MINNESOTA'S WILDLIFE ACTION PLAN 2025-2035

CONSERVING HABITATS AND BIODIVERSITY

MAMMALS

DEPARTMENT OF NATURAL RESOURCES

NONGAME WILDLIFE PROGRAM

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Mammals

Overview

Minnesota is home to 74 native mammal species with established breeding populations. This includes a recent immigrant to the state, the North American evening bat (*Nyticeius humeralis*). Three species were historically present but are now considered extirpated from Minnesota: free-ranging American bison (*Bos bison*); caribou (*Rangifer tarandus*); and North American least shrew (*Cryptotis parva*). Other mammalian wanderers from adjacent states make an occasional appearance in Minnesota and there are several mammal species whose distributions approach the state borders. Excluded from this list are humans, two non-native rodent species that have established populations in the wild, the brown rat (*Rattus norvegicus*) and house mouse (*Mus musculus)*, and several domesticated mammals that have become feral.

Among the mammals identified as Species in Greatest Conservation Need (SGCN), most Minnesotans will recognize the large and conspicuous gray wolf (*Canis lupus*) and moose (*Alces alces*). However, they may not know much about the smaller mammals on this list, such as prairie vole (*Microtus ochrogaster*), northern bog lemming (*Mictomys borealis*), or smoky shrew (*Sorex fumeus*). Seven of the eight species of bats found in the state are included but go largely unnoticed due to their nocturnal habits. These range from the more numerous big brown bat (*Eptesicus fuscus*) that frequents buildings to more secretive species such as the silver-haired bat (*Lasionycteris noctivagans*) and tricolored bat (*Perimyotis subflavus*).

Photo: Canada lynx, Anya Auerbach

For thousands of years mammals in Minnesota provided food and materials for clothing, tools, and shelter to the Ojibwe and Dakota people. Tribes in Minnesota maintained important relationships with American bison, American black bear (*Ursus americanus*), wolf, wapiti (elk; *Cervus canadensis*), snowshoe hare (*Lepus americanus*), North American beaver (*Castor canadensis*), and common muskrat (*Ondatra zibethicus*) (Swanson, 1940).

The arrival and expansion of European settlers caused one of the major stressors to some Species in Greatest Conservation Need through their unregulated take and market hunting that fed rapidly growing urban populations. In addition to the decimation of bison, current SGCN that declined during this period include elk, Canada lynx (*Lynx canadensis*), gray wolf, and American badger (*Taxidea taxus*) (Swanson, 1940). Although tightly regulated hunting and trapping seasons now help to maintain sustainable populations of these species, concern regarding their status remains. Like all SGCN taxa today, the loss and degradation of habitat is a primary threat that impedes the ability these species to recover from historic losses.

With exploration and settlement of the Minnesota Territory came accounts of the region's abundant wildlife. However, by the time scholarly publications first described the mammals present in this region, they recognized that losses were already occurring due to changing conditions associated with "encroachments of civilization" (Herrick, 1892). Subsequent accounts of the mammals of Minnesota included observations of the effect of human activities, such as tree harvest, pest removal, or fur-trapping, that benefited some mammals while decimating others (Surber, 1932; Gunderson & Beer, 1953; Hazard, 1982). Change has continued to occur since the last comprehensive account of Minnesota's mammals was published in 1982. Statewide surveys, beginning in the late 1980s by the Minnesota Biological Survey, have made significant contributions to our knowledge of the distribution and abundance of many mammal species found in the state.

Long an iconic symbol of Minnesota's Northwoods, one prominent SGCN is the moose. The state's moose population has experienced a 60% population decline since 2006 in northeast Minnesota. The state population estimate in 2006 was 8,840 animals; by 2025 it had declined to 4,040. The latter number actually was an increase above the lowest population estimate in the year 2018 of 3,030 animals (DNR Aerial Moose Survey). Heat stress, increased winter ticks, and introduction of parasites carried by white-tailed deer (brainworms and liver flukes) whose ranges are increasingly overlapping are key effects from a changing climate. During summer heat, moose experience elevated body temperatures that sometimes persist until the next day and reduce their ability to forage (Carstensen et al., 2024). Effects of warming temperatures on other mammalian SGCN associated with Minnesota's boreal forests, such as the Canada lynx and snowshoe hare, have also been noted and are discussed in the following pages.

Photo: Snowshoe hare, Julia Geschke

SGCN and SNI Summary Information

This chapter provides information on 31 mammals that were designated as Species in Greatest Conservation Need (SGCN). In addition, three species were designated as Species in Need of Information (SNI): prairie shrew (*Sorex haydeni*), North American evening bat (*Nycticeius humeralis*), and long-tailed weasel (*Neogale frenata*). One species on the 2015 SGCN list, the North American least shrew (*Cryptotis parvus*), was removed as it is extirpated from the state. The mountain lion (*Puma concolor*), which received a Presumed Extirpated S-rank (SH), was retained on the SGCN list as there have been sightings of vagrant individuals in recent years. Five new SGCN species were added: gray wolf, northern flying squirrel (*Glaucomys sabrinus*), snowshoe hare, rock vole (*Microtus chrotorrhinus*), and Eastern woodland jumping mouse (*Napaeozapus insignis*).

Among the newly added SGCN, snowshoe hare - *Waabooz* in Ojibwe - was Tribally-nominated due to its cultural significance to Native Americans within Minnesota, declines in parts of its range, and anticipated effects of climate change on the species through warming winters and reduced snow duration and depth. Snowshoe hare is a culturally important prey species valued for its meat and fur, particularly in winter. There are concerns over its reduced population size and range extent, as well as its future status with less extensive snow cover in shorter, milder winters under a warming climate. A special challenge for the snowshoe hare is the change in its fur color and the potential for phenological mismatch, when the timing of its color change does not match up with the presence of snow. The *Waabooz* was in the 99th percentile for climate vulnerability in the Aanji-bimaadiziimagak o'ow aki Climate Change Vulnerability Assessment (Great Lakes Indian Fish and Wildlife Commission [GLIFWC] Climate Change Team, 2023).

The range of the Northern flying squirrel appears to be retracting as Southern flying squirrels (*Glaucomys volans*) expand northward, possibly due to changes in climate and habitats that are bringing the two species into contact. The rock vole and Eastern woodland jumping mouse both have distributions limited to far northeastern Minnesota, where they appear to occur in small, isolated populations that could be vulnerable to local habitat alteration. Gray wolves are federally listed as threatened in Minnesota and endangered in the remaining contiguous 48 states where they are found. The Minnesota population remains vulnerable to the same threats as elsewhere in its range.

Federally listed SGCN include one species as endangered, northern long-eared bat (*Myotis septentrionalis*), and two threatened, the Canada lynx and gray wolf. In addition, at the state level, two species are state threatened, plains spotted skunk (*Spilogale interrupta*) and northern pocket gopher (*Thomomys talpoides*); 19 species are state listed as Special Concern. A complete list of both SGCN and SNI species can be found in Appendix B.

In light of recent field studies (see Case Study box) that suggest large regional population declines for both migratory and cave-using populations of bats (Boman, pers. comm.), seven of the eight bat species found in Minnesota are considered SGCN: little brown bat (*Myotis lucifugus*), Northern long-eared bat, tricolored bat, big brown bat, hoary bat (*Lasiurus cinereus*), silver-haired bat, and Eastern red bat (*Lasiurus borealis*). The evening bat, first confirmed in Minnesota in 2016, is a Species in Need of Information as few individuals have been confirmed in the state. Minnesota participates with several other states in regional conservation efforts for bat conservation, including the Lakes States Forest Management Bat Habitat Conservation Plan (ICF, 2023).

Case Study: Declines in Minnesota's Bats

Bats are a unique group of SGCN mammals in Minnesota, occupying both terrestrial and aerial habitat as the only mammals capable of true flight. Historically, bats have been understudied across the globe compared to other mammal groups, largely due to their cryptic nature, nocturnal activity, and limited technology for studying movements of such small animals. Since the early 2000s, research has expanded exponentially across the continent in response to a deadly bat-specific disease known as White-Nose Syndrome (WNS, Frick et al., 2010). The disease is caused by a non-native fungus, Pseudogymnoascus destructans, that grows in cold and humid environments (Gargas et al., 2009), such as the conditions found in caves and mines where bats hibernate. The fungus colonizes the tissues of hibernating bats leading to frequent arousals and energy expenditure, premature loss of critical fat reserves, and mortality rates exceeding 75% two years after infections are documented (Blehert et al., 2009).

In Minnesota, the disease was first confirmed at Soudan Underground Mine in the winter of 2016. Similar to trends throughout North America, severe declines for multiple hibernating bat species were documented throughout the state within five years of confirmation of the disease in hibernacula. By winter of 2019, the population of bats overwintering in Soudan had declined by over 90% just three years after WNS was documented in the mine. This population continued to decrease until reaching a 98% decline by 2024. At the southern border of Minnesota, Mystery Cave also observed declines of 94% a few years after the disease was confirmed, following a similar timeline as the Soudan Mine farther north. All known and accessible hibernacula have documented evidence of WNS. As of 2025 Minnesota is considered the western border of the endemic zone (i.e. the zone where the fungus is consistently present which stretches east to the Atlantic coastline and south to Arkansas, Tennessee, and North Carolina (USGS).

Photo: DNR biologist surveying hibernating bats for White-Nose Syndrome

SGCN such as the little brown bat, Northern long-eared bat, and tricolored bat have been heavily affected by the disease. The fourth cave-hibernating species in Minnesota, the big brown bat, appears to be less susceptible to mortality from the fungus (Frank et al., 2014), and their populations have experienced lower mortality. Little brown bats make up a large portion of the bat declines in hibernacula; they were once the most common bat species in the state and across their known range throughout North America. Northern long-eared bats and tricolored bats were often encountered in Minnesota caves and mines, though in lower numbers compared to little brown bats (Nordquist and Birney, 1985). After WNS infections, these species are encountered much less often during monitoring surveys, particularly the Northern long-eared bat. Due to these declines, the Northern long-eared bat was uplisted from federally threatened to endangered in 2022 (USFWS, 2022); the tri-colored bat and little brown bat are both also being considered for federal listing in 2025.

The need to monitor bat populations through time in response to WNS has generated improved tools for bioacoustics, allowing biologists to record bat vocalizations, also known as bat calls, and to assess changing activity through time. This development has increased the ability to monitor migratory bat species that travel long distances longitudinally, are not known to aggregate in colonies, and are difficult to survey with traditional methods. As their name suggests, migratory bats do not overwinter or use caves in Minnesota, instead they move to areas with milder climates (Hayes et al., 2015). As a result, they do not enter hibernation for any prolonged period (which is when the fungus infests the host bat) and their immune system is able to combat the WNS fungus. However, a disparate threat has emerged for these species that also causes high mortality rates with negative effects for migratory bat populations.

Migratory SGCN bat species, such as hoary bats, silver-haired bats, and Eastern red bats, are frequently found dead below wind turbines (Arnett et al., 2008). As a long-distance migrating species, hoary bats comprise the largest portion of fatalities at turbines (Kunz et al., 2007). In 2017, Frick et al. predicted that the estimated mortality in North America per megawatt (installation capacity levels in 2014) for hoary bats could threaten population viability and pose risk of extinction for this species. With the use of bioacoustics and improved monitoring protocols, evidence of summertime region-wide decline for hoary bat populations was confirmed in the Pacific Northwest (Rodhouse et al., 2019).

In Minnesota, bioacoustic monitoring was conducted from 2010-2019 by the U.S. Forest Service, Camp Ripley, and Minnesota Biological Survey (DNR). Bioacoustic monitoring uses special detection devices to record and analyze the ultrasonic calls that bats emit to navigate and locate food, enabling researchers to identify which species are present and to assess their abundance. Call abundance for WNS-affected species such as little brown bats and Northern long-eared bats declined 84% after 2015, closely following trends observed in winter hibernaculum (Figure 2.1, Herberg et al., 2020 and Melissa Boman, DNR, pers. comm.). The data collected by these partners also documented a large decline (greater than 78%) in the abundance of migratory Lasiurus, the hoary bat and Eastern red bat in Minnesota in the years following 2014 (Figure 2.1, Herberg et al., 2020). Unexpectedly, these trends were similar to cave hibernating species experiencing high mortality from WNS. Statewide, total call abundance declined by 54% from a peak in 2015. Big brown bats and silver-haired bats were combined into one category due to overlapping call parameters. This group composed the largest portion of call files (23%) and did not follow overall trends for steep declines. Due to high levels of interactions between migratory bats and wind turbines, these acoustic data suggest additional monitoring is needed to track migratory bat population trends as wind energy development expands nationwide. For all bat species in Minnesota, more information is needed on summer roosting requirements, important gathering areas, migratory pathways, and management actions that can benefit populations.

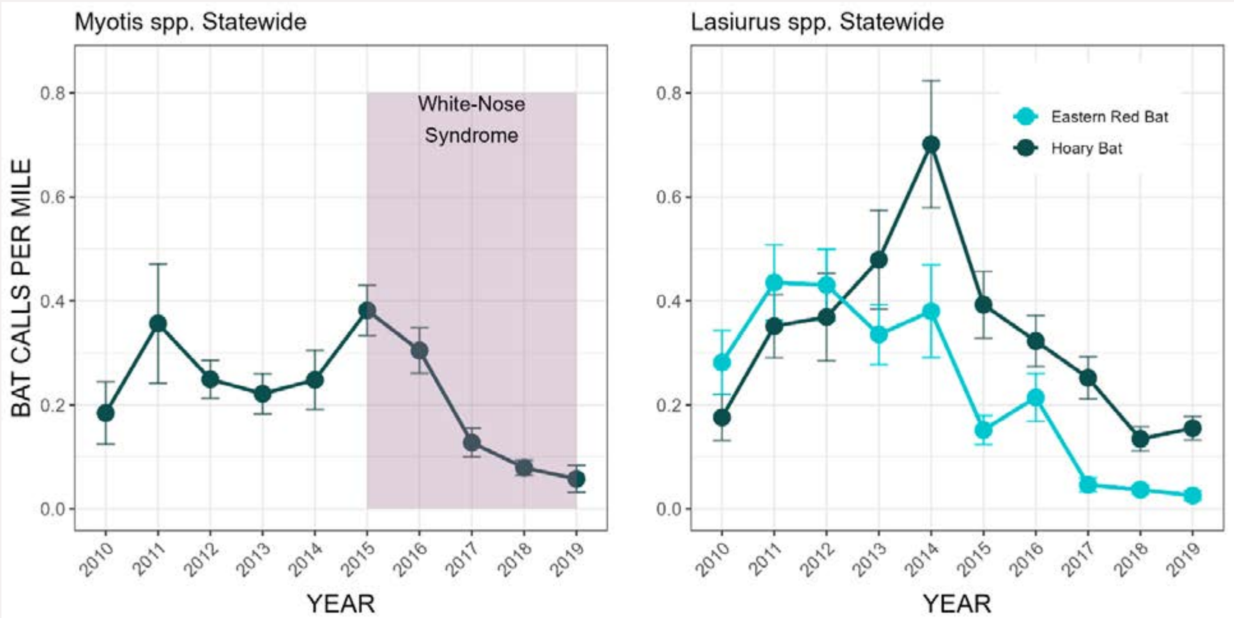


Figure 2.1 Graphs indicating population levels of bats in Minnesota for the years 2010-2019, based on bioacoustics data (bat calls). The left panel shows Myotis bats (Northern long-eared bat and little brown bat) that overwinter in Minnesota and the onset of white-nose syndrome in the state. The right panel shows data for two migrating bats for the same timeframe, also showing strong declining trends (Herberg et al., 2020 and Melissa Boman, DNR, pers. comm).

Habitat Associations

Mammal SGCN occupy diverse habitats including grasslands, wetlands, brushlands, peatlands, forested uplands and lowlands, and transitional habitats. Some species are found in a variety of habitats due to their mobility and life history traits. Large predators, such as mountain lions (*Felis concolor*), range widely in search of prey. Bats' ability to fly considerable distances allows them to utilize multiple habitats for foraging, rearing pups, and hibernating. Other SGCN mammals are strongly associated with a narrow range of habitat conditions, including the rock vole and Northern bog lemming.

A summary of mammal SGCN associations with the 15 primary habitat types in the SWAP are listed in Table 2.8. Primary habitats are those that species rely on and use most consistently; loss or degradation of these habitats would have the most significant negative effect on their populations. Secondary habitats are used by the species less frequently. Animals with more general habitat requirements are associated with multiple habitat types, while specialists are associated with one or few. The mountain lion was only assigned secondary habitat associations, with 12 habitat types, due to its ranging nature. No mammal species were officially associated with vernal pools, although vernal pools are visited by some mammals. A complete list of all primary and secondary habitats for each SGCN can be found in Appendix D.

Prairies and other grasslands are the primary habitat for a large number of SGCN mammals. The extensive loss and degradation of this habitat across western and southern Minnesota is responsible for the declining populations and vulnerability of so many species. Many of these SGCNs are small to mid-sized mammals that are limited to grassland habitats. These mammals include the white-tailed jack rabbit (*Lepus townsendii*), American badger, prairie vole, northern grasshopper mouse (*Onychomys leucogaster*), plains pocket mouse (*Perognathus flavescens*), and Richardson's ground squirrel (*Urocitellus richardsonii*).

The important ecological roles that small and mid-sized mammals play in grassland systems were summarized by Ayodele (2025) and highlighted by the DNR Prairie Wildlife webpage. They include nutrient cycling, soil disturbance, grazing, dispersal of seeds and mycorrhizal fungi, and serving as both predators and prey for other animals. SGCN mammals can be vital to populations of SGCN from other groups. For example, Richardson's ground squirrels are associated with the population health of key SGCN predators such as the burrowing owl (*Athene cunicularia*) and Swainson's hawk (*Buteo swainsoni*) (Houston & Bechard, 1984; Conway, 2018), while white-tailed jackrabbit's selective grazing activities play an important role in the distribution of grassland plants while their burrows can act as seed pits or refuges (Schlater et al., 2021). Both these SGCN species have experienced population declines. White-tailed jackrabbit populations, for example, have significantly declined over the past century, primarily from eradication efforts (e.g., hunting and poisoning) aimed at reducing crop damage in the early 1900s (Brown et al., 2018) and from the loss of the species' preferred habitats, including grasslands, pastures, hayfields, and small grains. Today, the species' population is only a fraction of what it was throughout its range compared to the previous century (Brown et al., 2020) and it is rarely seen in Minnesota (DNR ARS 2024). Despite this decline, little research on the species has been conducted (Schlater et al., 2021).

Table 2.8. Numbers of Mammal Species in Greatest Conservation Need associated with each habitat type.

Habitats	Primary Habitat	Secondary Habitat	Total
Prairie and Other Grasslands	12	1	13
Savanna	5	13	18
Upland Conifer Forest and Woodland	12	7	19
Upland Deciduous Forest and Woodland	11	10	21
Mesic Hardwood Forest	8	7	15
Deciduous Wet Forest	7	6	13
Coniferous Forest Wetland	1	6	7
Riparian and Floodplain Forest	9	2	11
Non-forested Wetlands	4	2	6
Rivers and Streams	0	9	9
Lakes	0	9	9
Cliff, Talus, and Rock Outcrops	2	12	14
Caves	4	0	4
Urban and Other Developed Lands	2	14	16

Photo: Richardson's ground squirrel, Amy Westmark

A variety of forests provide habitat for many SGCN mammals that have more general habitat requirements. These include many large SGCN mammal species such as gray wolves, moose, and elk, which have had a long history of importance to human communities as apex predators and game species. As a result, these mammals are well studied. Primarily found in the forested regions of Minnesota, many of these species are considered boreal species, with the majority of their populations occurring to the north in Canada or to the west in montane regions. They survive, in part, because these regions have been relatively undisturbed compared to the Great Plains and Eastern Deciduous Forest Biomes.

Minnesota forests also provide primary habitat for two small mammal SGCN species: rock vole (only in upland conifer and upland deciduous forests and cliff, talus, rock habitats); woodland vole (*Microtus pinetorum* (mesic, deciduous wet, and riparian forest habitats). Several small SGCN mammals rely on peatland habitat or mature conifer habitats with rich, damp forest floors that are often covered in sphagnum and ericaceous (acidic-soil loving) plants including the northern bog lemming (*Mictomys borealis*), smoky shrew, and Eastern heather vole (*Phenacomys ungava*).

Eight species of bats occur in Minnesota, seven of which are SGCN, equally divided into two groups that use different strategies for surviving long winters without insects. Migratory bat SGCN (hoary bats, Eastern red bats, and silver-haired bats) leave the state in early fall and head towards regions with milder weather. Evening bat, the only bat species not designated a SGCN, are likely to migrate out of the state, but little is known about overwintering habits in the northern Midwest. Cave-wintering bats (little brown bats, big brown bats, tricolored bats, and Northern long-eared bats) hibernate underground for the duration of winter until warm spring weather brings reliable insect hatches. All of the species use forested habitats during the spring, summer, and fall months, many using trees for pup-rearing.

Primary Stressors for Mammals

Stressors are factors that pose direct or indirect challenges to vulnerable plant and wildlife species. Habitat loss and degradation are generally considered the primary threat for most SGCN, and some stressors reduce the quality of those habitats. Other stressors may operate more directly on the SGCN, such as disease and pathogens. In some cases, stressors may operate both directly and indirectly. For example, roads, trails, and railroads can directly harm SGCN through vehicular strikes, or operate indirectly through habitat fragmentation and reduced landscape connectivity. The stressor list below is adapted from an internationally recognized threats classification developed by the International Union for the Conservation of Nature (Salafsky et al., 2024). For more information, see the "Stressors" section of Chapter 1: Species in Greatest Conservation Need.

It is important to note that some factors listed as "stressors" can also be used to advance conservation goals. Broad terms such as "fire management" reflect the dual nature of these factors as they may function as stressors in some contexts (e.g. catastrophic wildfire following a prolonged period of fire suppression) while serving as valuable conservation tools in others (e.g., appropriately planned and applied prescribed fire).

Information about a subset of primary stressors specifically affecting this species group is included below, followed by a set of conservation actions addressing those stressors.

Development

Development can cause habitat loss and fragmentation and makes traversing the landscape more difficult and dangerous for mammals of all sizes (see also Roads, Trails, and Railroads). This stressor is only projected to increase in the coming years with projections of urban land use increasing by a factor of 1.8 to 5.9 between the years 2000 and 2100 (Gao & O'Neil, 2020). Hanson et al. (2024) reviewed the effects of urbanization on mammals including changes in the diversity and abundance of species and changes in daily activity patterns. In some urban areas, mammals may actually thrive while in others the effects of urbanization are neutral or negative. Several factors may be involved, including city-wide landscape factors such as housing density and overall structure. One of the most common behavioral changes is increased activity during nighttime hours to avoid humans and/or predators. Overall, there is a direct relationship between the density/intensity of urbanization and the effects on mammal communities (Hanson et al., 2024). Maintaining natural areas near development sites is key to preserving the local mammal diversity, especially for species that cannot prosper in densely populated areas.

Crop Production

Small grassland mammals are affected by conversion of habitat to rowcrop agriculture. In general, studies have consistently demonstrated that more intensive agricultural practices, including more intensive use of herbicides and pesticides, and more narrow specialization of crop production, reduces the availability of terrestrial invertebrates and subsequently, those higher tropic levels that depend on their abundance, especially small mammals (Balestrieri et al., 2019).

Some agricultural producers view small burrowing animals, such as Richardson's ground squirrels, Franklin's ground squirrels (*Spermophilus franklinii*), American badgers, and Northern pocket gophers as pests. The burrowing nature of these species is concerning to some agricultural producers and results in removal of these animals, including by shooting, trapping, and poisoning.

Livestock Management

As Minnesota's wolf population has increased so have the conflicts with livestock operations. Wolves do kill and/or injure livestock such as cattle, sheep, poultry and occasionally pets. Among livestock, the wolves primarily attack young animals. The number of animals taken is low and affects less than 1% of all farms in the state, but the financial impact on individual operators can be substantial. Farmers do have the legal authority to kill wolves without a permit if they are "posing an immediate threat to livestock, a guard animal, or a domestic animal located on property owned, leased or occupied by the owner of the livestock, guard animal, or domestic animal" (M.S. 97B.645). During the past ten years the average number of complaints regarding by the USDA Wildlife Services Gray Wolf Depredation Management Program was 174 per year. In 2024 the number increased to 252. Biologists attributed the increase to the lack of snow cover, which made it more difficult for wolves to catch their primary prey, white-tailed deer (Stanley, 2025). The USDA's Wildlife Services Program works closely with livestock owners to address concerns and to implement changes that help deter and prevent wolf access to young livestock. Landowners also can be compensated for their losses; from about 2010 to 2020 an average of $135,000 per year was paid to farmers from Minnesota's Wolf Compensation Fund.

Following the reintroduction of elk to northwestern Minnesota in 1935, their populations also have increased, as have conflicts with livestock operations. Most of the damage is in the northwest counties but lone animals occasionally wander outside of the primary range and do damage elsewhere. As the USDA Wildlife Services office reports, "damage typically involves consumption of or damage to stored and stockpiled livestock forage" but can frequently include "damage to infrastructure such as livestock fences (Minnesota Department of Agriculture, 2025)". Like wolves, these conflicts are mitigated with a combination of compensation for fence and crop damage (managed by the MNDA) and abatement (managed by the DNR).

Smaller mammals, on the other hand, may respond differently to livestock grazing operations depending upon how it is managed. For example, SGCN mammals that require very short grasslands (e.g. Richardson's ground squirrel) may benefit from more intensive grazing whereas others (e.g. Franklin's ground squirrel) are associated with taller grasslands.

Mining and Quarrying

Sand and gravel quarries and taconite mining, all significant industrial activities in Minnesota, affect mammals not only by the loss of habitat but also by the increase in noise near these operations. The effects of noise pollution on mammals have received increased attention in past years, interfering with intra and inter-specific communication and inducing stress responses (Arcangeli et al., 2022; refer to Light and Noise Pollution Stressor). One SGCN, the northern grasshopper mouse, is found on sites with coarse or gravelly soils which include both active and inactive quarry sites. Despite its affinity for this habitat, active quarrying can disturb or destroy their burrows.

Wind and Solar Energy Infrastructure

Migratory, foliage and tree-roosting bats, including SGCN bat species such as hoary bats and eastern red bats, are frequently found dead below wind turbines (Arnett et al., 2008). Although variable in timing, most mortality occurs during late summer and fall, corresponding with migration and mating seasons. Estimates place the loss at approximately 888,000 bats per year (Smallwood, 2013). To date, lighting and noise appear to not influence the level of mortality. Although several other factors that have been investigated, including tree bats' attraction to large structures resembling trees as well as factors that influence their foraging and mating behavior (e.g. tall trees are an attractant for mating), many questions remain (Guest et al., 2022). Overall, collisions with wind turbines are considered a major, but not the only, factor contributing to the widespread decline of bat populations.

Roads, Trails, and Railroads

Mammals are susceptible to collisions with vehicles on roadways. Some studies have reported that carnivores are less affected than omnivores and herbivores while nocturnal species, which are more difficult to see, are more seriously affected. Among SGCN, moose are at some risk for vehicle collision as they use roads and trails for their own travel and as salt licks in the winter. Predators, such as wolves, do utilize secondary roadways and trails in efforts to hunt moose and deer in northeastern Minnesota. Indeed, research in Minnesota on Canada lynx found road and train collision-related mortality (Moen et al., 2005).

In addition to direct mortality, and the effect of roads, trails, and railroads in fragmenting habitats, these travel corridors can introduce other disturbances that also affect mammals (see Recreation and Light and Noise Stressors). Finally, construction and maintenance of bridges can affect bats that use bridge spans for roosting sites.

Utility Corridors

Corridors cleared for utility lines and pipelines may have different effects on different mammals. Species that depend on forest habitats, such as squirrels and mustelids (weasel family), usually avoid forest corridors. Conversely, the absence of woody cover in many corridors allows predators to more efficiently hunt for prey. They also are attractive to species such as white-tailed deer who, despite being more visible to predators, often forage along these utility lines. These openings allow more sunlight to reach the ground and allow fruit bearing shrubs and other lowland plants to grow, which provide food for many mammal species. However, if utility corridors are heavily treated with herbicide to reduce woody plant growth, that benefit is not realized.

At the landscape scale, habitat fragmentation is a major concern, especially for species that depend on large habitat areas or species that can utilize smaller tracts if they are interconnected. Corridors also create edge habitats which can negatively affect small forest-dwelling mammals by increasing predation. A recent and detailed analysis of the effects of linear infrastructure on vertebrates found the effects on mammals were more nuanced than previous studies had suggested; they depend on both the biological traits of each species and the overall environmental context (de Jonge et al., 2022). Carnivorous mammals were more abundant near infrastructure while non-carnivorous species "consistently display avoidance responses."

Hunting and Collecting Animals

The tradition of hunting large mammals such as deer, elk, and moose, is sustainably managed through the establishment of strict regulations and seasons. Small mammals, however, do not receive the same focused management attention and can be affected by deliberate trapping or shooting. For example, while Northern pocket gophers are rare, the Plains pocket gopher is very abundant and is unprotected, meaning that hunting and trapping is not limited. The collection of bounties for some animals, including gophers, ground squirrels, and woodchucks, may contribute to their decline. Most natural resource professionals, however, doubt their effectiveness in reducing populations. Although the state no longer pays bounties, counties and townships still maintain that authority (Sec. 348.13 MN Statutes). Payouts are usually based on the number of feet or tails that are collected, creating a small financial incentive. Today, Northern pocket gophers are very rare or extirpated from Minnesota. Several other SGCN such as Richardson's ground squirrels, Franklin's ground squirrels and American badgers, are still considered pests. Their burrowing nature concerns some agricultural producers, resulting in their continued persecution.

Photo: Northern flying squirrel, Levi Moxness

Timber Harvest

Timber harvest is a forest management tool that can affect wildlife habitat by changing forest structural and compositional diversity. Forest management decisions, including inaction, typically have positive effects for some species and negative effects for others. Indeed, a recent modeling exercise that examined 41 years of forest management on native wildlife habitat in Minnesota found that over that time span "35.5% of species experienced significant improvement in habitat, 29% significant reductions, and 35.5% nonsignificant change. The extent of habitat (acreage) increased for 100% of species, but the quality declined for 63% of species (Zobel et al., 2021).

Timber harvest activities benefit at least one SGCN mammal, the moose. The young regenerating forests that follow a stand's harvest, creates young, regenerating forests that serve as foraging habitat.

Bats, however, may not all benefit from timber harvest. A modeling exercise in Indiana examined the effects of different harvest scenarios on two bats, including the Minnesota SGCN, the Northern long-eared bat. Overall, suitable habitat for the species was negatively correlated with timber harvest intensity. Illustrating the importance of planning forest management activities to simulate the range of natural disturbance regimes, the models documented the bat's preference for forest edges for nocturnal foraging while preferring mature, intact forests for daytime roosting (Pauli et al., 2015).

The snowshoe hare also is affected by forest management activities relating to their foraging and sheltering needs, particularly those that decrease structural diversity in the forest. In Superior National Forest, snowshoe hare foraging habitat generally includes upland forest 3-15 years old or over 60 years old or lowland forest greater than 10 years old (USDA Forest Service – Region 9, 2004). A study in northeastern Minnesota found higher densities of snowshoe hare in regenerating-young forest (7-30 years since harvest) and coniferous forest than in other forest types (McCann & Moen, 2011). A study by the Leech Lake Band of Ojibwe Division of Resource Management found that snowshoe hare populations were restricted to northern white cedar stands that maintained old growth characteristics. The hares could not expand much beyond these stands because much of the surrounding forest lacked horizontal structure that provides hiding cover from predators (Tanya Roerick, Leech Lake Band of Ojibwe, pers. comm.). Effects on smaller mammals, such as shrews, and voles, are less well known. Nevertheless, species that prefer the structural complexity of mature forest stands, including two non-SGCN species, the fisher and marten, benefit from timber harvest strategies that strive to retain these features (Suffice et al., 2023).

Recreation

A recent, thorough review of the literature on the effects of recreational activities on mammals by Sganzerla and colleagues (2025) found that most studies have focused on large, charismatic mammals that rarely are of conservation concern. Only in recent years has this bias begun to be addressed. Although most of the 209 articles they reviewed analyzed the effects of recreational activities on foot (i.e. hiking and skiing), 74% of those reported at least one negative effect, including avoidance behavior, changes in habitat use, and physiological responses such as stress. Motorized vehicles, aerial disturbances and water-based disturbances were more likely to cause a significant response than hiking.

Regarding Minnesota's mammalian SGCN, recreation is not considered to be a major concern for moose (Larson, pers. com.). Field studies in Colorado focused on winter recreational activities found Canada lynx did not consistently avoid areas of low or moderate dispersed recreation but did avoid some areas with high levels of motorized recreation. When the level of recreational activity was high, lynx were more active during the nighttime hours (Miller, 2019). Finally, in a wilderness setting in Alaska, wolves were found to reduce their presence up to 6 km away from areas of high human use (Thompson et al., 2025). In Minnesota, the Voyageurs National Park Wolf Project has found that wolves are attracted to areas of human development because of the high concentration of white-tailed deer but still avoid any encounters with people while hunting (Johnson-Bice et al., 2023).

Bats can be negatively affected by recreation in caves, both by physical disturbance during hibernation and by spread of the fungus (*Pseudogymnoascus destructans*) that causes White-nose syndrome (WNS). When people visit caves where bats roost their activities can increase the noise levels and cause local changes in air flow and temperature that wake the bats, causing them to disperse and deplete their energy reserves during a critical time. This is when cave bats are most susceptible to WNS. Even climbing activities outside of the cave, but near its opening, can disturb roosting bats inside the cave. Pounding or chiseling the rock, placement of climbing gear in rocks and crevices, and high noise levels all create disturbances that can negatively affect bats (Schorr et al., 2025).

Fire Management

Proper fire management in grasslands is especially important for mammalian SGCN. Nearly 38% (12 species) of the SGCN depend on prairie and other grasslands as their primary habitat. Species such as the western harvest mouse (*Reithrodontomys megalotis*), plains pocket mouse, and prairie vole depend on upland prairies. When such sites become overgrown with non-native invasive plants and woody vegetation due to fire suppression they no longer provide suitable habitat. Fire helps to create a dynamic mosaic of forest ages and vegetative cover that is critical to many species such as moose. Fires create openings and young, regenerating forest stands that provide important habitat to SGCN that utilize fire-dependent upland conifer and upland deciduous forests in Minnesota. In the absence of fire, timber harvests can be planned to help create this habitat mosaic.

Dams and Water Management

Tile drainage to convert wet grasslands and pastures to farmland is the major effect of water use management on grassland-dependent mammalian SGCN. Loss of habitat remains the primary threat to all grassland species.

Diseases and Pathogens

Moose are severely affected by brainworm (*Parelaphostrongylus tenuis*), causing abnormally high mortality in Minnesota populations. Brainworm is carried by white-tailed deer, who have increased their range north into what previously was solely moose territory. Deer are usually not affected by the worm. In moose, on the other hand, *P. tenuis* damages the brain and spinal cord, causing weakness and disorientation. Although less pervasive than brainworm, other parasites that affect moose, occasionally causing death, include liver flukes (*Fascioloides magna*) and hydatid cysts (*Echinococcosis granulosis*) that are found in the animal's lungs or liver (Carstensen et al., 2017a). Moose can also be affected by chronic wasting disease (CWD), which could be a growing risk if expanding elk and deer populations bring it into moose range.

Gray wolves can be affected by several diseases and parasites. These include parvovirus, canine distemper, canine adenovirus, and mange, which may reduce pup survival and limit population growth (Carstensen et al., 2017b).

Bat populations of multiple species have been decimated by White-nose syndrome, caused by a fungus (*Pseudogymnoascus destructans*) that wakes bats up from hibernation and reduces their energy stores so they eventually die from starvation or dehydration. In Minnesota, the disease was confirmed at Soudan Underground Mine in the winter of 2016. Species such as the little brown bat, northern long-eared bat, and tricolored bat have been heavily affected statewide with population declines greater than 90% (Bowman, pers. comm; see Case Study: Bat Declines).

Water-borne Pollution

Aerial applications of herbicides and pesticides that end up in local wetlands, streams, and rivers can potentially affect mammal SGCN, especially in agricultural regions where their use may be intensive. There also is growing concern about the effects of microplastics on wildlife. Although most studies have focused on aquatic species, microplastics have been found in some terrestrial mammals including voles and foxes (Jeong et al., 2024).

Air-borne Pollution

The effects of aerially applied herbicides and pesticides are of greater concern to mammals, especially on grassland species. A study in Europe examined the presence of 140 currently used pesticides and banned or restricted pesticides (i.e. legacy pesticides) in the hair of small mammals and found 112 of the compounds in the hair samples with a total of 32 to 65 chemicals found per individual specimen. The detection and quantity of chemicals found in the specimens directly correlated with the amount of pesticide sold. Little is known about the relative contribution of different pathways of exposure (e.g. direct contact, consumption of treated seeds, or ingestion of soil invertebrates). Some of these chemicals have also been reported in the body tissues of bats. As the authors note, the ubiquity of exposure raises concern not only about acute exposure but about chronic exposure as well (Fritsch et al., 2022). Although this study did not assess the pesticides' effects on small mammals, they are widely recognized as causing neurological symptoms such as tremors and convulsions; gastrointestinal symptoms such as vomiting; and death.

Light and Noise Pollution

Nearly half of the United States land surface has light-polluted skies (Falchi et al., 2016). Sources of light pollution at night include interior and exterior lights on homes, buildings, billboards, parking lots, and streets as well as lighted sports fields, industrial plants, and airports (DarkSky International, 2025). Studies also point to the ecological effects created during the daytime by polarized light that reflects off surfaces such as asphalt roads, glass panes, and solar panels (Chock et al., 2020; Horvath et al., 2009).

Several studies have documented the effects of anthropogenic (human caused) light on mammals, the majority of which are nocturnal. Bats, for example, can delay their nighttime emergence from daytime roosts and caves, sometimes even abandoning the site (Jagerbrand & Spoelstra, 2023). Individual species, however, may response differently to lighting conditions. Foraging activity by big brown bats and little brown bats was reduced by nighttime lights while biologists found that eastern red bats and hoary bats responded neither positively nor negatively (Seewagen et al., 2023). Many other mammals decrease their activity in the presence of light and/or change the spaces in which they move (Jagerbrand & Spoelstra, 2023). In addition to these observed effects, biologists know that bright day and dark night cycles synchronize the internal clocks of animals. Alterations to these cycles have been shown to affect hormone production, reproductive behavior, neural activity, and metabolic functions (Bumgarner & Nelson, 2021).

Noise pollution from aircraft, vehicles, boats, and other human causes is pervasive. Anthropogenic noise was detected in 36% of national parks surveyed (Buxton et al., 2019), and 12% of wilderness areas had anthropogenic noise levels 3 decibels higher than levels predicted to occur naturally (Buxton et al., 2017). Exposure to increasing noise levels can change the spatial distribution and movement patterns of wildlife, cause avoidance of feeding and nesting areas, and interrupt sleeping patterns and communications (Kok et al., 2023).

Changes in Temperature related to Climate

Minnesota has experienced a clear warming trend over the past century. Between 1895 and 2020, average statewide temperatures increased by 3.0 degrees Fahrenheit (°F; Climate Trends). This warming has become more pronounced in recent decades and during the winter months.

Since 1985, average winter temperatures in Minnesota have risen by 5.4°F, with average winter low temperatures increasing even more significantly by 6.8°F (Climate Change in Minnesota). These changes have led to a shortened season of snow cover and a reduction in lake ice duration by 10-14 days over the past 50 years (Minnesota Pollution Control Agency and Minnesota Department of Commerce 2025). Furthermore, these shifts in thermal regimes are ecologically significant. Many species are adapted to narrow temperature ranges, and such rapid changes can result in increased thermal stress, the spread of invasive species, and heightened disease and pathogen risks (Ratcliffe et al. 2025).

This warming trend is expected to continue. By mid-century (2040-2059), Minnesota's average annual temperature is projected to rise by an additional 3.8 - 4.5 °F, depending on future greenhouse gas emissions scenarios (Liess et al., 2022; Climate Change in Minnesota). Increasing temperatures and prolonged 'hot' temperature events negatively affect moose (*Alces alces*) health in particular. As temperatures rise, moose experience elevated internal body temperatures and these "hot" moose are more likely to die than moose with fewer "hot" episodes (Carstensen et al., 2024). Shorter winters with less snow cover may also affect Canada lynx (*Lynx canadensis*) and snowshoe hare (*Lepus americanus*). University Minnesota-Duluth mammal researcher, Ron Moen also predicts steep declines and even potentially extirpation from Minnesota over the coming 50 - 100 years for four species of shrews and moles, nine species of rodents, the snowshoe hare, moose and three carnivores dependent on the north woods (NRRI, 2018). Small mammals such as mice and voles are prey for predators of all sizes and require subnivean zones (under the snow) to survive, helping to create a balance between population sizes of prey species and predator species. Milder winters with limited snow cover and earlier snow melt due to higher-than-normal temperatures create more hospitable environments for some parasites like winter tick (*Dermacentor albipictus*), which can lead to increased tick loads on moose and potentially to moose mortality. Milder winters also can promote the northward range expansion for other parasites and their hosts, as well as insect populations that may adversely affect moose health.

Climate change does not act in isolation, interacting with invasive species dynamics, land-use change, and shifts in water quality and quantity, compounding ecological effects (He et al., 2019; Finch et al., 2021). For additional context and resources, see the Climate Adaptation section in Chapter 6: Implementation.

Changes in Precipitation and Hydrology related to Climate

From 1895 to 2020, Minnesota's average annual precipitation increased by 3.4 inches (Climate Trends). The state has also seen a notable rise in the frequency and intensity of heavy precipitation events. Since 2000, very heavy rains (6 inches or more in a single day) have occurred two to three times more frequently than during the 20th century (Williams-Sether & Sanocki, 2025; NOAA National Centers for Environmental Information State Climate Summaries 2022: Minnesota). These extreme events have led to a corresponding increase in flooding, which can disrupt ecosystems, human infrastructure, and water quality (Williams-Sether & Sanocki, 2025).

Future projections indicate continued increases in annual precipitation, especially during the winter and spring months, which are likely to exacerbate flooding risks. The same climate models also forecast an increase in late summer drought events, underscoring the variability and unpredictability of hydrologic patterns under a changing climate (Climate Change in Minnesota). By mid-century (2040-2059), average annual precipitation is projected to increase by up to 1.2 inches, depending on emissions scenario (Liess et al., 2022; Climate Change in Minnesota). This seemingly counterintuitive pattern — wetter winters and springs, punctuated by hotter, drier late summers — has profound implications for water availability, wetland health, soil stability, and species dependent on seasonal hydrologic cycles (Runkle et al., 2022). For more information and resources for climate-adapted management strategies see the Climate Adaptation section in Chapter 6: Implementation.

In the north woods, the lack of winter precipitation (i.e., snow) or an early snow melt creates a better environment for parasites such as winter tick, which can cause moose mortality. Drier conditions could potentially create a less hospitable environment for other parasites and their vectors, such as brainworm (*Parelaphostrongylus tenuis*) and gastropod hosts.

Photo: Moose, Colin Canterbury, USFWS

Priority Species Conservation Strategies

To implement the SGCN Goal of this Plan, to conserve rare, declining, and vulnerable wildlife and plant SGCN through targeted actions, three strategies were identified:

Strategy 1. Survey, monitor and research to document the distribution and trends of SGCN, assess the threats they experience, and evaluate conservation actions that support resilient populations.

Strategy 2. Collaborate to deliver conservation actions that support resilient populations of SGCN and their habitats in partnerships with agencies, Tribes, non-governmental organizations, private landowners, and others.

Strategy 3. Develop and share informational material to guide conservation actions for SGCN wildlife, such as species accounts, threat assessments, recovery plans, relevant regulations, avoidance measures, and beneficial habitat management practices.

Examples of conservation actions are grouped below under these three strategies and tagged with icons for the stressor(s) that they address. Some of these actions are widely in place as best practices while others may be more novel. Some actions combine multiple strategies, in which case we present it under the one it fits best. Actions such as those focused on monitoring might not always be tied to a specific stressor; these are labeled with not applicable (NA) in the stressor column.

Potential Conservation Actions for Mammals

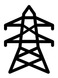
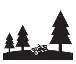
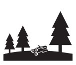
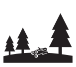
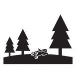
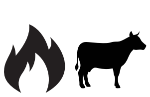
Strategy 1. Survey, monitor and research to document the distribution and trends of SGCN, assess the threats they experience, and evaluate conservation actions that support resilient populations.

Stressor	Action
	Conduct more studies to better understand the conditions that attract bats to wind turbine sites.
	Conduct more research on bat locations and response to timber harvest. Quantify spatial use needs and territory size requirements.
	Investigate options to reduce the effects of aerially applied pesticides and herbicides on grassland dependent small mammal SGCN.
	Continue important research and collaborative studies to investigate the effects of a changing climate on mammalian SGCN and to develop potential mitigation strategies, such as the Nature Conservancy's establishment of conifer strongholds that could benefit conifer-dependent SGCN, including moose.
	Determine moose habitat use/response prior to, during, and after landscape-level habitat management activities. Assess juxtaposition and patch size of key habitat types to ensure adequate forage and thermal cover (winter and summer) are available to inform forest management and promote moose population growth.

Stressor	Action
NA	Investigate the causes of declines in mammal SGCN, investigating threats, habitat characteristics and effectiveness of conservation measures. Conduct rigorous effectiveness monitoring (Ayodele, 2025) to assess responses of SGCN to specific management activities in priority habitat types to enable the development of improved, evidence-based management recommendations and avoidance measures for SGCN (Binley et al., 2025) as part of adaptive management.
NA	Support and develop opportunities for community scientists to engage in bat monitoring. Examples would be acoustic monitoring such as the North American Bat Monitoring Program, and bat box monitoring.
NA	Increase the number of bat caves that are monitored each winter to help ensure their protection and the sustainability of the wintering bats they provide habitat for each year.
NA	Improve moose population surveys by exploring improved/new methods and tools (e.g., thermal plane) and by applying advanced analytical methods. Monitor calving and calf survival with new tools (e.g., thermal plane) to improve population estimates.
NA	Assess fecundity (fertility) and recruitment of young moose to improve population modeling and info management activities and conduct research to understand predator-prey interactions among moose, deer, wolves, bear, etc.

Strategy 2. Collaborate to deliver conservation actions that support resilient populations of SGCN and their habitats in partnership with agencies, Tribes, non-governmental organizations, private landowners, and others.

Stressor	Action
	Install bat boxes using recommended guidelines to provide suitable roosting habitat for bats in urban or rural areas, particularly when bat colonies are excluded from building roosts (Boman, 2023; Boman et al., 2024).
	Retain wild areas for mammal SGCN that cannot thrive in developed areas.
	Promote and support restoration of prairie and grassland acres through innovative financial incentives, technical assistance, and engagement.
	Encourage non-lethal techniques for livestock owners to manage wolves. The DNR Wolf Plan includes a wolf livestock depredation toolbox which includes non-lethal techniques aimed at minimizing wolf depredation.
	Build better captive elk farm fences to keep wild elk from breaking in to help prevent the spread of diseases such as chronic wasting disease and bovine tuberculosis.
	Reduce overgrazing and implement conservation grazing methods that benefit the farmer and wildlife simultaneously. These include: flash grazing, where livestock graze intensively on small areas for a short period of time, patch burn grazing, the use of prescribed fire to attract cattle to highly palatable vegetation or other methods of adaptive grazing management that are suited to each farmer's conditions and that have been evaluated for their effectiveness.

Stressor	Action
	At active quarry sites that support populations of the northern grasshopper mouse, inform operators of the species' presence and work to find solutions that allow mining operations and species protection to continue simultaneously. Explore ways to restore expended mine pits to promote recolonization of affected SGCN.
	Encourage best management practices that reduce mortality such as reducing blade rotation when wind speeds are low and bats are more active (e.g. late summer and fall) and delaying turbine activation when bat activity is high (Mathewson, 2023).
	Promote wildlife safe road crossing programs. Advocate for safe crossings when providing technical guidance on roadway projects.
	Minimize new roads and trails and damaging recreational activities in important habitats for mammal SGCN.
	Co-locate utilities when possible to reduce environmental effects and consider wildlife in siting plans. Avoid routing lines near or across lakes where feasible or along known mammalian travel corridors.
	Consider implementing habitat enhancements for snowshoe hare. This could include increasing structural diversity in the forest by creating slash piles during or after timber harvest, dropping trees to leave as coarse woody debris, planting conifers to increase trees with low hanging branches that offer cover, protecting areas that have structural diversity and provide snowshoe hare habitat, and maintaining advanced regenerating forest on the landscape.
	Implement best management practices for bats such as winter harvest, protecting hibernacula entrances and maternity roost trees, and retaining older trees and standing snags for habitat including potential future roost trees; see Lakes States Forest Management Bat Habitat Conservation Plan (ICF, 2023).
	To manage for the wide array of forest-dependent SGCN, as well as forest-specialist furbearers like marten and fisher, leave some old forest patches or corridors within harvested areas. Overall protection of old growth forests can help provide habitat for wildlife associated with old forests (see Managing Old Growth Forests).
	Support collaborative efforts to implement the large-scale habitat management necessary to sustain moose in Minnesota, such as working with the Moose Habitat Collaborative, Grand Portage Band of Lake Superior Chippewa, 1854 Treaty Authority, Fond du Lac Band of Lake Superior Chippewa, The Nature Conservancy, Ruffed Grouse Society and Woodcock Society, Lake, St. Louis, and Cook Counties, and USFS Superior National Forest.
	Increase the use of prescribed fire. Proactively apply prescribed fire and grazing in ways that sustain native ecosystems and support SGCN mammals while also avoiding or minimizing negative effects on them through factors such as timing, intensity, acreage, and leaving unburned areas for escape cover. When developing grazing and burn plans, consider the requirements of SGCN. Aim to provide diversity across the landscape and over time (see also Prairies and Other Grasslands sub-chapter).
	Restrict entry to known hibernation sites during the winter months and, where possible, restrict climbing and other recreational activities immediately outside of caves where bats are known to hibernate.

Stressor	Action
	Encourage the application of best management practices for installing new or upgrading old drainage systems to help reduce the conversion of wet prairies and grasslands to cropland (Board of Soil and Water Resources and the Natural Resources Conservation Service).
	Protect bats from human disturbance and spread of White-nose Syndrome by increasing the number of caves that are gated and monitored.
	Designate specific areas of northern Minnesota as core moose areas and consider how to reduce transmission of brainworm from white-tailed deer. Integrate deer management as part of a comprehensive moose management strategy as outlined in the Minnesota DNR Moose Research and Management Plan (2011).
	Implement best practices for wildlife-friendly outdoor lighting, such as turning off lights when they are not needed, using timers or motion detectors, shielding lights pointed downward, and employing lights in the warmer part of the spectrum. For more detailed information, refer to solutions advised by conservation organizations such as DarkSky, the Xerces Society and National Audubon's Lights Out Program.

Strategy 3. Develop and share informational material to guide conservation actions for SGCN wildlife, such as species accounts, threat assessments, recovery plans, relevant regulations, avoidance measures, and beneficial habitat management strategies.

Stressor	Action
	Engage in education and outreach to raise awareness of persecuted SGCN mammals and provide information on their ecological roles.
	Initiate a public information campaign to raise awareness of the effects of aerial pesticide and herbicide applications on SGCN mammals.
NA	Develop and promote accessible opportunities for the public to report observations of priority SGCN.
NA	Update the Minnesota Moose Research and Management Plan with input from partners (also see Strategy 2 above).
NA	Design and implement education and outreach activities that raise awareness of bats and their ecological roles and unique adaptations.

Case Study: Minnesota Department of Transportation Develops a New Tool to Identify Bats in Culverts and on Bridges

Minnesota Department of Transportation (MNDOT) takes its responsibility to protect state endangered, threatened and special concern species seriously. Knowing that the Northern long-eared bat is already an endangered species at the federal and state level, and that two other bat species (little brown myotis and tri-colored bat) are under consideration for federal listing, staff began to investigate how their construction and maintenance activities on bridges and culverts could affect these species. These transportation structures have long been known to provide roosting habitat for bats. Given the devastating declines that bats have experienced due to white-nose syndrome, attention has focused on additional measures to protect their declining populations. For example, a recent study in Iowa (Bektas et al., 2018) examined factors that increase a bridge's suitability as a bat roosting site. Among the factors that increased suitability were the bridge's proximity to wetlands (important foraging habitat) and the bridge's height and depth (higher and deeper were most suitable). When there is evidence that bats are using a bridge for roosting habitat (e.g. presence of guano), MNDOT staff must assume that state and federal listed species are present. Physical inspection of the site, however, can cause the very disturbance that staff are trying to avoid. Lacking any other evidence to identify the presence of state or federally listed species, engineers must implement costly measures to protect the bats if a new bridge is being constructed or an old bridge is being maintained or upgraded. A new study by MNDOT begun in 2024 is aimed at addressing this challenge. Researchers are investigating the utility of analyzing the DNA present in bat guano as a means of identifying whether state or federally listed species are present and if special provisions are necessary to protect these species (MnDOT, 2024).

Photo: little brown bat, Bob Dunlap

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