leads to increases in arousal frequency during hibernation and physiological stress, which result in dehydration, starvation, and frequently, death. If infected bats survive to spring emergence, they may later die of severe inflammation associated with disease impacts, further contributing to population declines⁴. Peak transmission occurs in late autumn or early winter as bats return to infected hibernacula and come into contact with one another³; as disease progresses, mortality rates and overall prevalence are usually highest by the end of winter. Roosting behavior, hibernaculum conditions (e.g., temperature, humidity), and species-specific tolerance are key factors that influence which bat populations are most at risk from WNS². Body

condition also plays a role, as bats with increased body mass appear better able to survive infection⁵.

Impacts

WNS has caused severe population declines and near-extirpations of bat populations, particularly in *Myotis* and *Perimyotis* species and in populations located in the eastern U.S. and Canada. Scientists estimate that infected bat populations have decreased by 30 percent to 99 percent annually, with some species having an overall estimated population decline of 90 percent^{2,5}. As of 2025, Pd is confirmed in 40 U.S. states and 9 Canadian provinces⁶. Seven of Montana's 15 bat species are known to be susceptible to WNS, in addition to six species in which Pd has been detected without evidence of clinical disease⁷. It is suspected that some of these species may serve as vectors for disease¹. While the risk that WNS poses to western bat populations is clear, differences in species ecology may alter disease severity and risk of major declines. Such factors include reduced aggregation, alternative hibernacula selection (fewer caves or mines), shorter seasonal migrations, and colder hibernacula with increased temperature fluctuation⁹. However, substantial information gaps still exist for these factors and their influence on WNS's impact to western bat populations.

Presence in Montana

- The first detection of Pd in Montana occurred in the spring of 2020, followed by detection of WNS in spring of 2021. Both occurred in eastern Montana¹.
- Between 2021 to 2022, Azure Cave (Phillips County) experienced a 98 percent population decline in its hibernating little brown myotis colony due to WNS⁸.
- As of 2024 state-wide monitoring efforts, Pd and WNS have been detected in the central and eastern portions of the state. It has yet to be detected in regions west of the Continental Divide¹.
- Pd and WNS have been confirmed in the three largest remaining winter *Myotis* colonies in the state: Lick Creek Cave, Cascade County (Pd in 2023, WNS in 2024); Mystery Cave, Carbon County (Pd and WNS in 2023); and Whitaker Sink, Judith Basin County (Pd and WNS in 2024). It is predicted that these hibernacula will experience significant disease-induced declines in the next one to two years¹.
- Acoustic surveillance data from 2020 to 2022 suggests that WNS is causing detectable population declines in the eastern half of the state, which is consistent with observed declines reported by field staff in affected counties¹.

Climate Sensitivity

Because Pd is a fungal pathogen, WNS prevalence and severity are closely tied with environmental conditions. The growth temperature range for Pd is less than 68 degrees F (ideal range is 41 to 57 degrees F). However, evidence exists that infectious spores may be viable up to 98 degrees F, allowing for increased dispersal opportunities¹⁰. The theorized

impacts of climate variability on WNS are mixed. Warmer, longer autumns may allow for increased fat accumulation for bats pre-hibernation (improving survival rates), while increased temperature variability during winter may lead to increased arousals and energy expenditure or alter hibernacula microclimates that either favor or reduce Pd growth^{11,12}. Finally, effects of future climatic shifts, especially increased drought conditions in the west, are predicted to pose significant challenges to overall bat population health, impacting reproduction, range restrictions, and survival¹³.

Conservation Actions

Prevention

- Restrict access and/or advise public to avoid hibernacula during hibernation (October through May) to minimize disturbance and prevent spread of Pd^{14,15}.
- Promote adherence to the [National White-nose Syndrome Decontamination Protocol](#) for all relevant audiences (e.g., researchers, cavers, etc.)⁶.

Disease Management

- Explore methods to reduce prevalence of Pd in infected hibernacula (e.g., fungicides, sterilization techniques)^{14,15}.
- Participate in WNS vaccination research efforts and consider vaccination in vulnerable Montana bat populations¹⁶.

Species and Habitat Management

- Implement actions that promote bat health and improve adaptive capacity for disease, such as providing heated bat boxes, protecting or enhancing key habitats, preventing disturbance during hibernation, providing supplemental feed to improve bat body condition⁵, or applying topical probiotics in roosting areas^{14,15}.
- Support FWP's work in leading the development of Montana's Bat Conservation and Management Plan¹.
- Support overall bat population health by addressing other sources of population decline (e.g., improper building exclusions, habitat loss, wind energy, impacts of climate change, etc.) via education, Best Management Practices, Standard Operating Procedures, and other recommendations^{14,15}.

Surveillance and Monitoring

- Continue implementing and advancing the multimodal NABat monitoring framework (e.g., acoustics, colony counts, capture data) as it applies to Montana FWP's *WNS and Pd Surveillance and Monitoring*¹.
- Utilize methods from the National Wildlife Health Center's *Model Guided Surveillance*¹.

- Continue developing the “Bat Acoustic Call Library” (acoustic recordings of echolocation sequences from known species) to improve detection of species-specific population changes⁶.

Research/Knowledge Gaps

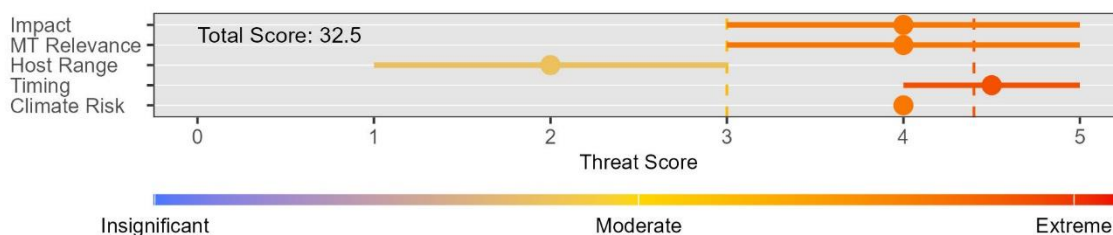
- Susceptibility and survival rates for Montana bat species and species-specific WNS epidemiology¹⁴, including sublethal effects and impacts on reproductive success
- Research on the adaptive capacities of bat populations that allow for recovery and persistence in the presence of Pd
- Improved knowledge on hibernacula selection and overwintering and migratory behavior of Montana bats, including important non-cave hibernacula within the state
- Understanding of fungal and disease dynamics and species behavior in non-cave hibernacula (e.g., talus, cliffs, and rock outcrops)
- Forecasts of WNS dynamics for Montana or the western U.S., and the use of bat migration and dispersal information in such forecasts

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Sylvatic Plague



SGCN with Known Impacts^{1,2}

Black-footed Ferret
White-tailed Prairie Dog
Black-tailed Prairie Dog
Canada Lynx

SGCN Susceptible to Infection³

Wolverine
Grizzly Bear
Swift Fox

SGCN Potentially Susceptible

SGCN rodent or rabbit/hare species living near prairie dogs

Other Susceptible Montana Species^{2,3}

Felids (lynx, mountain lion, bobcat)
Rodents, shrews
Canids (fox, coyote, wolf)
Other mustelids (badgers, weasels)
Rabbits, skunks, raccoons, badgers
Ungulates (pronghorn, elk, bison, etc.)

Drivers

- Flea abundance and host preferences^{4,5}
- Prairie dog colony size and connectivity^{4,5}
- Seasonal and climatic conditions (temperature, precipitation)^{4,5}

Background

Yersinia pestis is a bacterium and the causative agent of plague, a major disease of both humans and animals. Sylvatic plague (the disease affecting wildlife) causes severe, periodic episodes of high mortality (>90 percent) in certain species of rodents and black-footed ferrets. Fleas serve as the primary vectors of *Y. pestis*, and rodent communities can help maintain high densities of fleas, thus plague dynamics are strongly influenced by the distribution and abundance of rodent and flea communities⁴. A wide range of wildlife species are susceptible to plague, and individuals become infected through flea bites or exposure to infected rodents (via direct contact, ingestion, or inhalation of aerosolized bacteria)⁵. Susceptibility to clinical disease and death varies among species, with mortality typically resulting from the rapid spread of bacteria throughout the bloodstream, leading to shock and organ failure. Generally, felids, lagomorphs, certain rodents, and mustelids (particularly black-footed ferrets) are susceptible to severe disease, while other taxa, like canids, badgers, weasels, bears, and even ungulates, may become infected but are typically resistant to disease and may play an important role in spreading it to new areas^{3,5}.

Impacts

Prairie dogs and black-footed ferrets are most severely impacted by sylvatic plague, although other populations such as chipmunks and ground squirrels may occasionally be impacted. In prairie dog colonies, disease tends to shift between enzootic and epizootic phases. Epizootic phases involve rapid, large-scale die-offs, in which complete colony extirpations often occur⁶. Enzootic phases occur when *Y. pestis* is maintained at low levels in the environment, usually through transmission between relatively resistant small mammal hosts (e.g., deer mice and voles) and their fleas, without causing widespread mortality⁷. For black-footed ferrets and prairie dogs, without major interventions (e.g., vaccination, insecticides), infection is almost always fatal, with individuals usually succumbing to the disease within three to four days. Odds of survival for black-footed ferrets are further reduced by loss of their primary prey base (prairie dogs) during epizootics. Plague's impact is also felt not only on the level of individual species but across ecosystems. The burden of disease reduces prairie dogs' ability to fulfill their ecological role as ecosystem engineers, threatening the conservation of other species such as predators and grassland SGCN birds, like burrowing owls, mountain plovers, and chestnut-collared longspurs^{8,9}.

Presence in Montana

- In spring of 2025, a mountain lion in Beaverhead County was confirmed to have died from plague (Jennifer Ramsey, Montana Fish, Wildlife & Parks, pers. comm.).
- USDA Animal and Plant Health Inspection Service (APHIS) Wildlife Services surveillance indicates that *Y. pestis* is widespread across Montana³. Based on data taken since 1970, *Y. pestis* has been identified in either an animal or flea sample in almost all counties in Montana¹⁰.
- Plague management (e.g., insecticide, vaccination) efforts occur at all black-footed ferret reintroduction sites in Montana (UL Bend National Wildlife Refuge, Ft. Belknap Reservation, and Crow Reservation).

Climate Sensitivity

Data from outbreaks suggest that climate may have a significant influence on plague cycles¹¹⁻¹³. In the U.S., plague tends to occur in semi-arid regions of the west, with epizootics most frequently observed in mid to late summer when fleas are most abundant. Wet summers, moderate temperatures and moisture tend to favor increased rodent activity and provide favorable conditions for flea hatching, contributing to increased potential for epizootics^{11,14,15}. Extended periods of hot, dry conditions can reduce both flea and *Y. pestis* survival, but the pathogen may be able to persist under the protection of cooler underground burrows¹¹. Under future climates, longer, warmer summers and increased fluctuations in precipitation are expected to occur, which may extend the transmission season for plague and allow increased opportunity for outbreaks. In some instances,

extended drought periods may limit plague activity but will also lead to stress in host populations, leaving them more susceptible to disease. Altogether, due to the complexity of drivers of plague dynamics, the relationship between climate and plague still remains poorly understood and in need of further investigation.

Conservation Actions

Prevention

- Consider use of insecticides (e.g., deltamethrin dust¹⁶, fipronil-treated grain¹⁷, and fipronil bait pellets¹⁸) for flea control in prairie dog colonies, but make sure decisions regarding application integrate information on product's durability, weather conditions, and the life cycle/ecology of both hosts and vectors¹⁶⁻¹⁸.
- Continue to vaccinate captive black-footed ferrets and consider continued vaccination in released and wild-born ferrets⁶.
- Develop an integrated plague management plan based on current and future needs, goals, and available resources.

Disease Management

- In the event of plague outbreaks, consider wider application of insecticides (especially burrow dusting), but be aware of the risk of developing resistance in flea vectors^{17,19-21} and potential impact on non-target species¹⁹⁻²¹.
- Vaccination of prairie dogs (i.e., with oral baits) can be used for partial protection, and benefits may accumulate over time. If vaccination is chosen, consider appropriate timing, the likely vaccination rate, and combining it with other strategies²².
- Be aware that, while prairie dog colony control measures may reduce rodent abundance, they can also worsen outbreaks⁷.

Species and Habitat Management

- Develop public campaigns or messaging to advertise prairie dogs' importance to the environment and their role as a keystone species and need for conservation.
- Protect key prairie dog habitats and colonies, including through supporting programs that promote coexistence between private landowners and prairie dog ecosystem conservation¹⁹⁻²¹.

Surveillance and Monitoring

- Conduct serologic screening in species of interest (e.g., rodents, carnivores) to help determine disease foci and potential trends in plague activity¹⁹⁻²¹.

- Monitor for other indicators of plague activity, such as decline in active prairie dog colony area, decline in prairie dog abundance, presence of carcasses, and burrow abandonment¹⁹⁻²¹.
- Monitor flea species type and abundance in prairie dog colonies and other nearby rodents. If the number of fleas per prairie dog trend upwards, this may signal an increased risk of a disease outbreak¹⁹⁻²¹.

Research/Knowledge Gaps

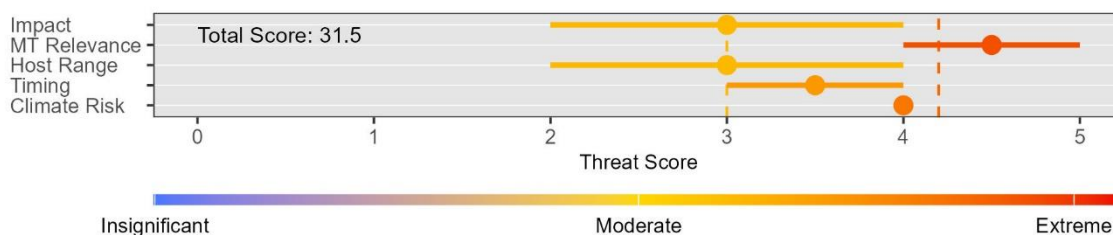
- Alternative insecticide options that mitigate drug resistance
- Reservoirs and persistence of *Y. pestis* in the environment and further investigation into triggers for shifts from enzootic to epizootic phases

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West Nile Virus



SGCN with Known Impacts¹

Greater Sage-Grouse

SGCN Susceptible to Infection²

American White Pelican	Golden Eagle
Black-crowned Night Heron	Great Blue Heron
Bobolink	Great Gray Owl
Boreal Owl	Least Tern
Burrowing Owl	Lewis's Woodpecker
Caspian Tern	Loggerhead Shrike
Cassin's Finch	Northern Hawk-Owl
Chimney Swift	Pinyon Jay
Clark's Grebe	Piping Plover
Clark's Nutcracker	Red-headed Woodpecker
Common Loon	Tennessee Warbler
Eastern Screech Owl	Varied Thrush
Evening Grosbeak	Western Screech Owl
Ferruginous Hawk	Whooping Crane
Flammulated Owl	Yellow-billed Cuckoo

SGCN Potentially Susceptible

Remainder of SGCN bird species should be considered potentially susceptible

Other Susceptible Montana Species³⁻⁵

Birds from families Corvidae, Icteridae, Fringillidae, Passeridae, Turdidae, Strigidae, Accipitridae, Falconidae, and Laridae tend to be the most susceptible to infection, but infection may still occur in birds outside these families.

Drivers

- WNV-infectious mosquito abundance and their host feeding preference³
- Presence of susceptible avian hosts³
- Climate and seasonality⁶

Background

West Nile virus (WNV) is a mosquito-borne disease that affects birds and some mammals. It is primarily transmitted by mosquitoes in the genus *Culex* with *C. tarsalis* being the vector of main concern in the western U.S. The virus is known to infect over 300 species of birds in North America, leading to high fatality rates and population declines in some species^{1,7,8}. The disease is propagated through a transmission cycle involving infected birds and mosquitoes. Horses and humans occasionally become infected but are considered dead-

end hosts because they do not transmit the virus back to feeding mosquitos. Some birds (e.g., the American robin) play a larger role in the spread of WNV because they are better at passing the virus to mosquitos than other bird species⁹. WNV causes neurologic disease in both birds and mammals. Birds that succumb to disease typically die within a few days to a few weeks following infection, while surviving birds can have long-lasting immunity to the virus¹⁰.

Impacts

WNV has caused significant mortality and been linked to population declines in multiple avian species. Most notably, greater sage-grouse have demonstrated a high susceptibility to WNV, marked by substantial mortality, reduced survival rates, and limited resistance^{1,11,12}. Other species of birds, such as corvids, thrushes, and raptors, have demonstrated significant mortality or population declines as a result of WNV, though some populations appear to have developed resistance to the disease^{4,7}. Future impacts of WNV on wildlife will be driven by WNV-prevalence in vectors, overall vector abundance and distribution, and climate. Many of the species that are affected by WNV are also involved with important ecological processes, such as scavenging of carcasses, seed dispersal, and control of insect pests, suggesting secondary, ecosystem-level impacts are possible with increased WNV spread and severity⁷.

Presence in Montana

- WNV has been associated with multiple, large-scale die offs in mixed avian populations (e.g., variety of waterfowl, crows, and American white pelicans) in Montana over the last two decades¹³.
- The most recent report to the U.S. Geological Survey (USGS) WHISPers database occurred in 2016 at the Bowdoin National Wildlife Refuge, where both WNV and botulism type C were isolated from dead birds¹³. Other reports of avian mortality in Montana describe WNV as either a confirmed or suspected diagnosis. These reports tend to occur in populations of waterfowl where other diseases (e.g., botulism type C, salmonellosis, and avian cholera) are of concern and sometimes diagnosed in conjunction with WNV.
- Greater sage-grouse in southern Phillips County have experienced WNV-associated mortality and impacts since its emergence in the area in 2003¹.

Climate Sensitivity

Warming temperatures and changes to precipitation are predicted to have significant impact on WNV distribution and timing, likely resulting in increased disease occurrence¹⁴. Milder winters and longer warm seasons lengthen and intensify the mosquito breeding season, providing more opportunity for contact with bird hosts and disease amplification. As habitat generalists, mosquitos are also often tolerant to drought conditions and have

even demonstrated population surges as a response to drought due to its negative impact on mosquito larvae predators (e.g., fish, other aquatic insects)¹⁵. Evidence already exists that milder winters have allowed for overwintering of the virus in mosquito populations, allowing for earlier spread and infection to wildlife¹⁶. Due to the virus's capacity to infect a wide range of avian hosts combined with mosquitos' general durability, WNV is expected to withstand extreme shifts in climate and potentially lead to an increase in the number of outbreaks.

Conservation Actions

Prevention

- Develop integrated pest management plans for vector control in collaboration with state public health agencies⁶.
- Engage with landowners or managers of wetlands to develop protocols or strategies for minimizing suitable habitat for virus-carrying mosquitos³.

Disease Management

- During outbreaks, continue to reduce mosquito abundance and larval habitat to minimize risk of WNV transmission (e.g., reduction of stagnant water, use of chemical or biological pesticides)^{3,6,16,17}.
- Consider vaccination against WNV in highly vulnerable species⁶.

Species and Habitat Management

- Locate and preserve key roosting sites for susceptible bird species as communal roosting may reduce WNV impact by reducing the number of mosquitos feeding per bird¹⁸.
- Consider strategies to prevent other avian diseases (e.g., avian cholera, botulism, etc.) to reduce cumulative host stress¹⁷.

Surveillance and Monitoring

- Conduct avian serosurveys to understand potential distribution of WNV and what populations are vulnerable^{11,6,14}.
- Monitor mosquito populations and WNV prevalence in vectors⁶.
- Develop public education campaigns to promote awareness about WNV transmission cycle and impacts to birds, and to monitor for unusual deaths in wildlife.

Research/Knowledge Gaps

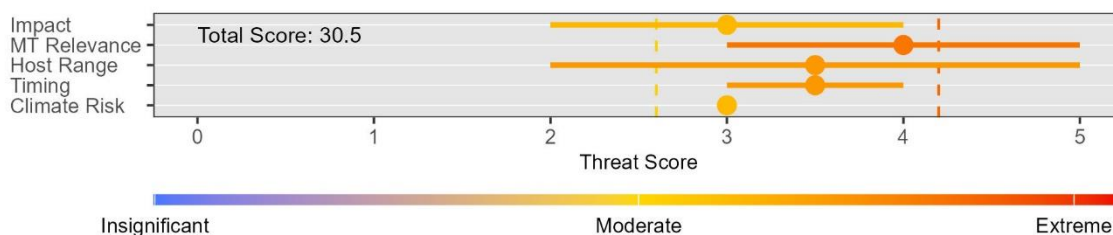
- Mosquito feeding patterns in Montana that influence relative risk among avian species
- Improved understanding of susceptibility at the individual and taxonomic level

- Impacts of WNV in Montana and changes in species susceptibility or virulence over time
- Indirect ecosystem-level impacts of WNV in Montana
- Identification of high-risk areas for WNV based on environmental conditions, vector, and host abundance^{3,6,16,17}

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Highly Pathogenic Avian Influenza



SGCN with Known Impacts^{1,2}

Caspian Tern

SGCN Susceptible to Infection^{1,2}

Grizzly Bear

American White Pelican

Black-crowned Night Heron

Common Loon

Ferruginous Hawk

Forster's Tern

Franklin's Gull

Golden Eagle

Great Blue Heron

Great Grey Owl

Greater Sage Grouse

Horned Grebe

Trumpeter Swan

SGCN Potentially Susceptible^{1,2}

Least Tern

Whooping Crane

Harlequin Duck

Piping Plover

Other bird and mammal species, particularly those in contact with water or waterfowl

Other Susceptible Montana Species^{1,2}

Over 100 of Montana's bird and mammal species can be infected with HPAI.

Drivers

- Mixing of populations at wetland habitats³
- Habitat location relative to migratory pathways⁴
- Contact with poultry⁵
- Seasonality^{6,7}

Background

Highly pathogenic avian influenza (HPAI) is caused by strains of the avian influenza (AI) virus that are highly transmissible and cause particularly severe diseases. Outbreaks of HPAI have been associated with mass mortalities in wild birds, mammals, and domestic poultry^{1,5,8}. HPAI is an emerging disease in the United States, with the first observations in North American wild birds occurring in 2021^{5,9}, and information on HPAI is rapidly changing as research and surveillance efforts grow⁶. The virus is transmitted through direct contact, aerosols, contaminated water, and surfaces, and infected birds often shed virus in their feces¹⁰. Influenza viruses can remain infectious in waterbodies for several months after

shedding^{10, 11}. Symptoms of infection include respiratory distress and neurological signs (lethargy, lack of coordination, seizures)^{8, 10}. Hundreds of wild bird species and many mammals can be infected with HPAI¹. Waterfowl and shorebirds are commonly infected with the virus but may or may not develop severe disease symptoms⁵. Other wild birds, including raptors, may contract HPAI by consuming infected waterfowl or through contact with contaminated waterbodies⁶. Wild mammals, particularly scavengers, may also be affected^{6, 8}. Outbreaks typically coincide with migration, with deaths peaking in spring and fall, and are facilitated by mixing of birds at wetland sites^{3, 4, 6, 7}. There are many different strains of avian influenza, and they evolve rapidly, meaning that even mild strains have the potential to mutate into highly pathogenic strains¹¹. This complicates vaccine development and the likelihood for populations to develop immunity¹¹.

Impacts

Outbreaks of HPAI have caused large mortality events in wild birds across the globe, affecting thousands of individuals in some cases⁶. Economic impacts of HPAI (i.e., in dairy cattle and poultry production) can be highly consequential and have received more attention than effects on wild populations⁵. However, HPAI is considered a threat to wild birds that are listed as threatened or endangered. Species with colonial nesting behaviors can be particularly at risk; for instance, the Caspian tern has suffered population declines in excess of 50 percent during a single season⁶. Given the relatively recent spread of HPAI within wild birds of the United States, the diversity of strains, and the rapid evolution of the virus, there are still substantial uncertainties regarding the long-term and population-level impacts of HPAI.

Presence in Montana

- HPAI is found throughout Montana, having been detected in at least 40 species of wild birds in Montana across 20 counties¹²⁻¹⁴. Montana FWP tests suspected cases where deemed warranted (e.g., where multiple birds are found dead or where human exposure occurs)¹⁴.
- In Montana, the most commonly reported species with HPAI are mallards, Canada geese, great horned owls, red-tailed hawks, American wigeons, and blue-winged and green-winged teals².
- Mortality from HPAI has been observed in Montana's wild birds, including hundreds of individuals during a 2022 outbreak^{12, 13}. Mass mortality events affecting thousands of wild birds have been observed in neighboring states (North Dakota, South Dakota)¹³.
- HPAI has been detected in wild mammals in Montana, including grizzly bears, mountain lions, red foxes, striped skunks, and raccoons. This includes cases where individuals were thought to have died due to HPAI or cases where animals suffered clinical signs and died of secondary causes^{12, 14}.

Climate Sensitivity

The spread, impact, and evolution of HPAI may be sensitive to aspects of climate variability. Migration is an important factor driving the long-distance spread of new strains, and aspects of migration (timing, number of individuals, migratory locations) are sensitive to climate factors¹⁵. Changes in migration patterns may bring new populations of wild birds in contact with one another, or with agricultural species, leading to the introduction and mixing (i.e., evolution) of new strains¹⁵. However, warmer conditions under future climates may also extend breeding seasons, improve individual fitness during migration, and lead to higher capacity to fight infection¹⁵. Warmer temperatures and freeze-thaw events can also reduce viral persistence in the environment¹⁶. Thus, the net effect of changing climate conditions for HPAI risk in Montana is still uncertain.

Conservation Actions

Prevention

- Work with agricultural producers to limit contact between wild and domestic birds⁵.

Disease Management

- Avoid concentrating wildlife around bait or other attractants during outbreaks⁵.
- Limit nonessential banding, capturing, or other efforts during active outbreaks⁵.
- Alert public of active disease outbreaks to help mitigate additional disturbance or risk to humans.

Species and Habitat Management

- Consider methods to manipulate waterbodies (e.g., pH, temperature, salinity, water levels) to facilitate viral inactivation¹⁶.

Surveillance and Monitoring

- Encourage the public to report cases of sickness and death in wild birds, and consider citizen science platforms to facilitate reporting¹⁷.
- Be aware of and investigate mortality events that may indicate HPAI: (1) those involving waterfowl, (2) a mortality event affecting more than five individuals at a given time, (3) mortalities affecting scavengers and raptors, (4) mortalities involving neurological signs, acute death, or respiratory symptoms¹². Consulting decision-making tools related to avian mortality may be particularly useful¹⁸.
- Participate in national surveillance programs and keep up to date on current distributions and develop protocols for consistent reporting and saving of HPAI data in Montana wildlife¹⁹.
- Conduct environmental surveillance at important aquatic sites (i.e., analysis of fecal material or collection of environmental DNA)¹⁹.

Research/Knowledge Gaps

- Shifts in the behaviors of migratory birds within Montana with climate factors
- Viral presence in aquatic habitats important to Montana's SGCN and the influence of climate and habitat features (e.g., waterbody size, water chemistry, presence of filter feeders) on viral presence and stability
- Efficacy of management actions such as carcass removal in reducing disease risk

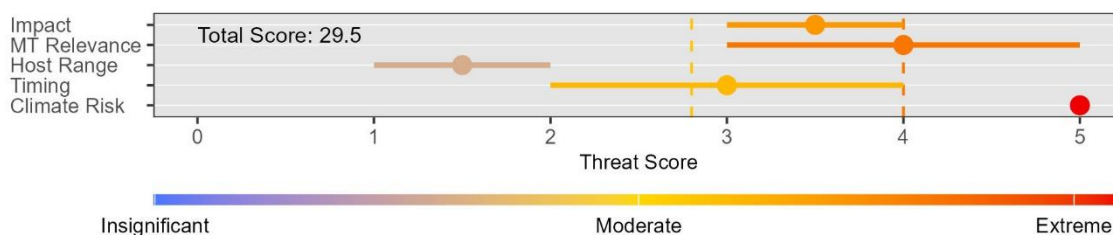
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DRAFT

Proliferative Kidney Disease



SGCN with Known Impacts¹

Cutthroat Trout

SGCN Susceptible to Infection

To date, no additional SGCN confirmed as susceptible

SGCN Potentially Susceptible

Arctic Grayling

Columbia River Redband Trout

Bull Trout

Pygmy Whitefish

Lake Trout

Other Susceptible Montana Species²

Mountain Whitefish

Rainbow Trout

Brown Trout

Brook Trout*

*Susceptible to infection without evidence of clinical disease³

Drivers

- Presence and abundance of bryozoans³
- Water temperature and quality (eutrophication)^{4,5}
- Mechanical vectors (e.g., waterfowl and other fish species transporting *T. bryosalmonae* to new locations)⁶

Background

Proliferative kidney disease (PKD) is an infectious disease of salmonid fish caused by the parasite *Tetracapsuloides bryosalmonae*. This parasite has a complex life cycle in which it alternates between fish and secondary host species, bryozoans (a class of freshwater, filter-feeding invertebrates). Bryozoans release infectious *T. bryosalmonae* spores, which are spread throughout waterbodies where they may infect susceptible fish species. Some fish species appear more tolerant than others, and generally fish are considered to be either intermediate or accidental hosts for *T. bryosalmonae* (depending on the species)³. Once fish are infected, the parasite may spread through the blood stream, where it invades and proliferates within the kidneys and can cause impaired function. Fish transmit *T. bryosalmonae* back to bryozoan colonies through urinary excretions. Frequently, fish are infected with the parasite without showing evidence of disease. However, if disease progresses, outward clinical signs are characterized by pale gills, lethargy, abdominal swelling, and bulging eyes¹. PKD outbreaks are most likely to occur in late summer once bryozoan colonies, spore shedding, and infections have had adequate time to proliferate in the warmer months^{3,7}. Fish that survive exposure to *T. bryosalmonae* are likely to develop immunity or tolerance to the parasite. Disease signs can be reduced, allowing fish an

opportunity for recovery, when water temperatures are below optimal range for *T. bryosalmonae* (59 degrees F)³.

Impacts

PKD has caused multiple, large-scale die-offs in free-ranging fish throughout western North America and Europe^{2,3,8}. Surveys indicate that the parasite is often widely distributed and highly prevalent in fish populations^{2,7}. Disease tends to be worse in younger fish, with one report citing a 90 percent loss in abundance of young-of-the-year brown trout in PKD-affected streams⁹. Outbreaks, disease severity, and mortality risk are primarily temperature-dependent and are exacerbated in warming water conditions⁵. In some cases, PKD may not be the direct cause of fish mortality but can contribute to lower fitness and exacerbate declines in populations affected by pollution, low-oxygenated waters, secondary pathogens, or other stressors⁷.

Presence in Montana

- The first recorded outbreak of PKD in free-ranging fish in North America occurred in Montana at Middle Creek Reservoir in the summers of 1990 and 1991, causing considerable mortality in Yellowstone cutthroat trout¹.
- A large-scale mortality event occurred in late summer of 2016 on the Yellowstone River, in which tens of thousands of mountain whitefish died as a result of PKD, initiating an unprecedented closure of over 180 miles of the Yellowstone River².
- Recent surveillance efforts in Montana demonstrate that *T. bryosalmonae* is widely distributed across watersheds in the central and western parts of the state², and it is likely to occur wherever suitable habitat for bryozoans exists (K. Staigmillier, Montana Fish, Wildlife & Parks, pers. comm.). During surveillance efforts, wild-caught fish routinely test positive for exposure to *T. bryosalmonae* DNA (J. Veilleux, USFWS, pers. comm.), suggesting the potential for high infection prevalence in Montana fish populations.

Climate Sensitivity

The emergence and impacts of PKD have been directly linked to warming temperatures and shifting environmental conditions^{3,5,7,8}. Warming waters and changes in precipitation patterns in the Northern hemisphere have led to an increase in PKD outbreaks and disease severity^{7,8}. Clinical PKD is known to occur when water temperatures exceed 59 degrees F (15 degrees C) for several weeks or longer, which promotes the release of *T. bryosalmonae* spores and the proliferation of bryozoan colonies. Importantly, warming waters also lead to increased stress and immunosuppression in fish overall, and when combined with reduced or altered water flows, such as those resulting from drought, fish suffer habitat loss and increased exposure to infected bryozoans. In Montana, severe outbreaks have been

preceded by multiple years of unusually warm summers, low water flows, and mild winters².

Conservation Actions

Prevention

- Continue routine screening for *T. bryosalmonae* in hatchery stock and avoid stocking (when possible) to prevent the spread of disease, especially in waterways in which *T. bryosalmonae* has not been detected⁷.
- Inform anglers and water recreation users about the risks and transmission routes of PKD (contaminated gear/boats, fish transport) and enforce aquatic biosecurity protocols.
- Conserve water and avoid low flows during high-risk years to reduce outbreak potential⁷.
- Implement habitat modifications to decrease colonization of bryozoans, such as encouraging turbulent water flow and reducing algal growth⁷.

Disease management

- Be aware of the effects of climate variability on PKD impacts and incorporate information on climatic trends into decision-making processes for disease management^{5,7}.
- If severe outbreaks occur, consider conservation stocking methods (e.g., developing PKD-resistant or temperature-resilient native fish stock) to restore imperiled populations⁷.

Species and Habitat Management

- Implement fishing closures as needed when high water temperatures and/or low water flows occur to reduce fish stress⁷.
- Maintain water quality, reduce pollution and runoff, and support habitat restoration and climate adaptation projects to promote overall fish health and resilience^{4,5,7}.
- Promote habitat connectivity to encourage natural selection, improve adaptive capacity, and provide fish species the opportunity to migrate to cooler waters⁷.

Surveillance and Monitoring

- Support and advance the use of noninvasive surveillance technologies such as environmental DNA (eDNA) to monitor *T. bryosalmonae* and bryozoan colonies².
- Monitor water quality regularly on high-risk waterbodies (e.g., areas where fish die-offs have occurred, areas that support infected bryozoan colonies, etc.)^{4,7}.

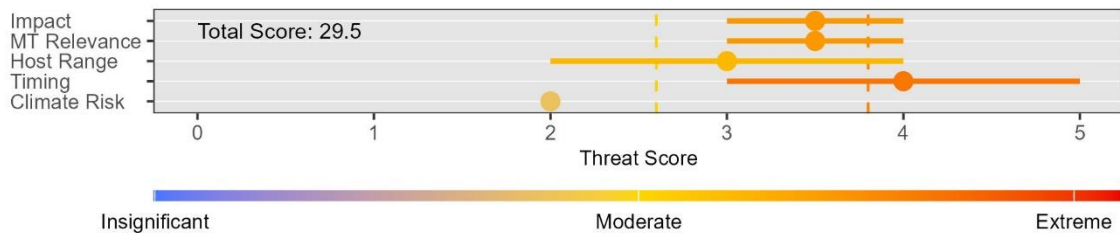
Research/Knowledge Gaps

- Distribution of bryozoans in Montana and factors that enhance growth of colonies or lead to infectious spore release
- Susceptibility to PKD in Montana fish species and impacts of subclinical infection
- Transmission and shedding dynamics of *T. bryosalmonae* in Montana fish species
- Relationship between PKD, climate, hydrologic events, and stress on fish populations in Montana
- Use of climate science to predict high-risk locations and periods for improved monitoring and management

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Avian Cholera



SGCN with Known Impacts^{1,2}

American White Pelican
Clark's Grebe
Franklin's Gull
Horned Grebe
Trumpeter Swan

Drivers

SGCN Susceptible to Infection^{1,2,4}

Harlequin Duck	Common Loon
Black Tern	Common Tern
Black-crowned Night Heron	Forester's Tern
Black-necked Stilt	Great Blue Heron
Least Tern	Long-billed Curlew
Marbled Godwit	Piping Plover
Solitary Sandpiper	White-faced Ibis
Caspian Tern	Whooping Crane

- High concentrations of waterfowl in wetlands and other waterbodies (e.g., along migratory pathways)^{1,2}
- Contaminated water from infected birds or carcasses³
- Movement of scavengers³
- Exposure to waste materials from poultry operations^{1,2}

SGCN Potentially Susceptible¹

Other avian SGCN, particularly waterfowl, are potentially susceptible.

Other Susceptible Montana Species¹

Wildlife most susceptible to avian cholera include geese, ducks, swans, coots, shorebirds, gulls, and crows.

Background

Avian cholera is a highly contagious disease among wild and domestic birds that is caused by the bacterium *Pasteurella multocida*^{1,2}. Cases of avian cholera in wild birds have been documented in the U.S. since the 1940s². Since that time, it has emerged as a significant threat to avian populations worldwide, particularly among waterfowl and shorebirds⁵. Outbreaks tend to be explosive in onset, often involving hundreds to thousands of birds at a time, and occur in densely populated bird colonies or along migration routes². Mortalities may occur year round; however, birds are usually affected while in their wintering grounds and during spring migration. Avian cholera is transmitted through contact with infected birds or carcasses, secretions or feces of infected birds, ingestion of contaminated food or water, and in some cases, inhalation of contaminated water droplets³. Once introduced into a dense population of waterfowl, infection can spread rapidly, with some highly

susceptible species (e.g., ducks, geese, and swans) dying as soon as 6 to 12 hours after exposure^{1,3}. The clinical course of cholera can be so rapid that infected birds may fall out of the sky or die while feeding with no other signs of illness³. The bacteria can persist and remain infectious in water for several weeks, and it is suspected that some birds can become chronic carriers, continuing to transmit the pathogen for years⁶.

Impacts

While most bird and mammal species can be infected by *P. multocida*, not all exhibit disease or experience mortality. In waterfowl, however, mass mortality events involving thousands of birds per day are regularly observed, with some outbreak events culminating in the deaths of tens of thousands of birds^{5,7}. As a result, avian cholera is considered one of the most highly impactful diseases of wild waterfowl. The population impacts of avian cholera are not well understood in wildlife, but significant impacts have been observed on individual breeding colonies and at particular wintering locations³. Imperiled waterfowl that stage or winter in Montana or have limited/highly concentrated breeding areas may be particularly at risk. In recent years, outbreaks are frequently associated with snow geese as they start to migrate south, with mortalities continuing throughout winter until departure in the spring (Robert Dusek, USGS, pers. comm.).

Presence in Montana

- There have been several outbreaks of avian cholera recorded in Montana since the 1970s, including in Ponderosa, Gallatin, Phillips, Teton, Sheridan, Cascade, and Flathead counties⁸.
- Outbreaks have killed hundreds (or more) of snow geese, northern pintails, northern shovelers, mallards, California gulls, Canada geese, American wigeons, American coots, ring-billed gulls and Ross's geese⁸.
- Locations along waterfowl migratory pathways (e.g., the Pacific Flyway in western Montana) are most at risk³.

Climate Sensitivity

The effects of climate factors on avian cholera are not well-understood. As a bacterium, *P. multocida* is likely impacted by temperature changes. Indirectly, warming temperatures, seasonal shifts, and changes to precipitation patterns can impact avian cholera by altering habitats, food availability, and migration patterns, which could lead to changes in animal stress, densities, and disease transmission^{4,9}.

Conservation Actions

Prevention

- In some instances, a vaccine for avian cholera can be administered to improve survival rates in chicks. This practice has mostly been used to protect colonies of endangered seabirds, and vaccines are species-specific¹⁰⁻¹².

Disease Management

- Once an outbreak occurs, if feasible, promptly remove sick and dead birds to help reduce the spread of the bacteria³.
- Consider actions (e.g., deterrents) that limit scavenging by gulls and crows, which are involved in spread to new locations³.
- Consider use of deterrents, hazing, and draining of waterbodies to limit wildlife use of contaminated waterbodies³.
- Consider the manipulation of habitat attributes (e.g., water temperature, water quality) that affect bacterial persistence and prevalence³.

Species and Habitat Management

- Enhance habitat quality at non-impacted waterbodies that may serve as refugia^{3,6}.

Surveillance and Monitoring

- Monitor habitats for sudden mortalities, particularly in highly susceptible species (e.g., snow geese, eared grebes), and determine cause of death to extent possible⁸. Priority sites for monitoring include waterbodies with high concentrations of waterfowl, a history of past outbreaks, or high use by migratory birds^{1,3,4}.
- Be aware of indicators of an avian cholera outbreak (e.g., large numbers of dead waterfowl in a short time). Sick birds may not be observed because death is often rapid. If sick birds are observed, they may show the following signs: convulsions, erratic flight or swimming patterns, lethargy, and/or mortality shortly after handling^{1,3,4}.

Research/Knowledge Gaps

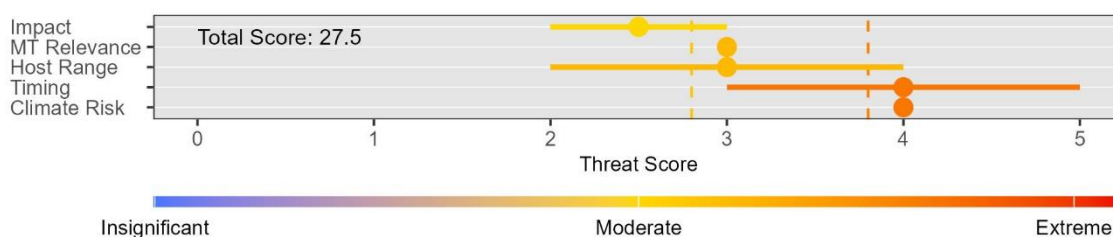
- The long-term consequences of avian cholera outbreaks on wild bird populations are not well understood.
- Research on the impacts of temperature and water quality on the survival of *P. multocida* could identify risk factors and control strategies that could be used on specific wetlands.

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Botulism



SGCN with Known Impacts¹⁻³

Least Tern
Piping Plover
Common Loon

SGCN Susceptible to Intoxication¹⁻³

American White Pelican	Franklin's Gull
Black-crowned Night Heron	Great Blue Heron
Black Tern	Great Gray Owl
Caspian Tern	Greater Sage-Grouse
Clark's Grebe	Golden Eagle
Common Tern	Harlequin Duck
Ferruginous Hawk	Horned Grebe
Forster's Tern	Trumpeter Swan
	Whooping Crane
	White-faced Ibis

SGCN Potentially Susceptible¹

Other SGCN, particularly waterfowl, are potentially susceptible.

Other Susceptible Montana Species^{1,4}

Peregrine Falcon
Prairie Falcon
Short-eared Owl
Western Grebe
Willet

Any warm-blooded animal and some fish are susceptible to botulism, but aquatic species (especially ducks, geese, gulls, and grebes) are particularly at risk.

Drivers

- Higher temperatures³
- Low oxygen levels in water³
- Major fluctuations in water levels³
- Aquatic animal death and carcass accumulation^{5,6}
- High levels of organic materials^{5,6}

Background

Botulism is a fatal non-infectious disease affecting warm-blooded animals and some fish species. It is caused by intoxication with neurotoxins produced by *Clostridium botulinum* bacteria¹, which are widespread in the environment. Intoxication may occur through ingestion of decaying tissue contaminated with the botulinum toxin or the bacteria, or through consumption of invertebrates that have fed on contaminated tissue (i.e., maggots concentrate toxin within their bodies after feeding on affected carcasses)^{5,6}. Animals may

also develop disease via a wound contaminated by the bacteria^{5,6}. Toxin accumulation in affected individuals leads to paralysis and death. There are multiple toxin strains produced by *C. botulinum*, with Types C and E most often associated with wildlife mortalities, particularly in waterfowl and other aquatic wildlife⁶. Optimal conditions for the growth of *C. botulinum* include warm temperatures, low oxygen levels, and high levels of organic materials (e.g., decaying animal carcasses); however, outbreaks may still occur without these conditions being present^{1,5}. Increases in pesticides and other agricultural pollutants, wetland flooding and draining, and anoxia of the wetland bottom that lead to increased wildlife mortality can promote *C. botulinum* growth and toxin production in the environment^{1,3,5,6}. Due to the various routes of exposure, a few mortalities due to botulism can rapidly amplify into large-scale die-offs involving hundreds to thousands of birds⁷.

Impacts

Botulism type C outbreaks are responsible for mass mortality events in wild birds, usually waterfowl species, and have caused hundreds of thousands of deaths in a single event^{5,6}. Migrating birds are most susceptible, and large die-offs are most likely to occur in sensitive species with smaller population sizes^{2,5,6}.

Presence in Montana

- More than a dozen outbreaks of botulism have been recorded in Montana since 2000, including in Sheridan, Phillips, Yellowstone, Musselshell, Cascade, and Teton counties. Over 100 outbreaks have been recorded since 2000 in neighboring states and Canadian provinces^{2,3,6}.
- Outbreaks in the early 2000s in Montana killed thousands of ducks, pelicans, and gulls, and a more recent outbreak in 2019 caused die-offs in ducks and shorebirds⁸.

Climate Sensitivity

Higher temperatures (77 to 104 degrees F; 25 to 40 degrees C) and longer warm seasons provide optimal conditions for *C. botulinum* growth. Drought can also lead to warm, stagnant water and die-offs in aquatic life, which increase the likelihood of an outbreak⁹. During drought years, birds are likely to concentrate at remaining wetlands in higher numbers, putting a greater number at risk. Botulism risk is likely to increase in the coming decades with warmer temperatures and more frequent drought conditions.

Conservation Actions

Prevention

- Consider removal of carcasses from large die-offs of aquatic animals (e.g., fish kills) to limit proliferation of *C. botulinum*, especially if area is highly trafficked by water birds

and other wildlife. Carcass removal is the most effective means for preventing the expansion of outbreaks¹.

- Mitigate or avoid abrupt changes in water levels from factors like drought or water management^{3,9}.
- Maintain water quality by limiting pesticide and agricultural pollution^{3,9}.

Disease Management

- In high priority habitats, survey outbreak sites regularly to remove carcasses. Consider the use of cadaver dogs to improve efficiency of carcass removal^{1,6}.
- In some limited cases (such as highly imperiled populations), consider clinical treatment for intoxicated individuals through the use of botulinum antitoxin⁶, but be aware that this option is not widely available due to the limited availability and high cost of botulinum antitoxin.
- Consider using deterrents to temporarily discourage wildlife visitation to affected wetlands^{1,6}.

Species and Habitat Management

- Control the spread of aquatic invasive species (e.g., zebra mussels) that may play a role in botulism outbreaks^{3,9}.

Surveillance and Monitoring

- Conduct routine surveillance at sites with known history of outbreaks and which are important habitat for imperiled populations.
- Be aware of signs of a botulism outbreak, including multiple animal carcasses and animals with paralysis or limited movements in close proximity to a water source^{1,6}.

Research/Knowledge Gaps

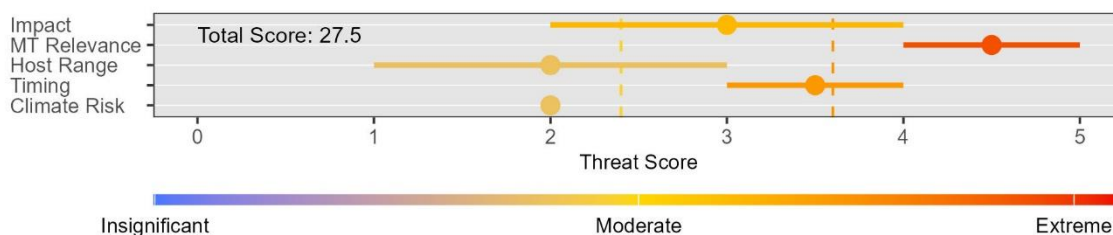
- Information on botulism's impacts on fish populations is limited⁹.
- Invasive species (e.g., zebra mussel, round goby) play a role in botulism transmission in the Great Lakes⁹, but the effects of invasive species on botulism in Montana are not known.
- The long-term effects of botulism outbreaks on bird populations are poorly understood^{1,6}.

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Canine Distemper



SGCN with Known Impacts¹

Black-footed Ferret

SGCN Susceptible to Infection¹

Grizzly Bear

Swift Fox

Canada Lynx

Fisher

Wolverine

Other Susceptible Montana Species¹⁻⁴

Most carnivores (including cougars, bears, foxes, coyotes, raccoons, skunks, and weasels) can be infected with CDV.

Drivers

- Seasonality and temperature⁵
- Age and previous exposure⁴
- Spatial connectivity and contact rates among carnivore populations^{3,4}
- Unvaccinated domestic animals (e.g., dogs, ferrets) in proximity to wildlife^{3,4}

Background

Canine distemper virus (CDV) is an RNA virus in the family Paramyxoviridae (*Canine morbillivirus*) that causes the disease canine distemper. Despite the name, CDV infects a wide range of carnivores besides canids, including cougars, bears, raccoons, and members of the weasel family. The virus is highly contagious and is primarily spread through contact with respiratory particles or bodily fluids (i.e., urine, feces, secretions)². It does not survive long in the environment, although cold temperatures can allow the virus to remain viable for up to a few days^{2,3}. Clinical signs include discharge from the eyes and nose, difficulty breathing, pneumonia, fever, and a neurological phase that can result in seizures, wandering, and aggressiveness^{3,5}. Some species, especially mustelids, experience high mortality rates (50 to 100 percent) and in most species, juveniles are more susceptible to severe disease than adults⁵. Outbreaks of CDV are often seasonal and in wildlife typically occur during spring and summer due to increases in susceptible (i.e., juvenile) individuals⁵. In urban settings, outbreaks may also occur during winter when the virus persists longer in the environment and when individuals are breeding and in close contact⁵. Due to its high mortality rate, low environmental persistence, and the fact that survivors experience long-lasting immunity, CDV generally fades out in small, isolated populations. In wildlife systems of the western U.S., maintenance of the virus likely requires the presence of multiple, interconnected populations and transmission between several carnivore species^{4,6}. In particular, raccoons and coyotes appear to play an important role in maintaining CDV and transmitting it to other wildlife species^{4,6}.

Impacts

Mustelids, including black-footed ferrets, often experience high rates of mortality from CDV, in some cases up to 100 percent^{7,8}. CDV likely contributed to the near-extinction of the black-footed ferret, and vaccination is now an important part of the recovery strategy for this species⁷. Periodic outbreaks of CDV in the Greater Yellowstone Ecosystem have caused significant mortality in gray wolves, particularly pups^{6,9,10}, but the disease has not threatened overall recovery. Similarly, CDV has caused mortalities in swift foxes in Wyoming, but longer-term population-level impacts have not been observed¹¹.

Presence in Montana

- CDV has a near-global distribution and a wide host range, and it is not uncommon in Montana wildlife, particularly among raccoons, coyotes, and skunks^{12,13}.
- In Montana, cases are most frequently observed in spring and early summer when there is an increase in young, highly susceptible animals (J. Ramsey, Montana Fish, Wildlife, & Parks, pers. comm.).
- CDV appears relatively common within carnivores of the Greater Yellowstone Ecosystem (GYE). For instance, a recent study found that 30 to 60 percent of wolves and 30 to 40 percent of grizzly bears in the GYE were exposed to CDV¹⁴. Outbreaks have typically occurred every two to five years.

Climate Sensitivity

Climate variability does not appear to play a strong role in CDV dynamics in the western United States, although links between CDV mortality and temperature have been detected in other countries¹⁵. Warmer winter temperatures could, in theory, reduce transmission by facilitating faster viral inactivation. Climatic shifts could also alter movements, population connectivity, and contact rates among carnivores in ways that change CDV transmission patterns.

Conservation Actions

Prevention

- Continue to encourage vaccination of domestic dogs to reduce the reservoir of CDV and risk to wildlife².
- Be aware that most CDV vaccines are not designed for wildlife and that some species may experience harmful effects from available CDV vaccines³. Consider the use of vaccines in highly imperiled populations for which approved, effective vaccines exist (e.g., black-footed ferrets are commonly vaccinated during reintroductions)^{2,3}.

Disease Management

- Evaluate the need for control of reservoir hosts (e.g., coyotes and raccoons) in cases where they may spread disease to vulnerable populations^{2,3}.
- If feasible, consider removing infected carcasses to reduce transmission risk during outbreaks⁵.

Species and Habitat Management

- Continue to improve the population size of threatened species to improve their ability to withstand periodic CDV outbreaks⁶.

Surveillance and Monitoring

- Encourage the public to report unusual behavior in wildlife, which can be a sign of CDV or other viruses, like rabies.
- Continue passive surveillance efforts for CDV through morbidity/mortality investigations and opportunistic serologic testing during captures (Jennifer Ramsey, Montana Fish, Wildlife, & Parks, pers. comm.).

Research/Knowledge Gaps

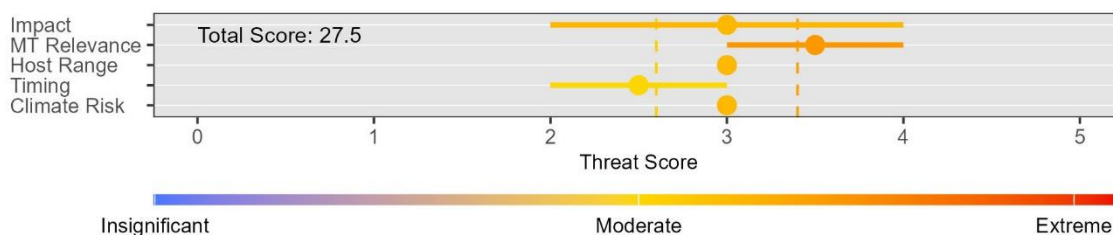
- The distribution and impacts of CDV in vulnerable SGCN like swift foxes, lynx, and wolverine is not well known.
- Understanding contact rates and connectivity between vulnerable populations and reservoirs can help identify risk factors and potential targets for management.

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Iridoviruses



SGCN with Known Impacts¹

Northern Leopard Frog
Western Toad
Pallid Sturgeon
White Sturgeon

SGCN Potentially Susceptible¹

Great Plains Toad
Coeur d'Alene Salamander
Paddlefish
Other amphibian, fish, and reptile SGCN may be affected.

Other Susceptible Montana Species¹

Columbia Spotted Frog
Western Tiger Salamander
Boreal Chorus Frog
Shovelnose sturgeon
American Bullfrog*
Other amphibians, fish, and reptiles may be affected.

*Potential concern as a reservoir species

Drivers

- High host densities, including captive/hatchery conditions^{2,3}
- Water temperature and quality^{2,3}
- Seasonality and life-stage³
- Presence of reservoir species^{3,4}

Background

Iridoviruses are a broad family of viruses primarily affecting cold-blooded species including amphibians, fish, and reptiles¹. The family includes several species of *Ranavirus* (e.g., *Frog Virus 3* [FV3], *Ambystoma tigrinum virus* [ATV], largemouth bass virus) as well as related viruses that cause fish diseases like White Sturgeon iridoviral disease (WSIV) and Missouri River sturgeon iridovirus (MRSIV). Infection typically occurs through exposure to viral particles in water, ingestion of infected tissues, or direct contact. Some Iridoviruses appear to be specialists, while others (e.g., FV3) may be transmitted across a wide range of hosts, including between fish and amphibians¹. Generally, loss of organ function related to hemorrhage and necrosis is the most common cause of death and may be preceded by signs like irregular swimming behavior, redness of limbs or vent, lethargy, lesions on the body, skin hemorrhaging, inappetence, and edema (swelling)⁵. Viruses can survive in water for weeks, and potentially months. In amphibians, ranaviruses can cause sporadic, short-lived, and intense outbreaks, which may intensify over a period of just a few days⁶.

Mortalities typically occur during summer, primarily affecting larvae or recently metamorphosed individuals^{3,5}. There is some evidence that outbreaks are more likely in areas with high human influence, such as suburban or cattle ponds^{3,7}; however, surveillance in wild populations is rare and thus the true distribution of ranavirus in remote populations is not well characterized.

MRSIV (a related Iridovirus) is of particular concern for efforts to recover the pallid sturgeon via hatchery breeding. Outbreaks at hatcheries in Montana have killed up to 60 to 100 percent of juvenile pallid sturgeon or shovelnose sturgeon⁸. Survivors of outbreaks may become carriers, continuing to transmit the virus without showing clinical signs. Transmission occurs through exposure to infected tissues (e.g., in water or in feed) or cohabitation with infected fish. Vertical transmission may also be possible. It is presumed that wild fish harbor the pathogen and, when it is introduced to the hatchery environment, large outbreaks are possible⁸.

Impacts

Although Iridoviruses can affect a wide range of fish, amphibian, and reptile species, impacts are of particular concern in hatchery-raised fish and in amphibians that are already rare and exhibit aggregation behavior in waterbodies³. Outbreaks of ranaviruses in wild amphibian populations have caused large mortality events, with mortality rates reaching 100 percent in some affected populations. But while the virus can strongly reduce abundances in the short term, to date, ranaviruses have not been associated with long-term population declines in North American amphibians³. In fish, outbreaks of Iridoviruses can drastically reduce hatchery survival rates (up to 100 percent mortality) and can threaten the success of recovery programs relying upon stocking efforts, such as those for pallid sturgeon⁹. Generally, the impacts of Iridovirus outbreaks in wild fish populations are not well-known, but in some populations, evidence of potential immunity and populations rebounding is emerging¹⁰.

Presence in Montana

- Few ranavirus outbreaks have been reported in Montana; however, two separate outbreaks in 2001 were associated with large die-offs of western toads (Ravalli County; 1000 reported dead) and Columbia spotted frogs (Gallatin County; 30 reported dead)¹¹. A die-off of tiger salamanders in the Powder River Basin in 2008–2009 appears to be driven by a ranavirus (ATV) outbreak.
- Surveys of the Prairie Pothole Region in 2017 found low occurrence of ranavirus in amphibian larvae and waterbodies¹², whereas amphibian monitoring projects in the Greater Yellowstone Ecosystem indicated multiple mortality events from 2000 to 2014 occurring over a wide distribution¹³.

- Neighboring states (Wyoming, Idaho, North Dakota) have recorded ranavirus outbreaks impacting tiger salamanders, western toads, Columbia spotted frogs, painted turtles, and treefrogs/chorus frogs¹¹.
- MRSIV has been detected in wild sturgeon and hatcheries in Montana and primarily affects pallid sturgeon and shovelnose sturgeon⁸.

Climate Sensitivity

Warmer temperatures are associated with increased mortality from Iridoviruses in both hatchery environments and the wild, suggesting that future climate conditions may lead to increased impact^{3,8}. Drying is thought to inactivate virus, and therefore, more frequent drought conditions could reduce the occurrence of the virus at seasonal waterbodies³.

Conservation Actions

Prevention

- Do not stock fish from hatcheries experiencing an outbreak⁸.
- Continue to screen wild broodstock for MRSIV or other Iridoviruses⁸.
- Avoid moving amphibians and conduct testing if translocations are performed^{2,8}.
- Educate public on possibility of spread through fishing gear, boats, boots, and other recreational equipment¹⁴⁻¹⁶.

Disease Management

- There is no vaccine or treatment for ranavirus infection, but sterilization (e.g., bleach, UV light) can be used to treat water or surfaces in captive facilities^{2,8}.
- Promote hatchery practices that limit the impact of Iridovirus outbreaks (e.g., sanitization protocols, isolation of rearing units, limited densities, and water quality)⁸.
- Consider the use of water drawdowns to inactivate virus².

Species and Habitat Management

- Improve water and habitat quality at amphibian breeding sites (e.g., via cattle exclosures, reductions in runoff). Pesticides, herbicides, poor water quality, and vegetation loss compound the impacts of ranaviruses^{2,6,7}.
- Control non-native species (e.g., American bullfrogs) that may transmit and serve as a reservoir for ranaviruses.

Surveillance and Monitoring

- Encourage the public to report observed amphibian and fish mortality events, including through participation in the Partners in Amphibian and Reptile Conservation Herpetofaunal Disease Alert System (HDAS)²⁰.

- Select appropriate tissue samples (e.g., internal organs, fin clips, etc.) for surveillance, in accordance with study goals and species².

Research/Knowledge Gaps

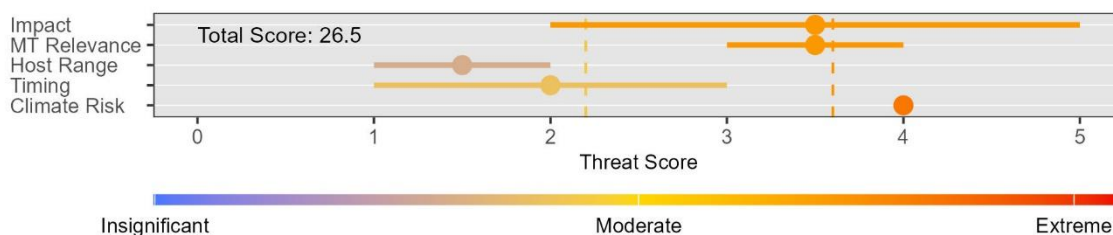
- The host range of many Iridoviruses is unknown. Therefore, which of Montana's SGCN are potentially affected is difficult to characterize.
- Effects of Iridoviruses in free-ranging fish populations are poorly understood.
- Research suggests that water temperature can impact Iridovirus transmission and pathology, but questions remain about whether temperature modifications can effectively be used for treatment, or how temperature-disease relationships vary among Iridovirus strains or hosts².

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Chytridiomycosis



SGCN with Known Impacts¹

Northern Leopard Frog
Western Toad

SGCN Susceptible to Infection¹

Idaho Giant Salamander
Great Plains Toad

Other Susceptible Montana Species¹

American Bullfrog*
Boreal Chorus Frog (S5)
Columbia Spotted Frog
Long-toed Salamander
Western Tiger Salamander
All amphibians potentially susceptible

*Disease reservoir

Drivers

- Host life-stage (e.g., tadpole, juvenile, adult)²
- Environmental factors influencing pathogen and host survival (e.g., temperature, precipitation, elevation)^{3,4}
- Presence of reservoir hosts⁴

Background

Chytridiomycosis is an infectious amphibian disease caused by the fungal pathogen *Batrachochytrium dendrobatidis* (Bd). Fungal spores spread within waterbodies and infect the skin of susceptible amphibians, impacting respiration and osmoregulatory functions, eventually leading to cardiac arrest for individuals in advanced stages of disease⁵. Susceptibility to infection varies widely among species, and the severity of disease in individuals typically depends on infection dose and life stage^{6,7}. Tadpoles (who frequently become infected but do not experience severe disease) and resistant species, such as the American bullfrog, serve as disease reservoirs and are important means of transmission and persistence within populations^{8,9}. Species that are larger in size, occur in wetland habitats, and have a limited range are more predisposed to disease¹⁰⁻¹². The primary modes of transmission include environmental (infectious spores in water or on moist substrates), direct contact (host-host), or reservoir species (bullfrog, crayfish¹³).

Impacts

Bd has led to extirpations and population declines for multiple species throughout the world since it was first described in 1998¹⁴⁻¹⁶. Among Montana's SGCN, the western toad

and northern leopard frog are the most susceptible to Bd, demonstrated by significant historical population declines in the Rocky Mountain region¹⁷⁻²⁰. The northern leopard frog suffered severe population declines that effectively extirpated it from its former range in western Montana¹. However, in Montana and across much of North America, evidence exists that Bd may be functioning as an endemic disease with host-pathogen coexistence^{4,17}. The dynamics and distribution of this disease are complex and appear to be highly influenced by the community structure of host species and environmental factors^{21,22}.

Presence in Montana

- Bd has been found in the northeast and western parts of the state; however, there is little published surveillance data from eastern Montana. Bd has been detected in Montana's western toads, Idaho giant salamanders, tiger salamanders, long-toed salamanders, northern leopard frogs, and Columbia spotted frogs^{21,22}.
- Western toad populations in Montana have historically experienced moderate to high prevalence of Bd with evidence of population decline in some regions^{1,17,18}.
- The Columbia spotted frog, which appears tolerant to infection with Bd, likely serves as an important reservoir species¹.
- While Bd has been present in Montana amphibian populations for about 40 years, current evidence indicates that there are no further declines in northern leopard frog and western toad populations (B. Maxell, Montana Natural Heritage Program, pers. comm.). However, there may be sporadic individual mortalities, and the long-term impacts to overall species fitness are still under investigation.

Climate Sensitivity

Generally, Bd favors cool, moist environments, and laboratory experiments indicate the fungus does not tolerate temperatures above 80 degrees F (27 degrees C) or below 50 degrees F (10 degrees C)²³. However, increasing climate variability and extreme weather events could impact amphibian immunity and alter habitat and community structures that favor pathogen survival and pathogenicity²⁴⁻²⁶. Factors such as snowpack and timing of precipitation have demonstrated a strong influence over amphibian population health. In years where snowpack is low and Bd is present in the environment, amphibian survival is significantly reduced²⁷.

Conservation Actions

Prevention

- Establish standard biosecurity measures (i.e., disinfection protocols) for work and recreation in wetlands and aquatic habitats²⁸⁻³⁰.
- Restrict or minimize human activity around sensitive habitats²⁸⁻³⁰.

- Develop communication to public about the risk of Bd and how to prevent introduction and spread²⁸⁻³⁰.

Disease Management

- In certain scenarios like acute die-offs, consider researching or applying environmental or individual-level treatments (e.g., salts, fungicides, chemical disinfectants, probiotics) to reduce prevalence of Bd, but be aware that effectiveness of treatments may be variable and requires further investigation²⁸⁻³⁰.
- Evaluate for the presence of and consider reducing abundance of Bd reservoir host species (e.g., infected amphibian larvae, bullfrogs, crayfish)²⁸⁻³⁰.

Species and Habitat Management

- Consider habitat manipulations to improve adaptive capacity to disease, such as (but not limited to): increased shallow warm water for tadpoles, open basking sites for adults and metamorphic individuals, artificial heat sources, altered water flow or pond drying regime, and/or promoting the abundance of microorganisms that consume zoospores²⁸⁻³⁰.
- Explore opportunities to re-establish populations in disease-free locations or areas unlikely to be affected by *Bd* (e.g., areas at higher elevation, and drier, warmer habitat)^{28,29,31}.
- If deemed necessary, consider implementation of captive colonies, head-start programs, and treatment facilities to improve imperiled species recovery²⁸⁻³¹.

Surveillance and Monitoring

- Develop a long-term surveillance plan that helps to determine Bd prevalence, impacts, and transmission; and monitors overall amphibian population health³⁰.
- Monitor for mortality events or population declines that may indicate a disease outbreak.
- Contribute to and stay up to date on the amphibian disease surveillance database at www.amphibiandisease.org.

Research/Knowledge Gaps

- How changing climate, novel species introductions, agricultural practices, or land use change may alter chytridiomycosis dynamics in Montana's SGCN

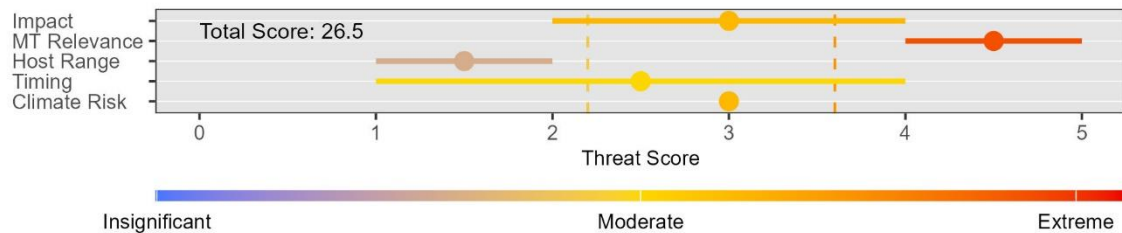
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Whirling Disease



SGCN with Known Impacts

To date, significant impacts on SGCN have not been reported.

SGCN Susceptible to Infection²

Westslope Cutthroat Trout
Yellowstone Cutthroat Trout
Bull Trout*

SGCN Potentially Susceptible²

Columbia River Redband Trout
Pygmy Whitefish

Other Susceptible Montana Species^{2,3}

Brook Trout
Brown Trout*
Chinook Salmon
Mountain Whitefish
Rainbow Trout

Drivers

- Stream/river morphology and flow rate¹
- Habitat suitability for *T. tubifex* (requires fine sediment, low flows)^{1,2}
- Water temperature^{1,2}

*Typically asymptomatic infections, unless high parasite dose

Background

Whirling disease (WD) is a disease of certain salmonid fish species caused by the parasite *Myxobolus cerebralis*. It is associated with severe population declines and outbreaks in rainbow trout throughout the Intermountain West. The parasite targets and consumes cartilage tissue in fish, resulting in neurologic impairments and skeletal deformities typically characterized by a crooked, blackened tail and deformed head³. Severe disease is more likely to occur in fish with higher parasite loads, in younger fish, and in more vulnerable species³. In Montana, rainbow trout and cutthroat trout are the most vulnerable to severe disease².

The life cycle of *M. cerebralis* is complex, requiring both a salmonid fish host and an aquatic, bottom-dwelling worm, *Tubifex tubifex*. Fish become infected by spores released from the *Tubifex* worm, which penetrate the skin and migrate to preferred tissues (cartilage) within the fish host. Infection risk is tied closely with environmental suitability for the release of spores from *T. tubifex*, which can vary widely across watersheds and may depend on the strain of *T. tubifex* present. Generally, however, water temperatures above 40 degrees F are optimal for parasite development and spore release, leading to peak

infectivity in spring and fall for most areas¹. Spatial spread of *M. cerebralis* may be facilitated by human-mediated transport, stocking, and digested spores in the fecal matter of fish-eating birds⁴.

Impacts

In Montana and surrounding states (Wyoming, Idaho, Utah, Colorado), whirling disease has been identified as the primary agent of population declines in many wild rainbow trout populations³. In addition, it has been documented as a significant threat to cutthroat trout conservation efforts in Colorado and Yellowstone National Park⁵⁻⁷. The disease was first identified in Montana in 1994 following a severe population decline (>90 percent) in rainbow trout in the Madison River⁸. Although *M. cerebralis* has the potential to drive population-level impacts⁹⁻¹¹ and has been present for many decades, impacts from disease are variable and appear to be site-specific. Impacts are largely based on factors influencing habitat suitability for *T. tubifex*, environmental conditions for parasite development (i.e., water temperature), fish species composition, immunity, and timing of spawning⁹. In addition, in areas with historical impacts of disease, fish populations appear to have developed resistance to whirling disease through natural selection¹².

Presence in Montana

- Following the Madison River outbreak in 1994, intensive statewide monitoring revealed that the pathogen was widespread throughout western Montana, with disease present at varying levels of severity¹⁰.
- There is a lack of recently published data on current distribution of whirling disease in Montana, but based on the pathogen's relationship with its hosts and environment, it still appears widespread throughout Montana waters (K. Staigmillier, Montana Fish, Wildlife, & Parks, pers. comm.).

Climate Sensitivity

Water temperature is a key factor in controlling the life cycle and release of *M. cerebralis* spores and also influences the growth and abundance of *T. tubifex*¹³. Warming temperatures speed the parasite's development, resulting in increased release of spores from worms³. The *Tubifex* worm also favors habitat consisting of fine sediment and low water flow, both of which can increase in the event of excessive erosion and/or human disturbance^{14,15}. Under the influence of climate warming, these factors may be exacerbated and increase the risk of whirling disease and compromise overall fish health.

Conservation Actions

Prevention

- Inform anglers and water recreation users about risks and transmission routes for WD (contaminated gear/boats spreading spores between waterbodies) and enforce aquatic biosecurity protocols.
- Avoid stocking juvenile fish, particularly at times when juvenile susceptible fish are abundant in environment, to reduce impacts of WD on populations².

Disease Management

- Promote habitat restoration efforts to increase water flow and reduce erosion, stream degradation, and runoff in order to limit *T. tubifex* colonization¹⁶.
- If stocking is needed, ensure that fish are WD-free and/or explore development of WD-resistant fish strains¹⁷.
- Consider the use of UV radiation in reducing impacts of WD by suppressing abundance of *T. tubifex* and infectivity of *M. cerebralis*².

Species and Habitat Management

- Support efforts related to improving overall fish health and adaptive capacity, such as promoting genetic diversity¹².

Surveillance and Monitoring

- Continue surveillance for *M. cerebralis* in wild fish populations, especially in areas where it has not previously been detected.

Research/Knowledge Gaps

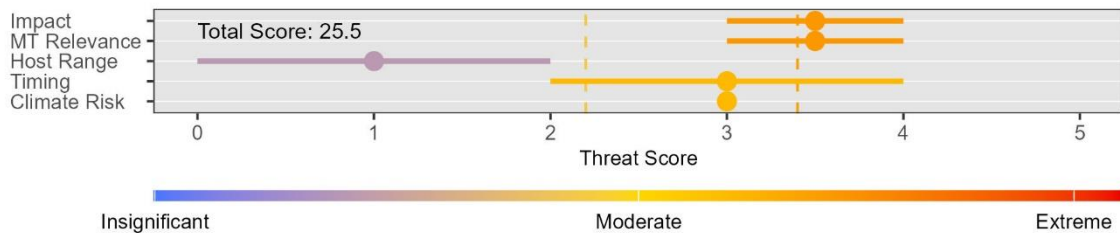
- Differentiate and characterize *T. tubifex* strains in Montana and their susceptibility to *M. cerebralis*.
- Explore mechanisms of resistance and susceptibility in salmonid species.

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Avian Trematodiasis



SGCN with Known Impacts

To date, significant impacts on SGCN have not been reported.

SGCN Susceptible to Infection

To date, no additional SGCN confirmed as susceptible.

SGCN Potentially Susceptible^{1,2}

Common Loon
Trumpeter Swan

Other Susceptible Montana Species^{1,2}

American Black Duck	Green-winged Teal
American Coot	Herring Gull
American Wigeon	Lesser Scaup
Blue-winged Teal	Mallard
Bufflehead	Northern Pintail
Canada Goose	Northern Shoveler
Canvasback	Ring-necked Duck
Common Goldeneye	Ruddy Duck
Gadwall	Snow Goose
Greater Scaup	Tundra Swan

Drivers

- Distribution and prevalence of trematode-infected faucet snails²
- Waterfowl migration and concentration at stopover sites³
- Host status (e.g., nutritional, age) and susceptibility¹
- Environmental conditions (e.g., water temperature)^{3,4}

Background

Avian trematodiasis is caused by infection with parasitic flatworms known as trematodes. While many trematode species can infect birds, most cause only mild or subclinical disease and only occasionally result in mortality. However, several species—*Cyathocotyle bushiensis*, *Sphaeridiotrema globulus*, *Sphaeridiotrema pseudoglobulus*, and *Leyogonimus polyoon*—are associated with recurrent, large-scale mortality events in waterfowl during spring and fall migrations¹. Birds become parasitized by eating infected faucet snails (*Bithynia tentaculata*; also known as the mud bithynia), an invasive mollusk that harbors the parasite. The snail (and thus the occurrence of the disease) is typically found in freshwater ponds and shallow areas (<6 m) of lakes³. Major outbreaks of trematodiasis in avian populations are driven by a combination of infected snail abundance, waterfowl density and species composition, avian host status (i.e., nutrition, age, exposure), and favorable environmental conditions for both the parasite and snail hosts⁴. Infection of birds with pathogenic trematode species leads to severe intestinal

disease (e.g., inflammation, bleeding) and disruption of nutritional absorption². Depending on the concentration of parasites within snails that are consumed, birds may ingest a lethal dose in as little as a few hours to several days, succumbing to trematode-associated disease within three to eight days¹. Due to the rapid onset of disease, signs preceding mass mortality events are rarely observed, but may include an inability to fly or dive, emaciation, diarrhea, and bloodstaining around the vent⁴. Survivors appear to develop some resistance to future infections but can further the parasites' life cycle and spread the disease to other waterbodies⁵. *C. bushiensesis* and *Sphaeridiotrema spp.* are the trematode parasites of greatest concern to Montana bird populations.

Impacts

Pathogenic trematode species have been associated with repeated, seasonal, large-scale die-offs of North American waterfowl over the last 40 years (or more)^{3,5}. Outbreaks have caused losses of hundreds to thousands of birds at a time and have triggered population declines of some species in certain areas (e.g., 40 percent decline in scaup in Wisconsin in 2006)². The geographical distribution of outbreaks overlaps closely with the distribution of the invasive faucet snail, which is well-established in Montana and much of the midwestern and northeastern United States⁶. Lesser and greater scaup and American coot are the avian species most frequently impacted; however, other water birds (e.g., diving ducks, swans) may also be affected⁷. It remains unclear why infection has a disproportionate impact on certain waterfowl species. Yet, while trematode infections may not lead to direct mortality in more resistant avian species, chronic parasitism can serve as a contributing factor for ill health and increased susceptibility to other diseases. Overall, this disease represents an additional stressor for already declining waterbird populations.

Presence in Montana

- Episodic outbreaks in Montana involving *C. bushiensesis* and *Sphaeridiotrema spp.* have been reported since 1988, occurring (on average) every few years in spring and fall months^{8,9}. Events involve hundreds to thousands of bird fatalities, with common species including American coot, lesser scaup, northern pintail, mallard, green-winged teal, American wigeon, northern shoveler, ring-necked duck, canvasback, gadwall, redhead, etc. Recent events have occurred in Flathead, Yellowstone, and Granite counties, including locations mentioned below where faucet snails have been identified⁸.
- The invasive faucet snail has been identified in multiple regions across Montana (primarily in the western half) with recently confirmed locations including Blanchard Lake, Georgetown Lake, McWeneger Slough, Smith lake, Upsata Lake, Rattlesnake Reservoir, and Whitefish Lake^{10,11}.

Climate Sensitivity

Avian trematodiasis is strongly influenced by environmental conditions, particularly temperature and water availability. Warmer lake and wetland temperatures accelerate trematode development within snail hosts, increasing the number of infective stages shed into the environment and heightening transmission risk to waterfowl^{12,13}. Additionally, reduced availability of stopover habitat—such as during drought—can force large numbers of birds to congregate at remaining wetlands, intensifying exposure to infected snails and amplifying disease severity. Fluctuating water levels and eutrophication may further shape the distribution and density of snail populations, especially in shallow, nutrient-dense systems that favor snail proliferation¹⁴. In the event of waterbodies drying out, disease risk may be limited due to reduced survival of aquatic intermediate hosts and trematodes¹⁵. Overall, such ecological shifts are likely to influence the frequency, timing, and geographic extent of trematodiasis outbreaks, with potential for earlier seasonal onset and increased transmission conditions.

Conservation Actions

Prevention

- Continue promoting policies and raising public awareness to mitigate the spread of aquatic invasive species, such as boat inspection and disinfection of all equipment¹¹.

Disease Management

- Consider habitat modification to reduce suitable habitat or disrupt life cycles for faucet snails (e.g., management of aquatic vegetation, periodic drawdowns of water levels)^{4,16}.
- Explore biological control methods for faucet snails and other invasive mollusks by supporting native, snail-eating fish or invertebrate populations^{4,16}.

Species and Habitat Management

- Promote wetland habitat conservation and improve water quality by reducing nutrient runoff and restoring/maintaining natural hydrological regimes¹⁶.

Surveillance and Monitoring

- Continue monitoring for mortality events, determining cause of death, and focus sampling efforts on major spring and fall stop-over areas during seasonal migration¹⁶.
- Explore use of environmental DNA sampling to detect presence of faucet snails and/or pathogenic trematodes¹⁷.
- Develop awareness around causes of waterbird mortality (e.g., trematodiasis, botulism, etc.) among hunters, anglers, and the general public and how to report unusual waterfowl mortality events.

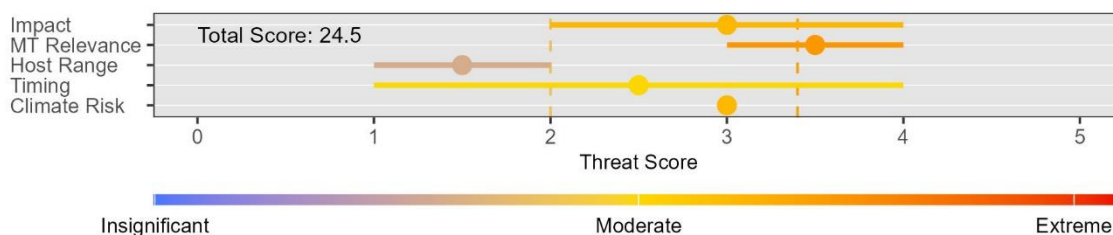
Research/Knowledge Gaps

- Montana avian species susceptibility to trematodiasis
- Prevalence and intensity of trematode infections in Montana faucet snail populations and transmission risk/dynamics to Montana avifauna
- Sublethal effects (e.g., reduced fitness, impaired migration, vulnerability to other disease) of trematode infection in waterfowl

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Bacterial Kidney Disease



SGCN with Known Impacts^{1,2,5}

Arctic Grayling*

Yellowstone Cutthroat Trout*

SGCN Susceptible to Infection^{1,2}

Bull Trout

Columbia River Redband Trout

Lake Trout

Westslope Cutthroat Trout

Other Susceptible Montana Species^{1,2}

All salmonids are considered susceptible to BKD.

*BKD has impacted survival in Montana hatcheries.

Drivers

- Hatchery conditions¹
- Water temperature¹

Background

Bacterial Kidney Disease (BKD) is a disease of salmonid fish caused by the bacterium *Renibacterium salmoninarum*. BKD is a systemic infection that can lead to high rates of mortality in affected populations (e.g., >80 percent)¹. The clinical signs of BKD are quite variable and include lethargy, skin darkening, blood-filled blisters, skin ulcers, bulging eyes, hemorrhaging around vent, and unusual swimming behavior^{1,2}. Internally, BKD leads to chronic inflammation and swelling in the kidneys and lesions on internal organs. However, some fish may be infected without displaying any outward signs, which complicates the detection of BKD. The pathogen is transmitted horizontally through contaminated water and contact among individuals, as well as vertically, in which bacteria are passed directly from an infected female to her eggs³. The bacterium can persist in sediment and fish feces for several weeks. All salmonids are considered susceptible to infection by *R. salmoninarum*; however, not all species experience severe disease.

Impacts

It can take many months for disease signs to appear after *R. salmoninarum* is introduced into a population. Infected fish can carry the pathogen and continue to transmit it for life. For those reasons, BKD is often associated with slow, prolonged declines over a long time period. BKD has been detected in both farmed and wild fish, and while *R. salmoninarum* bacteria are likely widespread within inland trout populations, it is not considered a major

threat to most inland wild fish populations, and most populations do not appear to be strongly impacted by the disease⁴. Population-level impacts in wild populations have mostly been observed in Chinook salmon and other Pacific salmon¹. Thus, the primary relevance of BKD to Montana fish conservation is the introduction of the bacteria into hatchery populations and the potential impact on captive rearing of endangered salmonids¹.

Presence in Montana

- The pathogen *R. salmoninarum* has been detected in both wild and hatchery fish in Montana. While testing is common within hatcheries, the extent of the pathogen in wild populations is not known⁵⁻⁷. However, BKD does not appear to be associated with significant impacts to wild fish in the state.
- BKD has been detected in wild trout in nearby states, including Wyoming (Yellowstone National Park and southeastern Wyoming)⁸⁻¹⁰. An outbreak affecting wild brook trout in Wyoming was tied to a stocking event¹¹. A recent study in Colorado reported the pathogen in all 68 of the streams tested and suggested the distribution is widespread⁴.

Climate Sensitivity

BKD appears highly sensitive to temperature; therefore, future climate variability and change could alter the timing and severity of BKD outbreaks. Outbreaks of BKD tend to occur after peaks in water temperature, and mortality rates increase with warmer temperatures^{1,13,14}. However, other studies suggest that warming temperatures, particularly beyond 59 degrees F (15 degrees C), will lead to declines in BKD¹⁵. For fish, warmer temperatures may have a mixed effect. In certain species it may enhance immune response and increase disease resistance¹², while in others (e.g., cold water-adapted salmonids), it can lead to increased stress and immune suppression. Future climatic shifts may reduce stream flow, the size of pools, and water quality; these factors have been linked to increased outbreak severity¹¹.

Conservation Actions

Prevention

- Continue to test brood fish coming into the hatchery system to prevent introduction of BKD¹.
- Continue to test fish prior to movement and/or stocking to prevent release of fish from BKD-infected hatcheries¹.
- Educate the public on BKD and the risk of spread from fish movements.
- Explore opportunities to invest and support hatchery infrastructure to protect the integrity of the water supply for hatcheries raising conservation broodstock¹.

Disease Management

- There are few known strategies to manage BKD in wild fisheries. Within hatcheries, depopulation is the preferred and most effective management option, but can be performed in combination with quarantine, water sterilization, and chemical treatment of infected individuals^{1,7}.

Species and Habitat Management

- Research the impact of water quality on BKD dynamics and if deemed necessary, consider habitat modifications (e.g., improving streamflow) that could reduce the risk of BKD^{1,11}.
- Reduce other stressors on fish populations potentially affected by BKD and continue to maintain adequate genetic diversity¹⁴.

Surveillance and Monitoring

- Consider pairing a molecular (qPCR) and immunological (ELISA) diagnostic test in surveillance efforts⁴.
- Increase awareness of BKD among public and FWP staff, including clinical signs.

Research/Knowledge Gaps

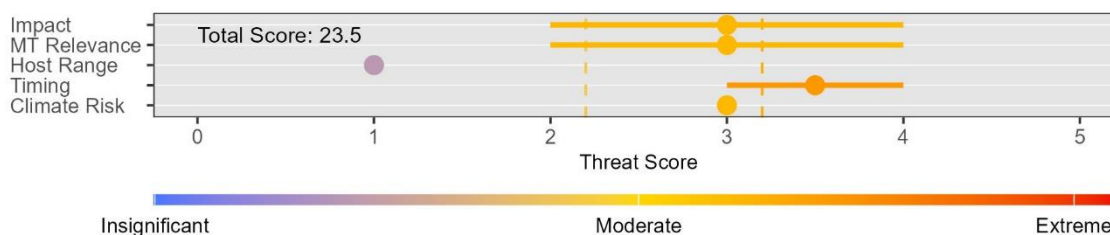
- Little is known about BKD impacts in wild fish populations, particularly among species of concern such as bull trout and wild strains of westslope cutthroat trout.
- There is little research on the potential impacts of climate change on BKD in the western United States.

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Rabbit Hemorrhagic Disease



SGCN with Known Impacts¹

Pygmy Rabbit

SGCN Susceptible to Infection

To date, no additional SGCN confirmed as susceptible

Other Susceptible Montana Species^{1,2}

White-tailed Jackrabbit

Black-tailed Jackrabbit

Desert Cottontail

Mountain Cottontail

Eastern Cottontail

Snowshoe Hare

American Pika*

*Potentially susceptible

Drivers

- Human-mediated transmission; domestic rabbit and rabbit product trade²
- Periods of increased activity/commingling (e.g., host breeding or rearing season)³
- Environmental persistence of pathogen^{3,4}
- Presence of vectors (e.g., insects, birds, predators)³

Background

Rabbit hemorrhagic disease (RHD) is a highly contagious viral disease affecting rabbits and hares. “Classical” rabbit hemorrhagic disease virus (RHDV) and a recently emerged strain (RHDV2) are the primary causative agents of RHD and can be found in almost all parts of the world. However, due to its recent impacts on native wildlife, RHDV2 is the variant of highest concern to North America³. In comparison to RHDV, RHDV2 has a broader host range (capable of infecting both rabbits and hares versus RHDV, which affects only European rabbits), can infect animals of almost any age, and can readily infect and cause mortality in rabbits previously exposed to RHDV (i.e., lack of cross-protective immunity)⁴. In wildlife, signs of disease are rarely observed as death tends to occur within several days following infection⁵. In some cases, blood may be observed around the nose or mouth and eyes can appear reddened⁶. Individuals that survive infection are likely to become chronic carriers, capable of shedding the virus into the environment for several months or longer¹. Major factors for RHD’s spread are that viral agents are highly resistant to environmental conditions and can easily be spread via direct contact with infected hosts, carcasses or meat, bodily fluids, or contact with contaminated surfaces⁷. Insects, birds, predators, or humans can also serve as mechanical vectors of disease, meaning that they can incidentally move infectious virus particles around when they come into contact, leading to geographical expansion of disease⁸. In wild populations, seasonal variation in outbreaks appears to be tied to periods of increased rabbit activity, with spring (breeding season)

being the peak period for observed mortality in North America (though mortalities have been observed in all months)³.

Impacts

Both short-term and long-term population declines due to RHD have been observed in rabbit populations around the world, with spread of the disease being primarily facilitated by human activities (e.g., transport of live rabbits and rabbit products)³. RHDV2 first emerged in North America in feral domestic rabbits in 2016, after which it occurred sporadically over the next several years as small, localized outbreaks¹. A major outbreak occurring in the southwestern U.S. in 2020 marked the first time that natural infection was observed in native North American species⁹. Since then, RHDV2 has spread across 14 states and is now considered endemic throughout the west. Challenges in surveillance have made it difficult to estimate the impact of these outbreaks on wild populations in the U.S. Studies have indicated that mortality rates from RHDV2 infection are more variable (50 to 80 percent⁵) than RHDV (70 to 100 percent²). While reduced mortality from RHDV2 may limit risk of extirpation, it increases the likelihood for rabbits to become carriers and further spread disease. Today, detections of RHDV2 are sporadic. It is difficult to determine if this is attributed to a reduced incidence in wildlife, effective management strategies (e.g., vaccination in domestics and decreased spillover), challenges in monitoring, or a combination thereof. Nonetheless, special concern exists for the impact of RHDV2 on imperiled species, such as the pygmy rabbit, which has a restricted range and is highly susceptible to RHD, with evidence of a possible disease-associated decline occurring in Nevada in 2022¹⁰. A final consideration is the bottom-up effect that may occur on predator communities following a major decline in a key group of prey species, should a severe outbreak occur¹¹.

Presence in Montana

- The most recent report of RHD in Montana occurred in a domestic rabbit in fall of 2024 in Lewis and Clark County¹².
- In free-ranging rabbits, the most recent report occurred in Musselshell County in summer 2023 (species unidentified). Several cases were reported in Yellowstone County (feral domestic rabbits and mountain cottontails) and in or around Yellowstone National Park in Wyoming (unidentified cottontail) in spring of 2021¹³, as well as Big Horn, Stillwater, Musselshell, Fallon, and Gallatin counties in recent years¹⁴. The extent of RHD in wild populations during these events is unknown.

Climate Sensitivity

RHD viruses are very environmentally durable, capable of resisting desiccation, heat, and freeze/thaw cycles^{7,15}. Therefore, they may be relatively resistant to the effects of climate variability. Both the impact and the number of outbreaks of RHD tend to be higher in

populations occupying arid regions, suggesting that increases in drought conditions due to rising temperatures and changes in precipitation patterns may increase risk of RHD^{3,16}. The association with arid climates and RHDV2's northward expansion in the U.S. highlights possible climatic drivers for disease risk, but further research is needed to better understand the relationship between RHD and climate.

Conservation Actions

Prevention

- Implement biosecurity measures (e.g., disinfection of equipment and clothing) when handling animals or working in areas of at-risk populations⁵.
- Support cross-jurisdictional efforts (e.g., Montana Dept. of Livestock, USDA), surveillance activities, and policies (e.g., importation bans) that help prevent spillover from domestic rabbits^{17,18}.
- Build public awareness about risks associated with exposing or releasing domestic rabbits into areas where at-risk wild populations exist.
- Advise hunters or falconers to avoid areas with known RHDV2 outbreaks, wear gloves when field dressing harvests, ensure proper disposal of remains, sanitize gear, and prevent birds from consuming dead or diseased rabbits^{17,18}.

Disease Management

- In the event of an outbreak in a wild population, spread of disease may be limited by ensuring proper disposal of carcasses to avoid potential contact by susceptible hosts or vector species^{5,18}.
- If considering vaccination in vulnerable wild populations, be aware of strain type needed as RHDV vaccines do not protect against RHDV2^{2,18}.

Species and Habitat Management

- Promote conservation actions that help bolster pygmy rabbit (or other affected SGCN) resilience to RHD outbreaks. These include actions that conserve greater sage-grouse and sagebrush habitat and improve habitat connectivity, which can benefit the population health and conservation of pygmy rabbits, who are obligate sagebrush dwellers^{17,18}.

Surveillance and Monitoring

- Continue to encourage the public, hunters, falconers, and rehabilitation centers to report unusual mortality events in rabbit/hare populations as a part of FWP's passive surveillance program^{5,18}.
- If conducting surveillance, be aware that RHD presence in wild populations may be best assessed in late spring during peak transmission times¹.

Research/Knowledge Gaps

- Improved surveillance methods for wild populations
- Impact assessment of wild lagomorphs exposed to RHDV2
- Evaluation of RHD in combination with other stressors (e.g., habitat alteration/loss, predation/harvest pressure, and climate variability) on lagomorph population health

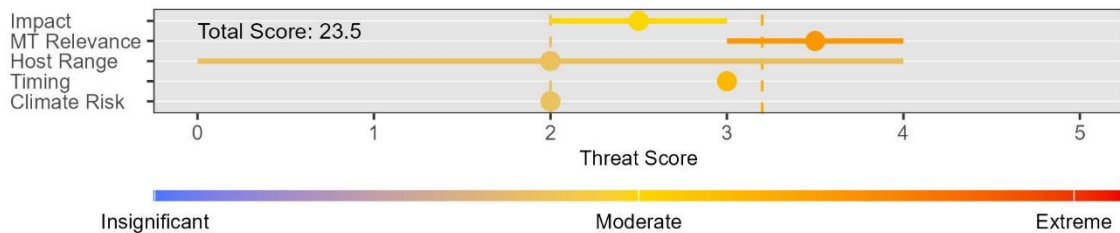
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DRAFT

Avian Salmonellosis



SGCN with Known Impacts

To date, significant impacts on SGCN have not been reported

SGCN Susceptible to Infection¹

American White Pelican	Evening Grosbeak
Black Rosy-Finch	Gray-Crowned Rosy Finch
Boreal Chickadee	Green-tailed Towhee
Brewer's Sparrow	Nelson's Sparrow
Brown Creeper	Tennessee Warbler
Cassin's Finch	Varied Thrush
Clark's Nutcracker	

SGCN Potentially Susceptible¹

Passerines and colonial waterbird SGCN

Other Susceptible Montana Species¹

American Goldfinch
Lazuli Bunting
Pine Siskin
Other animals, including mammals, reptiles, amphibians, and fish may also be susceptible.

Drivers

- Fecal contamination in food and water sources^{2,4}
- Mixing of carrier animals and susceptible animals³⁻⁵
- High contact rates and aggregation⁴

Background

Salmonellosis is a bacterial disease caused by *Salmonella* bacteria. It affects a wide variety of animals; including mammals, reptiles, amphibians, and fish; and has a worldwide distribution^{5,6}. In wild birds it can be a common cause of sporadic mortality events, especially for passerines around bird feeding stations in the winter and in young waterbirds in large breeding colonies⁶. Infected wildlife shed the bacteria in their feces for up to months after infection, and the fecal-to-oral route is the main transmission route. While reptiles, amphibians, and fish can be infected by *Salmonella*, infections are often asymptomatic, and affected individuals may serve as reservoirs that can further distribute the pathogen in the environment⁵.

Impacts

For the majority of wildlife, salmonellosis does not cause population-level impacts. However, salmonellosis outbreaks in passerines using bird feeders in the winter have caused larger mortality events, particularly in red crossbills, pine siskins, and American goldfinches⁷. Data from outbreaks indicate that mortality due to avian salmonellosis can be wide-ranging, multi-county events, involving hundreds to thousands of birds⁷. In some cases, particularly those involving waterfowl, salmonellosis is often reported in combination with multiple other sources of mortality, so it can be difficult to estimate the sole impacts of salmonellosis in certain populations.

Presence in Montana

- Salmonellosis has caused wild bird mortality events in Montana, including within the following species: crows, ravens, red crossbills, American goldfinches, pine siskins, evening grosbeaks, house finches, house sparrows, and Cassin's finches⁷.
- Salmonellosis has been involved in mortalities of wild birds in multiple counties including Sanders County (2024), Custer County (2021), Ravalli County (2020), Lewis and Clark County (2015), Garfield County (2015), Cascade County (2015), and Rosebud County (2015)⁷.

Climate Sensitivity

There is little evidence that salmonellosis is strongly tied to climate or weather. However, outbreaks are common in the winter due to an increased aggregation of animals around limited food sources, and severe winters may lead to increased use of feeders⁴.

Conservation Actions

Prevention

- Avoid supplying attractants (e.g., garbage, grain spills, bird baths, feeding stations, etc.) that may facilitate mixing of different species, which can facilitate transmission from carrier animals to susceptible animals⁸.
- Encourage the public to keep bird feeders and baths clean and sanitized, especially throughout the winter, and to use feeders that minimize transmission risk (e.g., feeders that keep food dry, smaller feeders, and those easier to disinfect)⁸.
- Consider eliminating/reducing point sources of potential bacteria (e.g., sewage, garbage, livestock wastewater discharges) near breeding colonies of aquatic species (e.g., pelicans, gulls)⁸.

Disease Management

- Antibiotic therapy may be considered but is challenging to administer in field settings with wild birds and is more easily applied to captive colonies^{8,9}.

- Promptly remove attractants (e.g., feeding stations) or point sources of bacteria (e.g., sewage, fecal buildup, garbage, etc.) during outbreak events⁸.

Surveillance and Monitoring

- Encourage reporting from the public and other agencies and consider online reporting tools.
- Accurate determination of cause of death (or sickness) during reported morbidity/mortality events in birds is important for developing prevention and management strategies⁸.

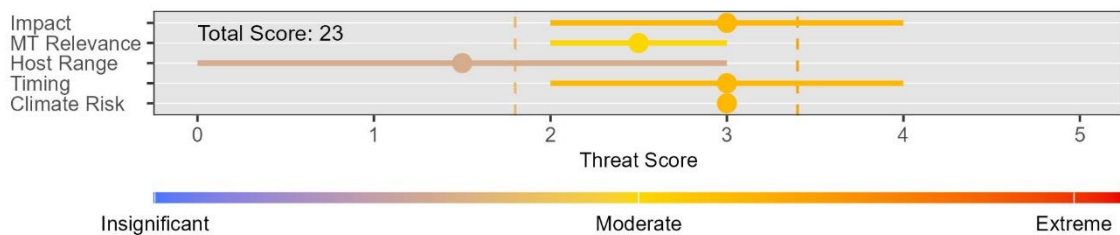
Research/Knowledge Gaps

- Most research available is concerned with salmonella spreading to humans/livestock from wildlife. Very little research is available concerning salmonella impacts to wildlife, though long-term population impacts appear to be minimal to non-existent.

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Tularemia



SGCN with Known Impacts

To date, significant impacts on SGCN have not been reported.

SGCN Susceptible to Infection¹

Pygmy Rabbit
Black-tailed Prairie Dog
White-tailed Prairie Dog
Black-footed Ferret
Columbia Plateau Pocket Mouse
Hispid Pocket Mouse
Northern Bog Lemming

SGCN Potentially Susceptible

See below.

Note that other SGCN relying upon beaver habitat may be indirectly impacted by the disease, while not being susceptible to infection themselves.

Other Susceptible Montana Species¹

Most mammals in Montana are potentially susceptible, especially species in orders Lagomorpha, Rodentia, and Sciuromorpha. Birds may become infected but are usually resistant to disease.

Drivers

- Vector abundance (ticks and other arthropods) and feeding preferences^{1,2}
- Density and distribution of mammalian reservoir hosts (rabbits, rodents, voles)^{1,2}
- Environmental contamination of *F. tularensis*^{1,2}
- Seasonality^{1,2}

Background

Tularemia is a vector-borne disease caused by the highly infectious bacterium, *Francisella tularensis*. *F. tularensis* has an exceptionally wide host range, capable of infecting over 250 species of animals (mostly mammals, some birds, and a few amphibians and reptiles)¹. Ticks are the primary vectors and reservoirs for tularemia, but some insects (e.g., flies, gnats, and mosquitos) and birds can play a significant role by mechanically spreading disease via contaminated mouth parts or excreting feces containing the bacteria². Aside from vector-borne transmission, animals are also readily infected via inhalation and ingestion of, or direct contact with, the bacterium, which can occur through exposure to other host species, contaminated water, soil, or carcasses³. The bacterium can persist for weeks to months in the environment³. Tularemia is typically detected through observations

of dead animals, since sick animals are rarely observed due to the rapid course of the disease (death usually occurring within 2 to 10 days post-infection).

Francisella tularensis is found in both terrestrial and aquatic environments. Rabbits, hares, and small ground rodents are particularly susceptible to infection and are important for persistence and amplification of *F. tularensis* in terrestrial ecosystems, whereas beavers, muskrats, and voles may become infected and amplify *F. tularensis* in aquatic environments¹⁻³. In susceptible species, it requires very few bacteria to cause disease. This, in combination with the multitude of transmission pathways, wide host range, and environmental persistence, makes tularemia a highly adaptive and ecologically complex disease.

Impacts

While *F. tularensis* is known as one of the most infectious pathogens to vertebrates, reports of long-lasting population-level impacts or declines in wildlife are uncommon. Mass mortality events are occasionally observed in aquatic rodent populations (e.g., beavers and muskrats) and susceptible terrestrial rodent and lagomorph populations, but typically disease fatalities occur sporadically^{4,5}. However, cases in humans have trended upward over the last 20 years^{3,6}, leading to concern about the potential for expansion and increasing impacts on wildlife populations. Moreover, the impacts of tularemia on beavers in particular are a concern due to their important roles as ecosystem engineers and because of the widespread desire to restore beavers within Montana. Impacts on beavers could therefore create indirect effects on a variety of SGCN that use beaver habitat. Generally, the disease threat can be variable, context-dependent, and prone to change over time, depending on shifts in environmental conditions, host abundance, community structure, and human activity.

Presence in Montana

- Recent reports have found tularemia-associated mortalities in mountain cottontail rabbits (2024, 2020) and beavers (2024) in Lewis and Clark County (Montana Fish, Wildlife, & Parks, *unpublished data*), and tularemia is suspected to have caused mortalities in desert cottontail rabbits and deer mice in Phillips County (2015)⁷.
- Mortalities in beavers continue to be documented within the state^{8,9}, including relatively large die-offs in the upper Madison River and upper Gallatin River drainages in 2016 and 2017. Tularemia is suspected to have contributed to beaver die-offs in the Centennial Valley and Ruby Valley around the same period.
- Past serologic studies occurring in Greater Yellowstone Area have shown a 21 percent prevalence of antibodies against *F. tularensis* in coyotes¹⁰, but no antibodies were observed in snowshoe hares¹¹.
- Outbreaks have occurred in domestic sheep herds (which frequently share habitat with wildlife) in Montana following severe winters and heavy tick infestations¹².

Climate Sensitivity

Climate variability can affect tularemia through its impacts on the distribution and abundance of tick vectors and reservoir host species (i.e., hares, rabbits, and rodents)^{13,14}. Warming temperatures may allow for increased northward expansion and extended periods of reproduction and development for arthropod vectors, increasing the risk of transmission¹⁵. An increase in drought conditions may limit vector abundance but can also increase host density and transmission risk by concentrating host populations during drought. Volatile weather patterns leading to sporadic, heavy rainfall events may also increase suitable breeding habitat for vectors or result in flooding events capable of facilitating spread of *F. tularensis* to new locations.

Conservation Actions

Prevention

- Advise FWP personnel and public (particularly hunters and trappers) on the routes of spread of tularemia (e.g., translocation of infected wildlife, carcasses).
- Partner with human health agencies (e.g., Montana Department of Public Health and Human Services) to develop collaborative approaches for disease monitoring, prevention, and management².

Disease Management

- In the event of severe outbreaks that threaten conservation goals, consider judicious use of insecticides in an attempt to lower vector abundance in the environment¹⁷.

Species and Habitat Management

- Protect vulnerable host habitat and reduce other stressors to promote resiliency and adaptive capacity to disease in susceptible populations¹⁷.

Surveillance and Monitoring

- Identify and map regions of possible disease foci based on lagomorph and aquatic rodent populations, serologic surveys (in carnivore species), and tick surveys^{1,16}.
- Increase opportunistic monitoring of susceptible wildlife species through lab testing of carcasses received at the Montana Wildlife Health Lab.
- Encourage hunters, trappers, and other recreationists to report observations of groups of dead rodents or lagomorphs so that samples can be collected and tested.

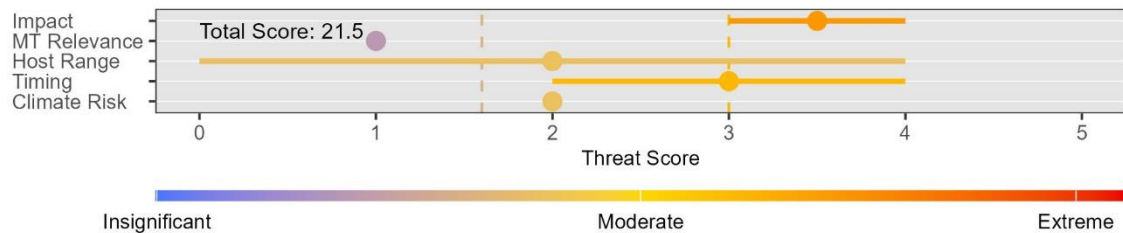
Research/Knowledge Gaps

- Impacts of tularemia on beaver restoration projects
- Effects of habitat creation or enhancement (i.e., for muskrats and beavers) on bacterial abundance

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Viral Hemorrhagic Septicemia Virus



SGCN with Known Impacts

To date, significant impacts on SGCN have not been reported.

SGCN Susceptible to Infection¹

Lake Trout Trout-perch

SGCN Potentially Susceptible²⁻⁴

Arctic Grayling Yellowstone Cutthroat

Blue Sucker Trout

Bull Trout Sauger

Columbia River Sicklefin Chub

Redband Trout Spoonhead Sculpin

Deepwater Sculpin Sturgeon Chub

Iowa Darter Torrent Sculpin

Northern Pearl Dace Westslope Cutthroat

Northern Redbelly Trout

Dace Pallid Sturgeon⁷

Pygmy Whitefish

Other Susceptible Montana Species¹

Rock bass* Walleye

Pumpkinseed* Yellow Perch

Bluegill Lake Whitefish

Largemouth Bass Rainbow Trout

Smallmouth Bass Chinook Salmon

Black Crappie Brown Trout

Spottail Shiner* Freshwater Drum

Emerald Shiner White Sucker*

Fathead Minnow White Crappie

Northern Pike Golden Shiner*

Round Goby Channel Catfish*

White Bass Brook Trout*

Drivers

- Human-mediated transmission (import of fish and fish byproduct, contaminated equipment, infected bait)⁴⁻⁶
- Presence of reservoir or highly susceptible species^{1,4}
- Waterway connectivity^{5,6}
- Water temperature^{5,6}
- Host density⁴
- Stress⁵

*Likely asymptomatic disease reservoir species

Background

Viral Hemorrhagic Septicemia Virus (VHSV) is a highly contagious and often fatal disease of both marine and freshwater fish. VHSV is well distributed throughout the Northern Hemisphere and is known to infect over 140 fish species³. In the United States, VHSV has

had severe impacts on wild fish populations in the Upper Midwest and Great Lakes regions and both wild and farm-raised fish (typically marine species) along the Pacific Coast. Fish become infected via contact with waterborne virus, direct contact with other infected fish or fish excretions (urine, reproductive fluids), or by consuming infected individuals³. Outbreaks typically occur in spring when water temperatures are still cold and within the virus's optimal range. Clinical signs include reddened areas (hemorrhages) around the eyes, gills, base of fins, or other areas of the body, bulging eyes, swollen abdomens, darkening of the skin, and abnormal swimming behavior. Infection severity and mortality rates tend to be higher in juvenile fish but can occur in any age⁵. Environmental persistence of VHSV is mediated through reservoir hosts (susceptible fish) and incidental hosts such as freshwater turtles, microcrustaceans (amphipods), and leeches⁵. Additionally, fish that survive the disease may continue to shed the virus for long periods of time (15 weeks or more), especially following stressful events⁸. Fish-eating birds may also serve as mechanical vectors for introducing VHSV into new areas⁹.

Impacts

VHSV is associated with severe disease outbreaks in both wild and farmed fish, with up to 100 percent mortality in some cases⁹. One particular strain of VHSV (the IVb strain) has caused multiple large die-offs in wild, freshwater fish (including freshwater drum, round goby, and yellow perch—species all present in Montana) in the Great Lakes region since it was first detected in 2005⁴. Since that time, it has been detected in inland waters throughout the Midwest and mid-Atlantic regions⁹. Current evidence suggests that VHSV outbreaks in North America are sporadic, with prevalence and environmental persistence appearing to wax and wane over a period of several years⁵. Mass mortality events are typically reported in common, relatively abundant species without evidence of sustained population declines. However, potential impacts to hatcheries and farm-raised fish are a concern. To date, VHSV has not been detected in Montana, but it remains a potential threat. Montana fish belonging to the orders Salmoniformes, Perciformes, and Cypriniformes should be considered most susceptible¹, yet the wide host range and difference in susceptibility between species makes predicting potential impact for Montana species difficult. Introduction of the virus would most likely occur via human-mediated transmission (e.g., transport of contaminated water, gear, or infected fish)¹⁰.

Presence in Montana

- VHSV is routinely tested for in Montana hatcheries and wild fish populations but, to date, has yet to be detected.

Climate Sensitivity

Survival and infectiousness of VHSV is heavily influenced by water temperature. Disease due to VHSV can be observed in water temperatures ranging between 34 to 64 degrees F (1

to 18 degrees C)⁹. It can survive outside the host for up to 14 days in ideal conditions, but it is highly susceptible to heat and desiccation⁸. Warming temperatures or increases in drought conditions may reduce viral spread. However, stressful events or changes to aquatic habitats that lead to crowding and fish seeking deeper, cooler waters may result in disease outbreaks. Therefore, it remains unclear to what degree climate variability may influence VHSV risk.

Conservation Actions

Prevention

- Implement and promote regulations on import of live fish or fish products from affected areas and maintain strict adherence to aquatic invasive species prevention guidelines⁶.
- Clearly communicate with anglers about the risk of VHSV spread from activities like baitfish transport and release and using contaminated boats and gear⁶.
- Develop response and management plan in the event of an outbreak¹¹.

Disease Management

- If severe outbreaks occur, consider manipulations to increase water temperature or draining and drying out of affected sites to eliminate virus^{6,11}.
- In environments where it is feasible (e.g., on equipment, in case of transport, or in hatchery environment), use disinfectants and UV light to inactivate the virus and treat water or contaminated surfaces².

Species and Habitat Management

- Reduce stressors (e.g., regulating fishing access, conserve/restore habitat, mitigate pollutants, etc.) to promote healthy, robust fish populations^{3,11}.

Surveillance and Monitoring

- Monitor for mortality events and provide training to public to watch for signs of disease¹¹.
- Continue routine surveillance efforts for VHSV in both wild fish and hatchery fish in Montana.

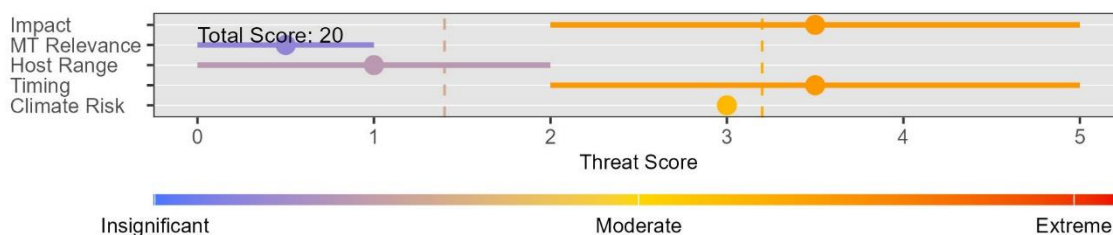
Research/Knowledge Gaps

- Montana SGCN susceptibility to VHSV
- Disease risk analysis and potential high-risk areas for introduction and viral proliferation

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Salamander Chytridiomycosis



SGCN with Known Impacts

To date, significant impacts on SGCN have not been reported.

SGCN Susceptible to Infection¹

Northern Leopard Frog*

SGCN Potentially Susceptible¹

Coeur d'Alene Salamander

Idaho Giant Salamander

Other Susceptible Montana Species

Additional species of amphibians may be potentially susceptible.

*Based on experimental infection

Drivers

- International pet trade; release of captive amphibians into the wild²
- Host life-stage (e.g., larva, juvenile, adult)³
- Temperature⁴

Background

Salamander chytrid disease, or salamander chytridiomycosis, is an emerging infectious disease caused by the fungal pathogen, *Batrachochytrium salamandrivorans* (Bsal). The disease has severely impacted certain species in Europe, but as of 2025, Bsal has not been detected in North America. Similar to *B. dendrobatidis* (Bd) in anurans (frogs and toads), Bsal invades the host's skin, leading to reddened or ulcerated lesions, increased shedding, and thickening². Other clinical signs associated with infection include lethargy, anorexia, and abnormal movement or posturing prior to death². Highly susceptible individuals typically succumb to infection within two to three weeks following exposure³. Transmission occurs through contact with fungal spores in the water, contact with contaminated surfaces (moist substrates, leaf litter, etc.), or direct contact with infected amphibians. Infective Bsal spores have also shown the ability to adhere to the feet of waterfowl, potentially facilitating widespread dispersal⁴. Understanding what species are susceptible to salamander chytridiomycosis remains ongoing, but disease appears most severe in adult salamanders in the families Salamandridae and Plethodontidae^{4,5}. Some members of the Salamandridae family (e.g., newts) and certain anurans appear susceptible to infection with Bsal with or without clinical signs, indicating potential disease reservoirs^{2,6}.

Impacts

First discovered in the Netherlands in 2010, Bsal is associated with mass mortalities and extirpation of the European fire salamander and other native European populations⁷. Populations have struggled to recover due to the sustained and disproportionate mortality observed in adults⁴. So far, eight species have been detected as infected in the wild in the Netherlands, Belgium, Germany, and Spain⁵, but experimental trials indicate many more species are susceptible to infection⁵. A laboratory study on North American amphibians revealed that Bsal caused infection in 25 (consisting of both salamanders and frogs) of the 35 species exposed to the pathogen, with eight of those species experiencing moderate to very high mortality¹. Montana's salamander SGCN were not included in this study; however, the Coeur d'Alene Salamander (*Plethodon idahoensis*) belongs to a family (Plethodontidae) in which researchers saw moderate to high mortality in tested species¹.

Presence in Montana

- Bsal has not been detected in North America as of 2025⁸.
- A geographic risk analysis for Bsal suggests that invasion risk potential is highest in the Northwest region of the U.S., posing a threat to Montana's amphibian species¹.

Climate Sensitivity

In culture, Bsal favors 50 to 60 degrees F (10 to 15 degrees C), but it has been detected on salamanders in water temperatures over 78 degrees F in the wild⁹. Infective spores have also been shown to survive and remain infective in filtered pond water for over 30 days². As a fungal pathogen, Bsal is likely to be highly influenced by environmental conditions; however, the precise impacts of future climatic changes on Bsal distribution and pathogenicity are not currently known.

Conservation Actions

Prevention

- Establish standard biosecurity protocol for work in wetlands and aquatic habitats (see [Disinfection Protocols for Herpetofaunal Pathogens](#))^{9,10}.
- Reduce the risk of spillover from captive to wild amphibians by supporting regulations on the import of certain high-risk species (Asian or European-origin amphibians) and the use of salamanders as bait¹⁰.
- Create a communication plan that includes messages on the importance and value of amphibians, the risks Bsal poses, and how target audiences (researchers, captive amphibian owners/breeders, hikers, etc.) can prevent introduction and spread of Bsal¹⁰.
- Restrict or minimize human activity around high-priority or sensitive habitats^{9,10}.
- Consider proactive management actions prior to Bsal invasion, such as connectivity reduction, habitat modification, and water treatments⁹⁻¹¹.

Disease Management

- Establish a Montana-specific rapid response plan in case of Bsal's introduction (refer to the [Rapid Response Template for Bsal](#) provided by the North American Bsal Task Force)^{9,10}.
- Potential management actions that may be considered following the invasion of Bsal include the application of antifungals to hosts at affected sites or, in high-priority populations, the capture and removal of amphibians, followed by habitat modifications or treatments (e.g., draining water bodies to kill fungal spores, applying fungicidal treatments to environment), and then release of disease-free individuals back to habitat^{9,10}.

Surveillance and Monitoring

- Identify and monitor populations and habitat areas that host Montana's high-risk amphibians.
- Develop a surveillance plan to test for occurrence of Bsal in the field in vulnerable populations.

Research/Knowledge Gaps

- Risk analysis for Montana's amphibians including information on susceptibility to Bsal
- Effects of climate variability on Bsal pathogenicity and distribution

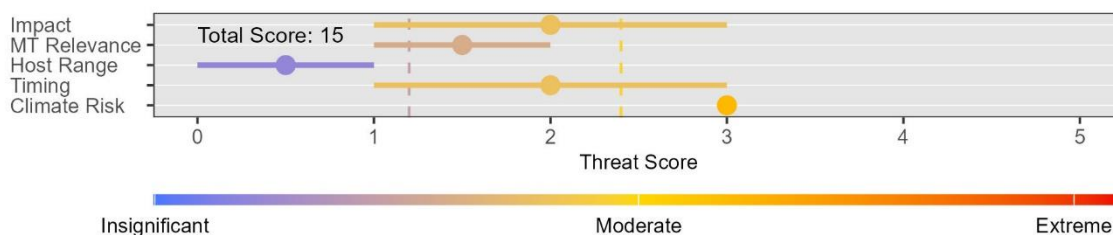
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DRAFT

Snake Fungal Disease



SGCN with Known Impacts

To date, significant impacts on SGCN have not been reported.

SGCN Susceptible to Infection⁵

Western Milksnake

SGCN Potentially Susceptible

Plains Hog-nosed Snake

Smooth Greensnake

Other Susceptible Montana Species^{5,6}

Common Gartersnake

Gophersnake

North American Racer

Prairie Rattlesnake*

Drivers

- Brumation (hibernation)^{3,4}
- Season, temperature^{4,5}
- Host factors (comorbidities, compromised skin barriers)^{4,5}
- Habitat preference^{5,6}

*Potential susceptibility based on relatedness to other susceptible species

Background

Ophidiomycosis (also known as snake fungal disease [SFD]) is a disease of snakes caused by a fungal pathogen, *Ophidiomyces ophidiicola* (Oo). It is associated with outbreaks of dermatitis in snake populations that involve crusting, ulceration and discoloration of the skin, abnormal molting, and inappropriate basking behavior in affected individuals^{7,8}. Infection is thought to occur opportunistically through breaks in the skin or via mucosal introduction^{9,10}. Clinical disease and prevalence tend to increase in spring, following brumation.

Impacts

It is unclear whether Oo affects overall population viability, but it has been linked to population declines and notable mortalities in certain species in the eastern United States^{3,11–13}. The current and potential impacts of SFD for snake populations in Montana and the greater region remains unknown. Further research and surveillance are needed.

Presence in Montana

- Only a few reports have evaluated Oo's presence in snakes in the western U.S. Of these, a survey on military lands identified infection in only a single individual (western milksnake in Idaho), which was asymptomatic for SFD⁵. A second report diagnosed SFD in a California kingsnake in California¹⁴.
- There are no known published reports evaluating the presence of Oo in Montana as of 2025.

Climate Sensitivity

Oo can grow in a wide temperature range¹⁵. However, cool, moist environments are most likely to promote fungal growth and persistence in the environment. Prevalence and evidence of clinical disease in snakes have been linked to emergence from overwintering³⁻⁶. Temperature increases during hibernation or increases in hot, dry weather patterns could drive snakes to spend more time underground. This might increase optimal Oo growth conditions, alter snake immunity, or increase contact rates among snakes, leading to heightened prevalence and worsened disease outcomes^{3,15-17}.

Conservation Actions

Prevention

- Employ strict disinfection protocols when using invasive marking techniques (e.g., radiotelemetry devices, scale clipping, cauterization, etc.), especially in areas where SFD is present^{5,18}.

Disease Management

- For species of concern, capture and treatment programs may be considered for SFD-affected individuals; however, efficacy of treatments is still under investigation^{19,20}.
- Avoid disturbance of snake populations; consider restricting or minimizing human activity around habitat if concern for disease emergence exists¹⁸.

Species and Habitat Management

- If deemed necessary, consider methods that reduce fungal load in the environment and/or improve adaptive capacity to disease, such as habitat modifications (e.g., increase basking sites, reduce moisture in denning habitats, improve habitat connectivity) or application of environmental treatments (e.g., antifungals)^{21,22}.

Surveillance and Monitoring

- Monitor for clinical disease or evidence of increased mortality in snake populations that may indicate an outbreak¹⁸.

- Explore multimodal approaches for monitoring for disease in wild populations, such as collecting swabs of individuals and conducting PCR to detect pathogen⁵ and using ultraviolet light to identify skin lesions in free-ranging snakes²³.
- Develop communication plan to inform the public about SFD and consider public monitoring programs.

Research/Knowledge Gaps

- Population-level impacts, species susceptibility, risk analysis for Montana
- Pathogen distribution in Montana
- Environmental factors affecting disease severity and environmental persistence
- Management or treatment options for disease

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CHAPTER 10:

WILDLIFE VIEWING AND EDUCATION

Enhancing conservation of SGCN and their habitats through communication, education, citizen science, and wildlife viewing

State Wildlife Action Plans (SWAPs) use the best available science to identify Species of Greatest Conservation Need (SGCN), Habitats of Greatest Conservation Need (HGCN), threats to both, and conservation actions that are needed to conserve, enhance, and recover these species and their habitats. While this chapter is not one of the eight required elements for a SWAP, two of the three broad, overarching pathways for implementing species and habitat conservation, include actions to communicate with a wide spectrum of the public and provide targeted educational messaging. Outreach and communication actions have an important role to play in wildlife and habitat conservation, including SWAP implementation.

This chapter highlights opportunities to further increase FWP's relevance to a broader range of the public. Expanding opportunities for wildlife viewing, engaging the public in citizen science, and delivering new communication and educational messages that improve conservation outcomes for SGCN and HGCN have the potential to reach nonconsumptive users and new constituents. All Montanans, as well as visitors to our state, benefit from the conservation of fish and wildlife. Hunters and anglers in Montana are passionate about conservation and engage regularly with FWP on hunting and fishing regulations, habitat conservation, and other topics related to wildlife management. But much of the public is unaware of the work that FWP does to conserve fish and wildlife, particularly nongame species. This challenge of raising public awareness is not unique to Montana. Recognizing that this lack of understanding and engagement by a large segment of society has implications for the sustainability of fish, wildlife, and their habitats, the Association of Fish and Wildlife Agencies (AFWA) formed the Blue Ribbon Panel on Sustaining America's Diverse Fish and Wildlife Resources. The panel made two recommendations:

1. That \$1.3 billion in new federal funding be secured and dedicated to support implementation of State Wildlife Action Plans to conserve SGCN and the habitats they depend on.
2. That state wildlife agencies examine the impact of societal changes on the relevancy of fish and wildlife conservation and recommend program changes to engage and serve broader constituencies.

This second recommendation resulted in the Fish and Wildlife Relevancy Roadmap (AFWA 2019), a compilation of nonprescriptive recommendations that are based on the best available research, insight, and experience of conservation professionals. Expanding conservation relevance to unengaged constituents, while continuing to engage those who are already allies, will allow FWP to be successful today and into the future.

Addressing the threats and implementing the actions identified in the SWAP isn't just a roadmap for conserving SGCN and HGCN; it presents an opportunity to build a broader, more supportive, and better-informed public that will support FWP's mission. This chapter provides options to enhance conservation of SGCN and their habitats through outreach, education, citizen science, and wildlife viewing. It outlines the strategy that FWP will use to expand the agency's relevance to otherwise unfamiliar constituents and improve customer service to all Montanans. We have organized the strategy around four avenues for delivering messages that will increase FWP's success in conserving SGCN and their habitats: communication, education, citizen science, and wildlife viewing.

10.1 Communication

Effective wildlife management and conservation in a state as large and diverse as Montana necessitates clear and frequent communication between FWP, partners, and the public. Strategic communication can help increase public awareness of and involvement in agency decision-making, simplify complex science behind management decisions, and support public resource stewardship, all of which help FWP meet its mission.

In recent years, FWP has created targeted and successful statewide, multimedia communications campaigns that integrate outreach with education related to bear safety and awareness, combating aquatic invasive species, improving hunter understanding of chronic wasting disease and the importance of testing game for disease, and more. These campaigns all identify various objectives related to the knowledge, beliefs, and behaviors of target audiences; identify messages that will resonate with those audiences; and employ an arsenal of communications tools ranging from print to digital and new to traditional media.

FWP's Communications Bureau will support the SWAP in the following ways:

1. Work with the Wildlife Division and other partners to develop and implement one or more statewide, integrated communication/education campaigns related to the SWAP's top priorities. Examples may include developing messages around the various values of nongame species, the importance of wetland and riparian habitat, or how landowners and urban wildlife watchers can help conserve and improve wildlife habitat on their properties.

2. Working from specific conservation actions identified for SGCN and HGCN that are related to communication, the communications and nongame wildlife bureaus will partner to identify strategic communications objectives, audiences, messages, and tools to meet conservation objectives.

10.2 Education

FWP recognizes the important role of conservation education in supporting the agency's mission and creating positive conservation and management outcomes for wildlife and habitat. Research, however, has shown that the connection between education and conservation-minded behavior is not linear. Rather, there is a complex web of interactions between an individual's knowledge, attitudes, values, and behaviors as well as the direct and measurable environmental impacts from those behaviors (Ardoin et al. 2020).

A 2020 review (Ardoin et al.) examined environmental education programs and their direct conservation impacts. The study highlighted a few key factors for success. It emphasized the importance of a local program focus, leveraging partnerships for program implementation, and integrating actions (e.g., weed pulling, bird surveying) into the program itself. These recommendations, which align well with FWP's existing program offerings, can guide future education program and partnership development as well as field trip and citizen science opportunities that collectively address SWAP priorities.

FWP offers a variety of place-based interpretive and educational programming at many of its 56 state parks and at the Montana WILD Education Center in Helena. Montana WILD is a premier education destination that welcomes K-12 students from across the state for educational programs (field trips) and is also open to the public for programs, live raptor viewing, and exhibit hall exploration. Similarly, many state parks provide interpretive programs for K-12 students throughout the year with hands-on learning opportunities.

FWP has identified several ways to support SWAP goals through education:

1. Integrate Species of Greatest Conservation and Inventory Need into existing educational programming.

Montana WILD offers high quality, hands-on educational programs that meet K – 12 standards across a variety of species and topics, including bats, songbirds, raptors, reptiles, amphibians, fish, macroinvertebrates, mammals, and more. Education staff frequently update programs to incorporate new data and information, hands-on elements, and recommended behaviors. Using SWAP as a guide, FWP educators will evaluate existing Montana WILD programs as well as Aquatic Education, which is delivered statewide, and integrate SWAP target species, habitats, threats, and actions whenever possible.

In addition, FWP educators host professional development trainings for teachers across Montana using the Project WILD Curriculum Guide, a collection of lessons curated by the Association of Fish and Wildlife Agencies that is used nationwide. As part of teacher trainings, educators often partner with biologists to facilitate field research experiences such as surveying for greater short-horned lizards and seine netting minnows. When these teachers return to their classrooms, they are empowered to deliver high-quality education on a variety of species, extending the reach of the material well beyond FWP's capacity. FWP will continue to prioritize and create place-based field trip opportunities for teachers and the public to further SWAP goals.

2. Create new educational programs and capacity to support SWAP.

FWP's education and interpretation specialists are well-poised to apply their skills in curriculum development and place-based educational techniques to highlight species, threats, habitats, and actions outlined in this plan. Using Level 3 conservation actions that teams of experts identified in the SWAP for 159 vertebrate SGCN and 52 HGCN, staff from the nongame and education bureaus will partner to create new education messaging and programs that aim to change human behaviors that threaten conservation or enhance human behaviors that contribute to conservation. Outcomes will yield regionally tailored programs in support of wildlife watching, key habitats and species of concern, ecosystem function, and more.

With the recent addition of seven regional Educational Technicians and an Education and Outreach Specialist in Helena tasked, in part, with SWAP implementation support, the agency will have increased capacity to support SWAP priorities through education starting in 2025.

3. Update interpretive signage and exhibits to highlight SGCN.

Working through the agency's interpretive work group—a collaborative effort between biologists, parks and recreation, and education staff—FWP will look for opportunities to integrate species and messages outlined in the SWAP into existing and new statewide interpretive signs and digital platforms. Biologists and education staff will work to develop new messaging on the threats and conservation actions for SGCN and habitats that are identified in the SWAP.

Montana WILD will explore ways to integrate a new exhibit highlighting species and habitats of concern (e.g., wetlands) in the education center's exhibit hall. In addition, the new Avian Center on the Montana WILD campus in Helena will provide on-demand opportunities for the public to view FWP's 10 to 15 ambassador raptors. These birds, including a variety of hawks, falcons, owls, and eagles, support educational programming highlighting birds, their habitats, and ecological importance. Ambassador raptors can be a highly impactful

tool for delivering messages that will enhance conservation for SGCN and the habitats they depend on.

4. Explore novel educational partnerships and partner programs.

Education staff will explore ways to continue to partner with organizations such as the Montana State Library, Montana Discovery Foundation, federal agencies, and other organizations on programs such as Adopt-a-Species (a habitat conservation program for Helena school kids) and Master Naturalist. Both programs have significant potential to integrate SWAP species and habitats and to expand outside of the Helena area with additional partnerships and capacity.

10.3 Citizen Science

Citizen Science engages the public in scientific research and monitoring through participation and collaboration. Professional biologists can train volunteers to follow field protocols and conduct surveys on wildlife to better understand species distribution and monitor trends. Citizen science projects can have multiple benefits, including augmenting wildlife monitoring capacity, increasing support and appreciation for wildlife conservation, improving scientific literacy, and fostering a sense of shared stewardship for wildlife and the habitats they depend on.

FWP and key conservation partners such as Montana Audubon and local Audubon chapters have implemented a number of successful citizen science projects monitoring SGCN and Species of Greatest Information Need (SGIN). Species that are easily recognizable and are surveyed using straightforward methods are great candidates for citizen science monitoring. Recent projects include surveys for chimney swift, common poorwill, common nighthawk, and long-billed curlew. Volunteers are trained to conduct surveys and enter data in real time using apps that can be downloaded to a smart phone, such as Survey123.

There is substantial cross-pollination between citizen science and education, such as Master Naturalist programs and FWP's teacher trainings, which often incorporate a field research experience for professional development credits. FWP educators and biologists can partner on professional development trainings designed to introduce Montana teachers to citizen science projects they can participate in with their students.

Mobile apps that allow users to log wildlife observations, such as iNaturalist and eBird, can transform even casual wildlife watchers into citizen scientists. The Montana Natural Heritage Program (MTNHP) conducts regular downloads to mine observations from both platforms, then uploads them into the statewide MTNHP database. Records are used to

document species distribution, build predictive habitat suitability models, and inform environmental reviews.

FWP has identified several ways that citizen science can be used to help conserve SGCN:

1. Identify SGCN and SGIN that can be surveyed or monitored effectively by citizen scientists.

The SWAP identifies vertebrate, invertebrate, and plant SGCN and SGIN. FWP biologists will determine which species are good candidates for citizen science projects and develop or refine survey methods to produce the data needed to meet information needs. New citizen science projects could be established for species that lack baseline data, or for which distribution data is inadequate. Citizen scientists can also resurvey locations where FWP biologists have established a baseline occupancy rate for a species, but periodic surveys (e.g., once every 10 years) are required to monitor trends.

2. Encourage participation in citizen science projects managed by partners that help FWP meet conservation and management objectives for SGCN and SGIN.

FWP will identify existing citizen science projects developed and managed by partner agencies, universities, and conservation organizations that meet SWAP goals. Examples include the Montana Bumble Bee Atlas and Project FeederWatch. FWP will also build relationships with partner organizations and look for opportunities to codevelop and implement citizen science projects that target SGCN and SGIN.

3. Increase the public's awareness and use of mobile apps that allow users to log plant and wildlife observations.

Outdoor recreation is a way of life for Montanans. A survey of outdoor recreation use by residents found that 87% of households use hiking trails (SCORP 2025). If even a small fraction of recreationists were trained in how to use mobile apps to record species observations, this would generate a tremendous amount of data on plants and wildlife. iNaturalist is particularly powerful for obtaining distribution data for plants and invertebrates; the user simply takes a photo, submits it, and a worldwide community of experts will identify the observation. When citizens submit observations of SGCN and SGIN vertebrates, invertebrates, and plants, they are feeding information into a database that is used to inform environmental review and avoid negative impacts to sensitive species and habitats.

10.4 Wildlife Viewing

Wildlife viewing is broadly defined as closely observing, feeding, or photographing wildlife; maintaining plantings or natural areas for the benefit of wildlife; or taking trips to parks and natural areas for the primary purpose of wildlife viewing (US DOI et al. 2016). More than half

of Americans participate in wildlife viewing; the 2022 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation estimated 148.3 million wildlife watching participants (US DOI 2022). Results from this national survey of U.S. residents have found that wildlife viewing is one of the fastest growing forms of outdoor recreation, and more Americans participate in wildlife viewing than fishing (39.9 million) and hunting (14.4 million) (US DOI 2022).

Here in Montana, we know that interest in outdoor recreation has never been higher; FWP has seen increased use at state parks, fishing access sites, and other FWP properties. State parks welcomed over 3.2 million visitors in 2024. This number is a 3.8% increase from 2023, a 21.9% increase from pre-pandemic levels and nearly a 50% increase in the past decade. The Statewide Comprehensive Outdoor Recreation Plan (SCORP) is Montana's strategic roadmap in the development of outdoor recreation opportunities. The Land and Water Conservation Fund program requires states to produce a SCORP every 5 years to remain eligible for LWCF funding. The SCORP identifies recreation trends, assesses existing outdoor recreation facilities and demands, and sets priorities for future investments and initiatives over a five-year planning cycle. To inform the revision of the SCORP, FWP conducted a survey regarding the outdoor recreation use of Montana residents, surveying 2,385 residents from 53 of 56 counties. Survey results confirm that outdoor recreation is a core value for Montanans, with 97% indicating that outdoor recreation is important for maintaining their quality of life and 90% indicating the importance of preserving natural areas and wildlife in recreation areas. When asked about which recreation facilities and areas they use the top response from Montanans was hiking trails (87%). Natural or wild areas was 4th (79%), wildlife viewing areas was 11th (63%), and interpretive trails was 14th (53%).

These results indicate that wildlife viewing is already popular and that there is tremendous opportunity for enhancing access and improving quality of life for even more Montanans. We know that compared to other states, Montana offers fewer developed wildlife viewing opportunities and less interpretive programming despite abundant opportunities and increasing user demand. Wildlife viewing can be further leveraged to help FWP implement SWAP goals. Research shows that wildlife viewers are more likely to participate in conservation behaviors, such as maintaining habitat for wildlife and supporting state wildlife agencies (Sinkular et al. 2022; Jennings 2024). FWP will leverage wildlife viewing experiences to deliver information on SGCN and their habitats and convey actions that lead to better conservation outcomes.

FWP has identified several ways to support SWAP goals through wildlife viewing:

1. Enhance wildlife viewing opportunities at existing FWP sites.

FWP staff from the wildlife, communications and education, and parks and outdoor recreation divisions will work collaboratively to develop a list of FWP sites, including parks, wildlife management areas, and fishing access sites, with exceptional wildlife viewing

opportunities. Site evaluations will be conducted to document the types of wildlife viewing available, opportunities for enhancement, and whether updates are needed to ensure ADA compliance. All sites will be included on FWP's wildlife viewing website, and those that meet specific ADA requirements for bird watching will be entered into the Birdability Map <https://gis.audubon.org/birdability/>.

2. Work with partners to identify and develop new wildlife viewing areas.

FWP has previously partnered with other agencies and conservation organizations to develop wildlife viewing opportunities. A recent example is the Reed's Slough Wildlife Viewing Area, a collaboration in which the Flathead Valley Land Trust secured a conservation easement on private property to protect important habitat for migratory birds, and FWP secured an access agreement with the landowner and developed the parking lot and other infrastructure to create a safe space for the public to access the site.

3. Build a wildlife viewing webpage on FWP's website under the Activities menu.

FWP staff from the wildlife and parks and outdoor recreation divisions will collaborate to build a webpage with wildlife viewing information, including a map of wildlife viewing areas and opportunities managed by FWP. The long-term vision is to include wildlife viewing information and opportunities maintained by other agencies, city and county development groups, and other partners on a common platform.

4. Incorporate wildlife viewing opportunities along trail systems.

Wildlife viewing provides opportunities to mesh State Wildlife Action Plan (SWAP) and Statewide Comprehensive Outdoor Recreation Plan (SCORP) objectives. Enhancing trail networks, pathways, and recreation connectivity is a core goal in the SCORP, and one action in the plan is to identify and designate wildlife viewing opportunities along trail systems. Incorporating wildlife viewing and interpretive information into trail systems offers multiple benefits that align with the objectives of both plans. Trails designed with wildlife viewing opportunities enhance the overall outdoor experience, attracting a broader range of users, including birdwatchers, photographers, and nature enthusiasts.

Guiding recreation to specific trail corridors helps minimize disturbance to sensitive habitats by concentrating visitor use in appropriate areas. Trail systems with designated wildlife viewing points can also be used to help monitor species occurrences and habitats (e.g., direct users to log observations in wildlife apps), providing valuable data to inform SWAP-related conservation and management decisions.

Finally, well-designed trails with wildlife viewing features can boost local ecotourism, generating revenue for nearby communities. They are also more inclusive and provide fully accessible opportunities for all ages and abilities.

5. Develop interpretive signage with targeted messaging on SGCN and HGCN.

Interpretive signage and information at FWP sites and along trails educate visitors about local wildlife species, their habitats, and conservation needs. This raises public awareness about biodiversity and the importance of protecting ecosystems. Adding interpretive elements creates a more engaging and meaningful visit, increasing repeat use and positive word-of-mouth about sites and trail systems. Such educational opportunities can foster stewardship and support for conservation initiatives outlined in SWAP, encouraging responsible recreation and wildlife-friendly behaviors.

Interpretive programs can guide visitors on how to reduce impacts, helping sustain both recreational access and wildlife habitats over the long term.

In summary, wildlife viewing within trail systems enhances the visitor experience, supports education and conservation goals of SWAP and SCORP, encourages sustainable outdoor recreation, and benefits communities economically and socially. This approach harmonizes recreation with wildlife stewardship, fostering a deeper connection between people and nature.

6. Encourage Montanans to enrich wildlife viewing opportunities at home.

FWP will develop or adapt best practices for bird feeders, share designs for building and placing your own bat box, encourage participation in backyard feeder watch programs, and provide guidance on creating pollinator gardens and other habitat.

Chapter 10 Literature Cited

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DRAFT

CHAPTER 11:

MONITORING

Element 5. Monitoring

The provisions for periodic monitoring of SGCN and their habitats, for monitoring the effectiveness of conservation actions, and for adapting conservation actions as appropriate to respond to new information or changing conditions

The inclusion of a habitat or species as one of greatest conservation concern does not imply that FWP and partners have the capacity to implement all the actions contained in this SWAP; rather, these lists and the accompanying threats and actions lay out options for making conservation progress, alongside and in collaboration with the many partners who engage in this work.

11.1 Monitoring SGCN and HGCN

Information about the status and trends of wildlife populations and their habitats forms the basis for informed management. However, obtaining such information is resource intensive, so taking this approach for all species would represent a consequential tradeoff to allocating resources for conservation actions (Buxton et al. 2020). As such, only a small number of Species of Greatest Conservation Need (SGCN) and their habitats have spatially explicit, repeated, species- or habitat-specific monitoring efforts.

A variety of circumstances dictate which species or habitats get specific monitoring efforts. For some SGCN, monitoring is obligated, planned, and executed through species recovery plans (e.g., piping plover, pallid sturgeon, Kootenai River white sturgeon, bull trout), species management plans (e.g., common loon, Columbia River redband trout, Arctic grayling, westslope cutthroat trout, Yellowstone cutthroat trout), or through the terms of conservation easements or lease agreements (e.g., prairie dogs). For these species, monitoring often informs conservation actions over short time periods (e.g., restricting access to a loon nest site). SGCN may also be monitored because they are harvested (e.g., greater sage-grouse, paddlefish), trapped (e.g., fisher), or removed for management of other species. Aside from these groups, SGCN might be the subject of short-term, species-specific monitoring efforts to address key information needs if they are petitioned for Endangered Species Act listing or if their status ranking is uncertain due to a lack of information on the species.

For the majority of terrestrial SGCN and their habitats, FWP relies on monitoring that occurs through a variety of efforts and sources to understand changes to SGCN and their habitats. These include our investment and participation in structured multispecies

monitoring programs that provide fundamental insight into trends across space or time. In Montana, examples of this type of work include involvement in Integrated Monitoring in Bird Conservation Regions, the North American Bat Monitoring Program, Breeding Bird Surveys, and the Bumble Bee Atlas.

Many SGCN fish species are monitored via the [Montana Statewide Fisheries Management Plan](#) (2023-2026), which provides management direction for both native and non-native sport fish. Monitoring fish populations and collecting ecological health data to describe trends in fish abundance, distribution, and genetic variation provides staff with essential information to manage Montana's fisheries. Monitoring is used to identify factors limiting fish populations, including habitat quality and environmental variables (e.g. flow, temperature), evaluate impacts of angling or harvest, determine the effectiveness of stocking waterbodies, and detect diseases in a population. Genetic samples of numerous fish species throughout the state are collected annually to address a wide variety of native fish management and conservation needs. For example, genetic data are necessary for species identification in cryptic species or life stages (e.g., larval pallid sturgeon), quantifying native vs. non-native genetic ancestry in individuals and populations of cutthroat trout, and documenting the amount of genetic variation in a fish population. This information is used to prioritize management actions (e.g., translocations) that address undesirable or limited genetic variation and potential inbreeding. Genetic data also play a fundamental role in helping identify and demarcate conservation and management units (e.g., populations), which in turn directly informs the spatial scale at which populations are monitored and managed.

FWP enhances its monitoring efforts by using information from incidental observations of species submitted via citizen science efforts and other platforms such as the Montana Natural Heritage Program, Fishes of Montana, eBird, iNaturalist, eMammal, and Bumble Bee Watch. FWP and partners contribute to many of these efforts through funding and/or staff time to conduct surveys. Investment in surveys that extend beyond Montana's boundaries has proven key to understanding Montana's role in stewarding species both within the state and within the region because these broader efforts provide spatially explicit density and trend information. Investments in these survey programs would be inherently less valuable without our partnership with the Montana Natural Heritage Program (MTNHP), which collates structured survey and incidental observation data from the aforementioned programs as well as data that have been submitted directly to them. Importantly, state resource agencies (e.g., FWP, Montana Department of Resources and Conservation, Montana Department of Environmental Quality) are statutorily mandated to submit collected species data to MTNHP (MCA 90-15-303), centralizing these data in one place. With these data, MTNHP supports a variety of tools that use monitoring data to help inform SGCN management. These include:

- [Map Viewer](#): This tool, which supports viewing of species occurrence and [habitat suitability model information](#), is used by nearly 1,800 agency personnel for environmental review, permitting, and planning processes across Montana.
- [Montana Field Guide](#): This tool provides accounts with information on the distribution, status, general biology, and ecology of nearly 18,000 species and habitats that are known to occur in Montana.
- [Invasive Weeds, Non-Native Watchlist](#), and [Aquatic Invasive Species Incident Management](#): These tools are used to prioritize survey and control efforts and respond to invasions of non-native species.
- [Montana Beaver Restoration HUB](#): These tools are used to support management and restoration of beavers, which provide habitat for a large number of SGCN.

Additionally, MTNHP incorporates observation data into regular re-evaluations of the conservation status of species at a state scale, and they coordinate with NatureServe on similar updates at a global scale. This process provides an opportunity to understand whether species status or trends have changed substantially given new information.

11.2 Adapting Conservation Actions to Changing Conditions

Most SGCN do not have a dedicated management plan. Monitoring data nevertheless informs conservation actions, primarily through identification of locations where actions should be implemented. The tools provided by MTNHP leverage monitoring data to inform conservation and management, and to minimize environmental impacts from human causes (see section 10.1). Monitoring data are also used to identify information gaps that can be addressed via research that examines the relationship of a threat or action to a species status or trend.

While an overwhelming amount of information about SGCN exists that could be used in conservation and management, no single agency has sufficient time to keep track of all new information for all SWAP species. Our collective goal is to identify and respond to reductions in SGCN populations and/or their habitats, and our primary means of accomplishing this is through partnership. Some of the work partners conduct offers deeper insight into threats and actions for species, and sharing this work provides broader benefits.

Participation in working groups within and beyond Montana facilitates understanding of patterns and concerns across broader spatial scales and coordination across the range of a species. FWP fish and wildlife biologists participate in dozens of working groups including Pacific and Central Flyway Committees, Partners in Flight, Montana Beaver Working Group, Western Bat Working Group, Montana Bird Conservation Partnership, Montana Chapter of

the American Fisheries Society Species of Special Concern Committee, Montana Arctic Grayling Working Group, Missouri River Recovery and Implementation Committee, Missouri River Natural Resources Committee, Mississippi Interstate Cooperative Resource Association, Bull trout Interagency Recovery Team, Kootenai River, Upper Basin Pallid Sturgeon Workgroup, Yellowstone Cutthroat Trout Multi-state Working Group, Missouri River Pallid Sturgeon Recovery Team, MT-ND Paddlefish Workgroup, Pallid Sturgeon Technical Team, Pallid Sturgeon Recovery Team.

FWP and its partners are closely involved with more temporary committees and advisory teams that offer insight into city, county, state, and national-level conservation issues and concerns. Involvement in these groups allows biologists to suggest or implement conservation actions through guiding policies and decisions around development, resource extraction, and other forms of land management. Examples of these types of efforts include involvement with county land-use planning efforts, working with federal land management agencies on updating Forest Plans and Resource Management Plans, and serving on advisory panels for the development of recreation areas.

11.3 Monitoring the Effectiveness of Conservation Actions

Ecological responses to conservation actions are often slow to occur and difficult to assess given the complexity of factors impacting a given ecosystem. For some actions, there is reasonable evidence to support their effectiveness (e.g., <https://www.conservationevidence.com/>), so project-specific effectiveness monitoring would not provide enough additional insight to warrant the dedication of limited resources. Given this, we aim to implement effectiveness monitoring when the insight it offers is of high value in understanding the impacts of actions on the threat to a SGCN or Habitat of Greatest Conservation Need (HGCN) the action was meant to address. We therefore do not plan to outline monitoring objectives or undertake effectiveness monitoring for all actions outlined in the SWAP. We aim to follow several best practices when engaging in effectiveness monitoring:

- Assess metrics that are anticipated to be responsive to the treatment within the timeframe of the assessment. In some cases, these may be variables related to changes in habitat features instead of species occurrence or abundance patterns.
- Determine whether there is likely to be adequate statistical power produced by our monitoring efforts to assess the change or difference anticipated. If greater effort is needed, then we can partner with other entities undertaking similar actions to perform an assessment that can be more broadly informative. Some funding sources for actions will require effectiveness monitoring, which we will engage with even if the potential inferences are limited. In these cases, working on small-scale effectiveness monitoring within a larger framework (e.g., Integrated Monitoring in

Bird Conservation Regions) will make the greatest contribution toward broader understanding of impacts of actions on SGCN and HGCN.

- Use the most informative approach to monitoring given the constraints of the resources available to conduct the monitoring. It is better to fully answer a smaller question than assemble a data set that does not have adequate power to address a more desirable question.
- Use a combination of genetic and demographic metrics to monitor populations and consistently evaluate novel techniques to improve precision and effectiveness of monitoring SGCN.

11.4 Monitoring the Effectiveness of Montana's SWAP

FWP is working in collaboration with MTNHP to build a forthcoming SWAP dashboard, which we will use to track conservation actions implemented in relation to SGCN, HGCN, and other SWAP objectives. By tracking the spatial and temporal implementation of actions, we hope to gain and provide better insight into where, how, and for which SGCN and HGCN we are having the greatest impact. We also intend to use the SWAP dashboard to facilitate continued and improved collaboration with partners through shared understanding of priority actions and locations where those actions are needed.

11.5 Partnering with FWP to Address Monitoring

Conservation of species and habitats is a collaborative endeavor in which different partners have different capacities, abilities, priorities, and constraints. For example, some partners directly manage habitat, while others can work to develop and test new conservation strategies or facilitate landowner access to cost-share opportunities and technical support. In the context of monitoring, an important component of collaboration is sharing information across ownership to better assess conservation needs and impacts. In particular, all partners can encourage the reporting of wildlife observation and survey data through platforms like iNaturalist or eBird, or directly to MTNHP. This steady accrual of occurrence data for different species forms the basis of our understanding of SGCN in Montana. Observations in habitats and parts of Montana that are under-visited are particularly valuable.

Explicit acknowledgement of the constraints and prioritization processes shaping the work we undertake can facilitate more efficient collaboration. Each year, FWP's Wildlife and Fisheries Divisions consider priorities for monitoring efforts that are not already dedicated through recovery or species management plans (Section 9.1). These considerations are informed by:

- ESA candidate species petitions and designations for which information on the species in Montana is needed to contribute meaningful data for a U.S. Fish & Wildlife Service (USFWS) Species Status Assessment.
- MTNHP species status ranking needs, including addressing baseline distribution information, especially for species for which Montana has disproportionately high stewardship responsibility.
- Opportunities where FWP participation in a collaborative monitoring project can meet Montana objectives that we cannot meet on our own (e.g., participating in multi-state monitoring projects that span a species' entire range).
- The need to understand how human-related stressors or management actions may impact HGCN condition or SGCN population status (e.g., developing protocols for assessing the use of bridges by bats for roosting).

New research or monitoring projects that require FWP resources, including staff time, supplies, equipment, data collected by FWP staff, or money from any FWP-managed account; or require FWP sanction (e.g., to use our logo or describe FWP as a “partner”) are vetted through FWP’s Research Prioritization Process (Version 2024-April-3). FWP defines research to include “every new study, monitoring method, or project except established, ongoing monitoring of fish or wildlife populations, habitats, or communities, and user harvest, user effort, or recreational use, or application of established monitoring methods to new species, situations, or areas.”

The FWP Fisheries and Wildlife Divisions operate research steering committees that are the vehicle for vetting, prioritizing, and recommending approval of research projects by the FWP Director. The committees consist of the division administrator, bureau chiefs, regional program managers, and the primary contact from the Research Unit; each division also may include other relevant staff in proposal review and prioritization at their discretion. These committees meet twice annually (spring and fall) to evaluate research and new monitoring proposals. Proposals are scored based on the following criteria:

- Meets information needs or research obligations identified in FWP plans, legislation, by FWP-sponsored public working groups; or by commitments made by the director, governor, or in legislative or commission processes.
- Informs or improves FWP’s management, conservation actions, or programs in a tangible way.
- Addresses concerns of vocal, influential, or large constituency groups or has significant economic impacts.
- Uses appropriate methods and techniques (analytical and technological), and products are realistically achievable in the specified timeline with identified resources.

- Applicable to a broad geographic scale, including as many FWP regions as possible.
- Encourages partnerships and collaboration and encourages work with good collaborators.
- Maximizes funding partnerships and leverages partner contributions.
- Complements and builds from existing research and data.
- Investigators' experience and expertise match the project plan.
- Encourages training of graduate students and FWP staff.

While the wording of these criteria is subject to change over the life of this SWAP, the concepts have proven to be durable over time. Following proposal scoring and discussion, the research steering committee makes a preliminary recommendation about whether to proceed with each project, or to refine the project proposal or scope, which is then vetted with the FWP Director's Office. We welcome partners to engage with us to conduct research and monitoring, knowing that these are the criteria that FWP uses to prioritize these efforts.

Chapter 11 Literature Cited

Buxton, R. T., Avery-Gomm, S., Lin, H.-Y., Smith, P. A., Cooke, S. J., & Bennett, J. R. (2020). Half of resources in threatened species conservation plans are allocated to research and monitoring. *Nature Communications*, 11, 4668.

CHAPTER 12:

REVIEW AND REVISION

Element 6. Review and Revision

Each State's provisions to review its Plan at intervals not to exceed 10 years

We will continue to follow the guidelines in the *Guidance on Wildlife Action Plan Review and Revision (2017)*, which identifies the process and requirements for the review and revision of State Wildlife Action Plans (SWAPs) for states and the U.S. Fish & Wildlife Service. Montana's first SWAP, titled "Montana's Comprehensive Fish & Wildlife Conservation Strategy," was released in 2005, followed by the first comprehensive review and revision in 2015. The 2025 SWAP was submitted in October 2025, and our next comprehensive review and revision will be submitted no later than October 1, 2035. We do not anticipate needing to conduct a major revision over the 10-year life of the 2025 SWAP. We may submit several minor revisions from 2025 to 2035 if there's new available data that adjusts the Species of Greatest Conservation Need (SGCN), Species of Greatest Information Need (SGIN), or Habitats of Greatest Conservation Need (HGCN) lists.

CHAPTER 13:

PARTNER AND PUBLIC INVOLVEMENT

Element 7. Partner Involvement

Each State's provisions for coordination during the development, implementation, review, and revision of its 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 species or their habitats

Element 8. Public Involvement

Each State's provisions to provide the necessary public participation in the development, revision, and implementation of the Plan

13.1 Partner Involvement

To gather partner feedback and assess desire for participation, we sent a survey to external partners to learn how they use Montana's State Wildlife Action Plan (SWAP) and how we can make the 2025 SWAP most useful for them. The survey was sent to 198 people across 48 agencies, and 101 people responded, resulting in a 52.6% survey response rate. See Appendix E for a list of the agencies contacted and see Appendix D for a list of the questions that were included in the survey.

One of the survey questions asked, "Are you interested in being on a SWAP External Partner Team?" Eighteen people responded "Yes" and 41 people responded "Maybe." Due to the large number of people interested in being on the external team, and due to the complexities of managing 10 different internal teams that also had diverse external representation, we decided not to create an official external team that would have been limited to 10 to 15 people. Instead, we emailed those who responded to the original survey and asked if they or their staff would like to be on an email list of interested external partners where we could provide updates and opportunities for all partners to engage. A total of 236 people across 85 agencies and organizations wanted to receive these email updates. We held three meetings in December 2024, June 2025, and August 2025 to gather feedback on the vertebrate, invertebrate, and plant SGCN, HGCN, focal areas, and our process for threats and conservation actions.

We also provided for partner participation by giving presentations about the 2025 SWAP revision at Montana Chapter of The Wildlife Society (MTTWS) and the Montana Chapter of the American Fisheries Society (MTAFS) conferences. We presented at the 2024 MTTWS and 2025 MTTWS and MTASF annual conferences about the SWAP revision process and

invited partner participation and outreach during and after both presentations. We also presented at the 2024 Montana Natural Heritage Program (MTNHP) Annual Partner Meeting, 2024 Montana Pollinator Summit, 2025 Montana Bat Working Group meeting, and the 2025 Montana Bird Conservation Partnership meeting.

At the 2025 annual MTTWS conference, we held a SWAP Partners Workshop where experts from around the state split into groups based on our Habitats of Greatest Conservation Need (HGCN) classifications and developed recommendations for threats and conservation actions affecting these habitats. The recommendations that came out of this workshop formed the basis for compiling, prioritizing, and organizing threats and actions for HGCN.

Partner participation provided valuable feedback on our SWAP products as well as the methods we used to select Species of Greatest Conservation Need (SGCN), Species of Greatest Information Need (SGIN), and HGCN. We incorporated partner feedback to the greatest extent possible, and the 2025 SWAP is a better document because of the expertise and dedication offered up by our external partners.

13.2 Public Involvement

FWP held a 20-day public comment period for Montana's Draft 2025 SWAP from August 26, 2025 through September 14, 2025. The public comment period was announced through FWP's public comment newsletter, FWP's website, and FWP's social media pages. We also notified the SWAP partners engagement list via email.

Chapter 13 Literature Cited

Montana Fish, Wildlife & Parks. 2006. Montana Comprehensive Fish and Wildlife Conservation Strategy. Helena, MT. 658 p.

Montana Fish, Wildlife & Parks. 2015. Montana's State Wildlife Action Plan. Helena, MT. 441 p.

Montana Fish, Wildlife & Parks. 2016. Montana Fish, Wildlife & Parks Vision and Guide 2016-2026. Helena, MT. 28 p.

USNVC (United States National Vegetation Classification) Database, Version 2.04. 2022. Federal Geographic Data Committee, Vegetation Subcommittee. Washington, D.C. Accessed 25 July 2025.

APPENDICES

Appendix A. Acronyms in the SWAP

Acronym	Full Text
AFWA	Association of Fish and Wildlife Agencies
BRAT	Beaver Restoration Assessment Tool
CMP	Conservation Measures Partnership
FWP	Montana Fish, Wildlife and Parks
HGCN	Habitat of Greatest Conservation Need
MTAFS	Montana Chapter of The American Fisheries Society
MTNHP	Montana Natural Heritage Program
MTTWS	Montana Chapter of The Wildlife Society
NHD	National Hydrography Dataset
NVC	National Vegetation Classification
NWI	Nation Wetland Inventory
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SGCN	Species of Greatest Conservation Need
SGIN	Species of Greatest Inventory Need
SWAP	State Wildlife Action Plan

Appendix B. Table of SGCN and SGIN Total Counts

Table B1. Total counts of Species of Greatest Conservation Need (SGCN) and Species of Greatest Information Need (SGIN) in Montana's 2025 SWAP.

Group	SGCN	SGIN	Total
Vertebrates	153	37	190
Amphibians	7	0	7
Birds	82	12	94
Fish	23	11	34
Mammals	31	14	45
Reptiles	10	0	10
Terrestrial Invertebrates	57	35	92
Ants	1	1	2
Arachnids	1	1	2
Bees	9	5	14
Beetles	2	10	12
Bugs	2	0	2
Butterflies	11	6	17
Cricket	0	1	1
Flies	1	0	1
Grasshoppers	5	0	5
Lacewings	0	1	1
Mantis	0	1	1
Millipedes	5	0	5
Mollusks	15	0	15
Moths	1	8	9
Rock Crawlers	0	1	1
Skippers	3	0	3
Springtails	1	0	1
Aquatic Invertebrates	56	26	82
Beetles	2	0	2
Caddisflies	13	9	22
Crustaceans	2	7	9
Damselflies	2	0	2
Dragonflies	3	0	3
Freshwater Sponges	2	0	2
Mayflies	14	5	19
Mollusks	7	3	10
Stoneflies	11	2	13
Plants	109	0	109
Total	375	98	473

Appendix C. List of Partners Who Assisted with Threats and Conservation Actions

Table C1. List of partners who assisted with drafting threats and actions for species and habitats in the 2025 State Wildlife Action Plan.

Name	Organization
Kevin Ellison	American Bird Conservancy
Carl Brown	Biodiversity Research Institute
Angela Dwyer	Bird Conservancy of the Rockies
Molly McDevitt	Blackfoot Challenge
Jay Carlisle	Boise State University
Amy Seglund	Colorado Parks and Wildlife
Art Soukkala	Confederated Salish and Kootenai Tribes
Cara Thompson	Confederated Salish and Kootenai Tribes
Brent Mitchell	Flathead Audubon Society
Jami Belt	Glacier National Park
John Waller	Glacier National Park
Lisa Bate	Glacier National Park
Caleb Boleman	Idaho Department of Fish and Game
Cory Mosby	Idaho Department of Fish and Game
Joel Sauder	Idaho Department of Fish and Game
Tempe Regan	Idaho Department of Fish and Game
Stephen Dinsmore	Iowa State University
Marirose Kuhlman	Missoula County Department of Ecology
Christian Meny	Montana Audubon Society
Jeff Marks	Montana Bird Advocacy
Paul Hendricks	Montana Bird Advocacy
Frank Etzler	Montana Department of Agriculture
Ian Foley	Montana Department of Agriculture
Joshua Campbell	Montana Department of Agriculture
Susan Lenard	Montana Department of Transportation
Clint Smith	Montana Fish, Wildlife & Parks
Cody Nagel	Montana Fish, Wildlife & Parks
Jim Dunnigan	Montana Fish, Wildlife & Parks
Jim Olsen	Montana Fish, Wildlife & Parks
Kristina Harkins	Montana Fish, Wildlife & Parks
Ladd Knotek	Montana Fish, Wildlife & Parks
Matt Jaeger	Montana Fish, Wildlife & Parks
Nate Kluge	Montana Fish, Wildlife & Parks
Ryan Rauscher	Montana Fish, Wildlife & Parks

Ryan Williamson	Montana Fish, Wildlife & Parks
Kristi DuBois	Montana Fish, Wildlife & Parks (retired)
Lynn Kelly	Montana Loon Society
Marian Lyman	Montana Moth Project
Mat Seidensticker	Montana Moth Project
Alexis McEwan	Montana Natural Heritage Program
Bo Crees	Montana Natural Heritage Program
Casey Delphia	Montana State University
Cayley Furot-Damiels	Montana State University
Dave Willey	Montana State University
Elizabeth Leipold	Montana State University
Justin Becker	Montana State University
Lance McNew	Montana State University
Mike Ivie	Montana State University
Sarah Bassing	Montana State University
Frank Szollosis	Montana Wildlife Federation
Mike Mershon	Montana Wildlife Federation
Kate Stone	MPG Ranch
Erin Fairbank	Northern Great Plains Joint Venture
Beth Mendelsohn	Owl Research Institute
Denver Holt	Owl Research Institute
Shaun Cleveland	Paul Smith's College
Ali Marschner	Pheasants Forever
Heather Nenninger	Pheasants Forever
Shaun McCabe	Pheasants Forever
Kayhan Ostovar	Rocky Mountain College
Andy Boyce	Smithsonian Institute
Bryan Bedrosian	Teton Raptor Center
Katherine Gura	Teton Raptor Center
Kelsey Malloy	The Nature Conservancy
Andrew Oestreich	U. S. Bureau of Land Management
Andy Oestrich	U. S. Bureau of Land Management
David Wood	U. S. Bureau of Land Management
Dillon Moes	U. S. Bureau of Land Management
Fiona Peterson	U. S. Bureau of Land Management
Heather Harris	U. S. Bureau of Land Management
Jesse Hankins	U. S. Bureau of Land Management
Katie Benzel	U. S. Bureau of Land Management
Matt Comer	U. S. Bureau of Land Management
Mike Borgreen	U. S. Bureau of Land Management
Rebecca Newton	U. S. Bureau of Land Management
Rebecca Newton	U. S. Bureau of Land Management
Wendy Velman	U. S. Bureau of Land Management

Maggie Sain	U. S. Bureau of Land Management
Alan Harrington	U. S. Fish and Wildlife Service
Brad Andres	U. S. Fish and Wildlife Service
Carly Lewis	U. S. Fish and Wildlife Service
Colleen Moutlon	U. S. Fish and Wildlife Service
Jeff Berglund	U. S. Fish and Wildlife Service
Jenny Sika	U. S. Fish and Wildlife Service
Marisa Sather	U. S. Fish and Wildlife Service
Mike McGrath	U. S. Fish and Wildlife Service
Scott Somershoe	U. S. Fish and Wildlife Service
Allison Stringer	U. S. Forest Service
Amanda Hendrix	U. S. Forest Service
Dan Tyers	U. S. Forest Service
Dean Pearson	U. S. Forest Service
Jessica Swanson	U. S. Forest Service
John Squires	U. S. Forest Service
Mary Manning	U. S. Forest Service
Scott Jackson	U. S. Forest Service
TJ Fontaine	U. S. Forest Service
Ron Torretta	U. S. Forest Service
Zackary Poetzsch	U. S. Forest Service
Barb Pitman	U. S. Forest Service (retired)
Jeff DiBenedelto	U. S. Forest Service (retired)
Blake Hossack	U. S. Geological Survey
Brian Tornabene	U. S. Geological Survey
Dustin Toy	U. S. Geological Survey
Pat Braaten	U. S. Geological Survey
Rose Swift	U. S. Geological Survey
Tabitha Graves	U. S. Geological Survey
Peter Billerman	University of Connecticut
Courtney Conway	University of Idaho
Hannah Sipe	University of Montana
Anna Kurtin	University of Montana
Anna Noson	University of Montana
David Tevs	University of Montana
Erim Gomez	University of Montana
Erim Gómez	University of Montana
Holli Holmes	University of Montana
Holli Holmes	University of Montana
Kerry Foresman	University of Montana
Maggie Blake	University of Montana
Tricia Rodriguez	University of Montana
Andrew Lant	University of Montana Western

Carly Rismon	University of Montana Western
Colton Folts	University of Montana Western
Gryphon Lombardi	University of Montana Western
Ian Smith	University of Montana Western
Kyle Richardson	University of Montana Western
Michelle Anderson	University of Montana Western
Sam Brown	University of Montana Western
Tyler Fitte	University of Montana Western
Zane Massmann	University of Montana Western
Ben Turnock	Washington Department of Fish and Wildlife
Michael Atamian	Washington Department of Fish and Wildlife
Candace Fallon	Xerces Society for Invertebrate Conservation
Kevin Burls	Xerces Society for Invertebrate Conservation
Michelle Toshack	Xerces Society for Invertebrate Conservation
Rich Hatfield	Xerces Society for Invertebrate Conservation
Saff Killingsworth	Xerces Society for Invertebrate Conservation

Appendix D. List of Survey Questions in Montana's SWAP Partner Survey

Montana's State Wildlife Action Plan (SWAP) identifies community types, Focal Areas, and species in Montana with significant issues that warrant conservation attention. Montana Fish, Wildlife & Parks (FWP) is currently undertaking efforts to update and revise Montana's 2015 SWAP. The new plan will be completed in October of 2025.

This survey will provide valuable information that will assist FWP in improving Montana's SWAP for you, your agency/organization, and others. Thank you for taking time to provide feedback on Montana's SWAP. It should take no more than 5-7 minutes to complete this survey.

1. On a scale from 1 (not at all familiar) to 5 (very familiar), how familiar are you with Montana's 2015 State Wildlife Action Plan (SWAP)?
 - a. 1 (not at all familiar)
 - b. 2
 - c. 3
 - d. 4
 - e. 5 (very familiar)
2. Were you involved in helping to draft and/or review Montana's 2015 SWAP?
 - a. No
 - b. Yes
3. In your current position, have you ever used Montana's 2015 SWAP? If you have not used Montana's 2015 SWAP, why have you not used it?
 - a. No
 - b. Yes
4. On a scale from 1 (very infrequently) to 5 (very frequently), how frequently do you use Montana's 2015 SWAP in your current position?
 - a. 1 (very infrequently)
 - b. 2
 - c. 3
 - d. 4
 - e. 5 (very frequently)
5. On a scale from 1 (not at all useful) to 5 (very useful), how useful are the following sections of Montana's 2015 SWAP to you in your current position?
 - a. Executive Summary

- b. Species of greatest conservation need
 - c. Species of greatest inventory need
 - d. Community types of greatest conservation need
 - e. Focal areas
 - f. Monitoring and adaptive management
 - g. Appendices
6. In your current position, in what different ways have you used Montana's 2015 SWAP?
(check ALL that apply below)
- a. Obtain information on species of greatest conservation need
 - b. Obtain information on species of greatest inventory need
 - c. Obtain information on key habitat types
 - d. As a reference document in land-use planning (zoning, growth planning, subdivision development)
 - e. Decide where to target conservation easements
 - f. Decide where to conduct habitat conservation or restoration projects
 - g. Use as a guide to target mitigation projects
 - h. Assist with habitat improvement projects
 - i. As a reference document for conservation actions
 - j. As a reference document for threats
 - k. To help prioritize conservation action planning and implementation
 - l. As a reference document for compliance, project commenting, or permitting relating to the National Environmental Policy Act or Montana Environmental Policy Act
 - m. Assist with writing management plans
 - n. As a reference document in writing grant proposals
 - o. Use criteria in the SWAP to help evaluate proposals for funding
 - p. To identify and/or prioritize specific research questions to answer
 - q. Decide where to conduct research
 - r. Prioritize what I do
 - s. Other (please specify)
7. How do you feel about the length of the 2015 SWAP?
- a. Much too short
 - b. Too short
 - c. Just right
 - d. Too long
 - e. Much too long
8. In what ways do you think Montana's SWAP can be improved in 2025 to assist you and your agency/organization?

9. We are seeking 10-15 people to serve on a SWAP External Team. Members of the SWAP External Team will provide feedback to the SWAP coordinator to ensure the 2025 SWAP meets the needs of Montana partners. This team will meet virtually for a couple of hours every other month between August 2024 through May 2025. Are you interested in being on the external team?
- a. No
 - b. Yes
 - c. Maybe, please send me more information about the team before I decide
10. Can we contact you again if we have any follow-up questions regarding the topics of this survey?
- a. No
 - b. Yes

Appendix E. List of Agencies That Were Sent Survey

Appendix E will be included in the final version of the 2025 SWAP.

DRAFT

Appendix F. Conservation Measures Partnership Tables

Table F1. [Conservation Measures Partnership Threats Classification \(Version 2.0\)](#) used to categorize threats to SGCN and HGCN for Montana's 2025 SWAP (Salafsky et al. 2008).

Level 1 "Threat Categories"	Level 2 "General Threats"
1 Residential & Commercial Development Human settlements or other non-agricultural land uses with a substantial footprint	1.1 Housing & Urban Areas Human cities, towns, and settlements including non-housing development typically integrated with housing
	1.2 Commercial & Industrial Areas Factories and other commercial centers
	1.3 Tourism & Recreation Areas Tourism and recreation sites with a substantial footprint
2 Agriculture & Aquaculture Threats from farming and ranching as a result of agricultural expansion and intensification, including silviculture and aquaculture	2.1 Annual & Perennial Non- Timber Crops Crops planted for food, fodder, fiber, fuel, or other uses
	2.2 Wood & Pulp Plantations Stands of trees planted for timber or fiber outside of natural forests, often with non-native species
	2.3 Livestock Farming & Ranching Domestic terrestrial animals raised in one location on farmed or non-local resources (farming); also domestic or semi-domesticated animals allowed to roam in the wild and supported by natural habitats (ranching)
	2.4 Marine & Freshwater Aquaculture Aquatic animals raised in one location on farmed or non-local resources; also hatchery fish allowed to roam in the wild
3 Energy Production & Mining Threats from production of non- biological resources	3.1 Oil & Gas Drilling Exploring for, developing, and producing petroleum and other liquid hydrocarbons
	3.2 Mining & Quarrying Exploring for, developing, and producing minerals and rocks
	3.3 Renewable Energy Exploring, developing, and producing renewable energy (except hydropower)
4 Transportation & Service Corridors Threats from long narrow transport corridors and the vehicles that use them, including associated wildlife mortality	4.1 Roads & Railroads Surface transport on roadways and dedicated tracks
	4.2 Utility & Service Lines Transport of energy & resources
	4.3 Shipping Lanes Includes dredging
	4.4 Airplane Flight Paths Air transport

5 Biological Resource Use Threats from consumptive use of “wild” biological resources including both deliberate and unintentional harvesting effects; also persecution or control of specific species	5.1 Hunting & Collecting Terrestrial Animals Killing or trapping wild animals for commercial, recreation, subsistence, research or cultural purposes, or for control/persecution reasons, including accidental mortality
	5.2 Gathering Terrestrial Plants Harvesting plants, fungi, and other non-timber/non-animal products for commercial, recreation, subsistence, research or cultural purposes, or for control reasons
	5.3 Logging & Wood Harvesting Harvesting trees and other woody vegetation for timber, fiber, or fuel
	5.4 Fishing & Harvesting Aquatic Resources Harvesting aquatic wild animals or plants for commercial, recreation, subsistence, research, or cultural purposes, or for control/persecution; includes accidental mortality
6 Human Intrusions & Disturbance Threats from human activities that alter, destroy and disturb habitats and species associated with non-consumptive uses of biological resources	6.1 Recreational Activities People spending time in nature or traveling in vehicles outside of established transport corridors, usually for recreational reasons (e.g., off-road vehicles, snowmobiles, mountain bikes, hikers, skiers, birdwatchers, pets in rec areas, temporary campsites, caving, rock-climbing)
	6.2 War, Civil Unrest & Military Exercises Actions by military forces without a permanent footprint (e.g. training exercises and ranges, munitions testing)
	6.3 Work & Other Activities People spending time in or traveling in natural environments for reasons other than recreation, military activities, or research (e.g., law enforcement, drug smugglers, illegal immigrants, vandalism)
7 Natural System Modifications Threats from actions that convert or degrade habitat in service of “managing” natural or semi-natural systems, often to improve human welfare	7.1 Fire & Fire Suppression Suppression or increase in fire frequency and/or intensity outside of its natural range of variation
	7.2 Dams & Water Management/Use Changing water flow patterns from their natural range of variation either deliberately or as a result of other activities
	7.3 Other Ecosystem Modifications Other actions that convert or degrade habitat in service of “managing” natural systems to improve human welfare (e.g., land reclamation projects, abandonment of managed lands, rip-rap along shorelines, mowing grass, tree thinning in parks, beach construction, removal of snags from streams)
	7.4 Removing/ Reducing Human Maintenance Absence or reduction of current or historical maintenance regimes important for key ecological attributes. Includes regimes historically maintained by protected area staff, farmers and ranchers, indigenous peoples, private landowners, or any other resource manager.

8 Invasive & Other Problematic Species & Genes Threats from non-native and native plants, animals, pathogens/microbes, or genetic materials that have or are predicted to have harmful effects on biodiversity following their introduction, spread and/or increase in abundance	8.1 Invasive Non-Native/Alien Species Harmful plants, animals, and microbes not originally found within the ecosystem(s) in question and directly or indirectly introduced and spread into it by human activities
	8.2 Problematic Native Species Harmful plants, animals, or microbes that are originally found within the ecosystem(s) in question, but have become "out-of-balance" or "released" directly or indirectly due to human activities
	8.3 Introduced Genetic Material Human altered or transported organisms or genes (e.g., pesticide resistant crops, using nonlocal seed stock, genetically modified insects for biocontrol)
	8.4 Pathogens & Microbes Harmful native and non-native agents that cause disease or illness to a host, including bacteria, viruses, prions, fungi, and other microorganisms
9 Pollution Threats from introduction of exotic and/or excess materials or energy from point and nonpoint sources	9.1 Household Sewage & Urban Waste Water Water-borne sewage and non-point runoff from housing and urban areas that include nutrients, toxic chemicals and/or sediments
	9.2 Industrial & Military Effluents Water-borne pollutants from industrial and military sources including mining, energy production, and other resource extraction industries that include nutrients, toxic chemicals and/or sediments
	9.3 Agricultural & Forestry Effluents Water-borne pollutants from agricultural, silvicultural, and aquaculture systems that include nutrients, toxic chemicals and/or sediments
	9.4 Garbage & Solid Waste Rubbish and other solid materials including those that entangle wildlife
	9.5 Air-Borne Pollutants Atmospheric pollutants from point and nonpoint sources
	9.6 Excess Energy Inputs of heat, sound, or light that disturb wildlife or ecosystems (e.g., noise from highways or airplanes, heated water from power plants, lamps attracting insects)
10 Geological Events Threats from catastrophic geological events	10.1 Volcanoes
	10.2 Earthquakes/Tsunamis
	10.3 Avalanches/Landslides
11 Changes in Climate Threats from changes in long term climatic patterns which may be linked to global warming and other severe	11.1 Ecosystem Encroachment Large-scale effects of ecosystems shifting and impinging on other species and ecosystems.
	11.2 Changes in Geochemical Regimes

climatic/weather events that are outside of the natural range of variation	Broad-scale changes in the geochemical conditions of ecosystems including ocean acidification
	11.3 Changes in Temperature Regimes Broad-scale changes in temperature mean, variability, seasonality and extremes, including changes in temperature extremes, increased average summer temperature, and decreased minimum winter/spring temperature
	11.4 Changes in Precipitation & Hydrological Regimes Broad-scale changes in precipitation mean, variability, seasonality, and extremes, including decreased or increased precipitation, changes in timing of precipitation, changes in form of precipitation, changes in evapotranspiration rates and hydrological cycles, and droughts and floods
	11.5 Severe/Extreme Weather Events Changes in frequency, timing and/or intensity of storms as well as severe weather events that threaten targets that have lost resilience

Table F2. [Conservation Measures Partnership Threats Classification \(Version 2.0\)](#) used to categorize conservation actions for SGCN and HGCN in Montana's 2025 SWAP (Salafsky et al. 2008).

Level 1 "Action Categories"	Level 2 "General Actions"
1 Land/Water Protection Actions directly managing or restoring sites, ecosystems and the wider environment	1.1 Site/Area Stewardship Enhancing viability / mitigating stresses for sites and/or ecosystem targets, especially on a smaller scale
	1.2 Ecosystem & Natural Process (Re)Creation Restoring missing or severely degraded ecosystems and ecosystem functions and processes, especially on a large scale
2 Species Management Actions directly managing or restoring specific species or taxonomic groups	2.1 Species Stewardship Enhancing viability of/ mitigating stresses to specific taxa within their current range
	2.2 Species Re-introduction & Translocation Transferring species or genetic material to places where they formerly occurred or to suitable future habitat or benign introductions of species to an ecosystem
	2.3 Ex-situ Conservation Protecting specific taxa in artificial settings with the aim of ultimately restoring them to their natural settings
3 Awareness Raising Actions making people aware of key issues and/or feeling desired emotions, leading to behavior change	3.1 Outreach & Communications Promoting desired awareness and/or emotions and subsequent behavior change by providing information to target audiences through appropriate channels
	3.2 Protests & Civil Disobedience

	Promoting desired awareness and subsequent desired behavior change by conducting protests, naming and shaming, civil disobedience, or sabotage activities
4 Law Enforcement & Prosecution Actions monitoring and enforcing compliance with existing laws and policies at all levels to deter threats or compel conservation action	4.1 Detection & Arrest Detecting, directly stopping, and/or deterring violations of existing laws and policies
	4.2 Criminal Prosecution & Conviction Ensuring appropriate application of sanctions for violations of existing laws and policies
	4.3 Non-Criminal Legal Action Threatening or bringing non-criminal legal action to get individuals, organizations, agencies or firms to change or deter undesired behaviors or compel conservation action
5 Livelihood, Economic & Moral Incentives Actions using livelihood, other economic and moral incentives to directly influence attitudes and behaviors	5.1 Linked Enterprises & Alternative Livelihoods Developing enterprises that directly depend on the maintenance of natural resources or provide substitute livelihoods as a means of changing attitudes and behaviors
	5.2 Better Products & Management Practices Developing, promoting and/or providing more environmentally friendly products or practices that substitute for environmentally damaging ones
	5.3 Market-based Incentives Using market mechanisms to change behaviors and attitudes
	5.4 Direct Economic Incentives Using direct or indirect payments or ascribing economic value to change behaviors and attitudes
	5.5 Non-Monetary Values Using intangible and moral values to change behaviors and attitudes
6 Conservation Designation & Planning Actions directly protecting sites and/or species	6.1 Protected Area Designation and/or Acquisition Legally or formally establishing or expanding public or private parks, reserves, and other protected areas
	6.2 Easements & Resource Rights Legally or formally establishing protection of some specific aspect of the natural resources on public or private lands
	6.3 Land/Water Use Zoning & Designation Designating land/water uses or designating conservation areas outside of formal parks or wildernesses
	6.4 Conservation Planning Planning for management of sites, species, or thematic conservation projects
	6.5 Site Infrastructure Building or maintaining the physical infrastructure for protected areas and other conservation sites
7 Legal & Policy Frameworks	7.1 Laws, Regulations & Codes

Actions developing and influencing legislation, policies and voluntary standards affecting conservation	Creating, amending, or influencing laws, regulations and codes at all levels
	7.2 Policies & Guidelines Creating, amending, or influencing policies and guidelines at all levels
8 Research & Monitoring Actions collecting data and transforming it into information to support conservation work	8.1 Basic Research & Status Monitoring Collecting, managing and analyzing data and creating information about any conservation-related factors
	8.2 Evaluation, Effectiveness Measures & Learning Assessing and learning about the effectiveness of conservation work
9 Education & Training Actions enhancing the knowledge and skills of specific individuals to build capacity	9.1 Formal Education Enhancing knowledge and skills of students in a formal degree program
	9.2 Training and Individual Capacity Building Enhancing knowledge, skills and information exchange for practitioners, stakeholders, and other relevant individuals in structured settings outside of degree programs
10 Institutional Development Actions creating the institutions needed to support conservation work	10.1 Internal Organizational Management & Administration The basic work needed to establish and operate conservation organizations
	10.2 External Organizational Development & Support Creating or providing non-financial support & capacity building for conservation organizations
	10.3 Alliance & Partnership Development Forming and facilitating partnerships, alliances, and networks of organizations
	10.4 Financing Conservation Raising and providing funds for conservation work