

MINNESOTA'S WILDLIFE ACTION PLAN 2025-2035

CONSERVING HABITATS AND BIODIVERSITY

BIRDS



mn DEPARTMENT OF
NATURAL RESOURCES

NONGAME WILDLIFE PROGRAM

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Birds

Overview

Birds are perhaps the most popular and intensively studied animals in Minnesota and throughout the world. Most species are easily visible, display beautiful plumages, and communicate with unique calls and songs. From Native Americans who first occupied North America to the European settlers who arrived, people have observed, listened, consumed, collected, studied, and written about birds for hundreds of years. Indeed, Minnesota has a spectacular legacy of information regarding our avifauna, beginning with the oral legends of Native Americans (e.g. Adikwan, 2019) to articles, pamphlets, peer-reviewed papers, and numerous books describing their life history, distribution, and abundance.

Minnesota is fortunate to have the recent [Minnesota Breeding Bird Atlas](#), a project led by the National Audubon Society, which documents the breeding status and locations of all birds nesting in Minnesota at a local scale and provides in-depth species accounts (Pfanmuller et al., 2017). Earlier foundational works include the two-volume tome by T.S. Roberts in 1932, followed with books by Green and Janssen (1975), Janssen (1987; 2019), and Pfanmuller, Niemi, and Green (2024). Multiple other accounts, projects, journal articles, and publications by resource agencies and the [Minnesota Ornithologists' Union](#) supplement these sources and provide a wealth of information on the 452 species that have been reported in the state (MOU, 2024). These include the [Blueprint for Minnesota Bird Conservation](#), the [North American Bird Conservation Initiative](#), the [Minnesota National Forest Breeding Bird Monitoring Program](#), and the [Audubon Christmas Bird Count](#). The [North American Breeding Bird Survey \(BBS\)](#) has monitored the population trends of North American birds since 1967 providing an abundance of valuable data on the status of all birds for more than 50 years.



Photo: Black-backed woodpecker, Julia Geschke

This information is now augmented by [eBird](#) data collected by recreational birders and compiled by the Cornell Laboratory of Ornithology, which has recently produced information for state-level [eBird Status and Trends](#). Some birds, such as colonial nesting waterbirds, secretive marshbirds, raptors, and nocturnal birds will likely still require additional efforts to track their numbers. It is important to find cost-effective and efficient means to monitor all these types of species throughout the future.

Given the depth of attention they have received over the years, our knowledge of bird trends is relatively well-developed. Nationally, pervasive and significant declines of birds have been noted. One study of more than 650 North American species estimated a 29% reduction in numbers since 1970, with declining trends showing for many common birds (Rosenberg et al., 2019). Recent continent-wide assessments found prominent declines in the most abundant species and in regions where they were most abundant (Dupont et al., 2025 and Johnston et al., 2025). The [State of the Birds Report](#) indicates long-term trends of -43% for grassland birds, -33% for shorebirds, and -27% for forest birds (North American Bird Conservation Initiative, 2025).

We noted during the species conservation status assessment (S-rank) process that many bird species are experiencing declines, extending beyond those listed as SGCN. To inform the S-rank process, we reviewed or estimated breeding bird relative abundance trends using data from BBS and eBird. From BBS data, 158 species had sufficient records in Minnesota to estimate (“estimable”) long-term trends (1972–2021), and 160 species had sufficient records in Minnesota for short-term trends (2000–2021; Table 2.4). From eBird, 220 species had sufficient records in Minnesota to estimate short-term trends between 2012 and 2022 (Table 2.4). While we used a more conservative 95% confidence level to declare significant declines using BBS data, we used the 80% confidence level for eBird data. The 80% level is justified for eBird data because: (1) using a 95% interval would make many intervals so wide as to appear uninformative given the relatively shorter time series of data available in eBird compared to BBS, (2) the goal of eBird trend estimates are to detect emerging population signals that could indicate conservation concerns and serve as actionable early-warning indicators, (3) eBird status and trends are global, covering areas with varying amounts of data (Cornell Lab of Ornithology eBird Status and Trends: Methods and Data Products).

BBS results showed that 42% of species with estimable long-term trends were in significant decline at the 95% confidence level, and 39% of species with estimable short-term trends were also in significant decline (Table 2.4). Importantly, while many of these species are SGCN, declines were also widespread among non-SGCN species: 37% were significantly declining in the long term and 33% in the short term. Similarly, eBird results showed that 40% of species with estimable short-term trends were in significant decline at the 80% confidence level (Table 2.4), with 40% of non-SGCN species also showing significant declines. While population declines in SGCN species are expected, these findings demonstrate that declines are pervasive across the broader bird

community. Notably, even species considered sufficiently abundant to be excluded from the SGCN list – such as aerial insectivores (e.g., swallows) – are undergoing statistically significant declines that warrant attention.

Examples of species with significant population declines occur in a variety of habitats such as the eastern screech owl (*Megascops asio*) in Upland Deciduous Forest and Woodland, eastern whip-poor-will (*Antrostomus vociferus*) in Savanna, Connecticut warbler (*Oporornis agilis*) in Coniferous Forest Wetlands and [purple martin \(*Progne subis*\)](#) associated with Lakes (Pfanmuller et al., 2024). In addition, some groups of species may warrant additional concern.

Grassland bird species with especially steep declines include bobolink (*Dolichonyx oryzivorus*), grasshopper sparrow (*Ammodramus savannarum*), and western meadowlark (*Sturnella neglecta*). In a recent analysis, these species showed declines in BBS surveys in Minnesota that include habitats with variable quality and protection as well as in high-quality permanently protected prairies as documented in the DNR-led project: Sustaining Prairies in a Changing Landscape (SPICE, see Case Study). Seven of the 11 prairie obligate bird species for which data were sufficient to determine trends were found to have declining trends, and similar in magnitude, in both the BBS and SPICE results (see Table 2.5). Aerial insectivores are another group that have been showing steady and widespread declines causing concern. Drivers of declining trends are numerous (see Stressors section below) but most studies cite habitat loss and degradation. A sound understanding of threats to these species is made more difficult due to the migratory nature of many of our species encountering differing conditions across their life cycles and across continents. An ongoing concern is how well species will adapt to the stress caused by changing climatic conditions and even potential extirpation of many of our northern boreal forest species as temperatures continue to rise ([National Audubon Society](#)

2019; see Case Study later in this chapter). Despite these pervasive threats, there are remarkable success stories. Due largely to targeted conservation efforts some species, such as the [trumpeter swan \(*Cygnus buccinator*\)](#) (see inset), [peregrine falcon \(*Falco peregrinus*\)](#), and [bald eagle \(*Haliaeetus leucocephalus*\)](#),

have recovered from the brink of extirpation in Minnesota. It is not uncommon nowadays, for example, to see a bald eagle not only over a lake in the dense forests of northern Minnesota, but also in the center of the Twin Cities or in the agricultural landscapes across southern and western Minnesota.

Table 2.4. Counts of Minnesota breeding bird trends from BBS data in the long-term (1972-2021) and short-term (2000-2021) for both SGCN and non-SGCN assigned species, as well as counts of Minnesota breeding bird trends from eBird data in the short-term (2012-2022). Significant declines for BBS data were established at the 95% confidence level and for eBird at the 80% confidence level.

Number of Bird Species Trends	BBS Long-term Total	BBS Long-term Declining	BBS Short-term Total	BBS Short-term Declining	eBird Short-term Total	eBird Short-term Declining
Total Estimable	158	67	160	62	220	92
SGCN	31	20	32	20	60	34
Non-SGCN	127	47	128	42	160	58

Table 2.5. Obligate grassland bird declines in abundance detected in Minnesota, based on transects from the North American Breeding Bird Survey (BBS) in the Minnesota prairie region (Bird Conservation Region 11; except for Henslow’s Sparrow for which data in BCR 11 were insufficient and BBS from all of Minnesota were used) and the DNR’s Sustaining Prairies in a Changing Environment (SPICE) long-term monitoring project. Of the 11 grassland-obligate bird species (based on Vickery et al., 1999) for which data were sufficient to determine trends, 7 had declining trends for the period of 2008 to 2024, generally similar in magnitude for BBS and SPICE.

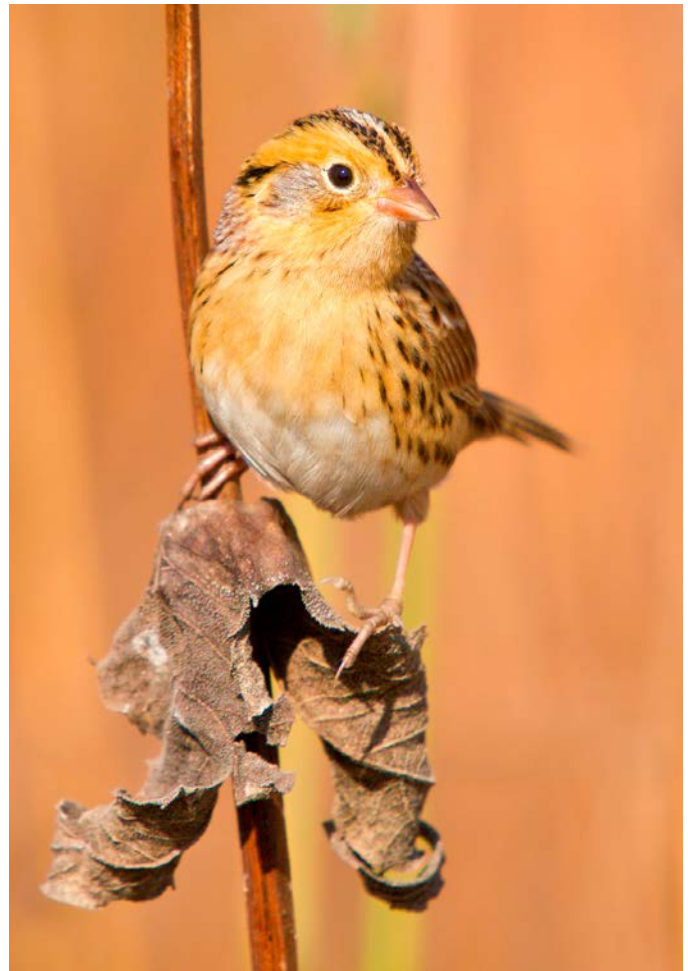
Bird Species	SGCN	Breeding Bird Survey	SPICE Survey
bobolink (<i>Dolichonyx oryzivorus</i>)	Y	Decline of 4%	Decline of 1%
dickcissel (<i>Spiza americana</i>)	N	Increase of 21%	Increase of 11%
grasshopper sparrow (<i>Ammodramus savannarum</i>)	Y	Decline of 4%	Decline of 7%
Henslow’s sparrow (<i>Centronyx henslowii</i>)	Y	Probably Stable	Increase of 17%
LeConte’s sparrow (<i>Ammodramus leconteii</i>)	Y	Decline of 7.5%	Decline of 10%
marbled godwit (<i>Limosa fedoa</i>)	Y	Increase of 1%	Increase of 1%
northern harrier (<i>Circus hudsonius</i>)	Y	Decline of 7%	Decline of 5%
savannah sparrow (<i>Passerculus sandwichensis</i>)	N	Decline of 6%	Decline of 7%
sedge wren (<i>Cistothorus stellaris</i>)	Y	Decline of 3%	Decline of 6%
upland sandpiper (<i>Bartramia longicauda</i>)	Y	Decline of 1%	Decline of 12%
western meadowlark (<i>Sturnella neglecta</i>)	Y	Decline of 3%	Decline of 2.5%

Species Information

The 2025-2035 list of Species in Greatest Conservation Need identified 79 Minnesota bird species as SGCN and one species, the Eastern Screech Owl, as a SNI (Species in Need of Information). A total of 21 species were removed from the SGCN list in the 2015-2025 SWAP primarily because their numbers have increased and/or they are now known to be more common and widespread than biologists thought in 2015 (see for example Case Study box below). Eight species were added: canvasback (*Aythya calisineria*), bufflehead (*Bucephala albeola*), buff-breasted sandpiper (*Calidris subruficollis*), solitary sandpiper (*Tringa solitaria*), great gray owl (*Strix nebulosa*), American barn owl (*Tyto furcata*), American three-toed woodpecker (*Picoides dorsalis*), and Swainson's thrush (*Catharus ustulatus*).

Five of the bird SGCN were assigned a Presumed Extirpated S-rank (SH): [Sprague's pipit \(*Anthus spragueii*\)](#), [burrowing owl \(*Athene cunicularia*\)](#), [Baird's sparrow \(*Centronyx bairdii*\)](#), [horned grebe \(*Podiceps auritus*\)](#), and [king rail \(*Rallus elegans*\)](#). All of these species are listed as State Endangered. Bird species were considered extirpated if there are not any regular breeding populations in the state (i.e., breeding in the same location in successive years). Notably, several of these species have been documented as nesting in Minnesota in recent years. There is a chance that populations may become established in the state over the next ten years, and conservation actions may be taken to support these species.

Among the 79 Minnesota birds that are designated SGCN, the [piping plover \(*Charadrius melodus*\)](#) is federally endangered, the red knot (*Calidris canutus*) is federally threatened, and the golden-winged warbler (*Vermivora chrysoptera*) is under review for federal listing. Nine species are state listed as Endangered, two as Threatened, and 19 listed as Special Concern. A complete list of SGCN and SNI species can be found in [Appendix B](#).



LeConte's sparrow, Bob Dunlap

Case Study: The Successful Recovery of the Trumpeter Swan in Minnesota

When Roberts compiled his treatise on Minnesota birds in 1932, he wrote, “The days of the Trumpeter Swan as a bird of Minnesota have long since passed.” Unfortunately, this large white bird was an easy target for the state’s early European settlers and market hunters. The young birds were tender and tasty while the older birds were either shot for sport or for their skin and feathers. By 1932 only 69 birds were believed to remain, surviving in the remote mountain valleys of Montana, Idaho, and Wyoming. These birds, along with those from a breeding population found in Alaska in the 1950s, became breeding stock for introductions farther east, in areas formerly occupied by the species, including the LaCreek National Wildlife Refuge in western South Dakota.



Photo: Trumpeter swan, Beau Liddell

Interest in reintroducing trumpeter swans to Minnesota began in 1966 by the Hennepin County Park Reserve District (now Three Rivers Park District). Their initial efforts to establish a breeding population by releasing adult birds secured from Montana failed. The tide turned when the district initiated its own captive breeding program, caring for the young cygnets and not releasing them until they were two years old. The first release of young raised by this program occurred in 1978, and the first successful nesting occurred in 1979. By 1996, more than 245 young birds had been raised and were successfully nesting within the park district and beyond. The park district’s program continued for another thirteen years, until it was retired in 2009. In 1982, the DNR’s Nongame Wildlife Program outlined an initiative to build on the work of the park district by reintroducing birds in northwestern, north-central, and south-central Minnesota, working collaboratively with state and federal agencies, provinces, universities, tribes, and the Trumpeter Swan Society. Together, these two initiatives by the Park District and DNR were so successful that by 2019, the Minnesota Waterfowl Breeding Population Survey generated a statewide population estimate of 23,200 swans. It is now common to find breeding pairs of trumpeter swans in wetlands across the state. (Excerpted from Pfanmuller et al., 2024.)

Habitat Associations

SGCN birds rely upon many different habitats across Minnesota. Table 2.6 provides a summary of their associations with the 15 habitats discussed in the 2025-2035 SWAP. Three habitats that provide primary habitat for the largest number of SGCN are prairie and other grasslands (22 SGCN), followed by non-forested wetlands (18 SGCN), and lakes (18 SGCN). Collectively, forested habitats (upland, lowland, and riparian) provide primary habitat for 27 bird SGCN. Primary habitats

are those where the species is found most consistently; the species is most reliant on the habitat and, should the habitat be degraded or lost, it would have the greatest effect on the species. Secondary habitats are those where a species can be found some of the time, but less frequently than a primary habitat. Some species, especially those with more general habitat requirements, may be assigned to multiple primary or secondary habitats. A complete list of all primary and secondary habitats for each SGCN can be found in [Appendix D](#).

Table 2.6. Numbers of Bird Species in Greatest Conservation Need associated with each of the habitat types.

Habitats	Primary Habitat	Secondary Habitat	Total
Prairie and Other Grasslands	22	7	29
Savanna	3	4	7
Upland Conifer Forest and Woodland	7	9	16
Upland Deciduous Forest and Woodland	4	8	12
Mesic Hardwood Forest	6	2	8
Deciduous Wet Forest	0	5	5
Coniferous Forest Wetland	9	3	12
Riparian and Floodplain Forest	3	3	6
Non-forested Wetlands	18	12	30
Rivers and Streams	1	0	1
Lakes	18	6	24
Vernal Pools	0	1	1
Cliff, Talus, and Rock Outcrops	2	0	2
Urban and Other Developed Lands	3	6	9

Primary Stressors for Birds

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

Collisions with towers and buildings, especially windows, are a well-documented threat to bird populations (e.g. Loss et al., 2015; Loss et al., 2014). Birds often mistake reflective glass that mirrors vegetation or sky as open habitat, leading them to fly directly into it, often resulting

in injury or death. Long-distance migratory species are particularly vulnerable to these collisions (Arnold & Zink, 2011; Machtans et al., 2013). Among the 10 migrants that were disproportionately vulnerable to building collisions was the Minnesota SGCN, the black-throated blue warbler (*Setophaga caerulescens*; Runwal, 2020). Communication towers also pose a significant hazard, especially during migration on foggy nights or when cloud ceilings are low (Loss et al., 2015).

Birds that nest or feed along lake and river shorelines are especially vulnerable to the increasing rate of shoreline development and habitat degradation. These areas are considered prime real estate for summer homes and recreational use, leading to widespread alteration. A recent report estimates that Minnesota has lost 40-50% of its natural shoreline and continues to lose an additional 1 to 2% per decade (Minnesota Natural Shoreline Partnership, 2023). This ongoing loss affects species like the common loon (*Gavia immer*) that requires undisturbed shorelines for nesting. Additionally, during migration, many migrants depend on shoreline habitats rich in insects to refuel, making these areas essential stopover habitat.

The loss and degradation of forests, especially across the intensively developed Eastern Broadleaf Forest Province, is a notable factor in the decline of forest-dependent bird species such as the [cerulean warbler \(*Setophaga cerulea*\)](#), [Acadian flycatcher \(*Empidonax virescens*\)](#), and eastern whip-poor-will (Pfanmuller et al., 2024).

In addition, unsupervised domestic and feral cats can pose a serious threat to local bird populations. Annual bird mortality caused by cats is estimated at 1.4 to 4 billion birds in the U.S. alone, though these figures include significant uncertainties (Loss et al., 2013a). Feral cats in particular may be a greater threat than free-roaming domestic cats (Loss et al. 2015; 2022).



Crop Production

Grassland birds, including sedge wrens (*Cistothorus stellaris*), bobolinks, grasshopper sparrows, and [short-eared owls \(*Asio flammeus*\)](#) are affected by loss of habitat caused by conversion to rowcrop agriculture on the landscape. Since 1970, birds dependent on grassland habitats have declined an average of 43% as the Great Plains continues to lose approximately 1 to 2 million acres of grassland per year ([State of the Birds Report](#)). Additionally, areas with cover crops can function as population sinks when birds build nests in them, but the crop is terminated before young have hatched and left the nest.

In addition to habitat loss, extensive tiling of agricultural lands increases runoff to wetlands embedded in the agricultural landscape. Spring and summer storms increase runoff, which can suddenly flood the nests of waterfowl, shorebirds, and rails. Over time, the resulting sediment load can accumulate and gradually fill in wetlands (see also Dams and Water Management stressor below).



Tree Plantations

Tree plantations typically support lower plant species diversity and reduced structural complexity, resulting in lower-quality habitat for forest-dependent birds. The lack of a well-developed understory, for example, can significantly reduce the suite of forest bird species, often reducing it to 6 to 15 species that primarily occupy the conifer canopy. In contrast, plantations that include deciduous shrubs and saplings may support an average of 20 to 35 bird species (Green, 1995).



Livestock Management

Grazing by large ungulates, especially bison, was historically an important natural disturbance that helped maintain grassland habitats and the bird species that depend on them. Bison played a vital role in sustaining prairie ecosystems through

selective grazing, wallowing behavior that disturbed soil and created new microhabitats (Ratajczak et al., 2022), and dung that attracted insects, providing a key food source for many grassland birds. Today, livestock have replaced bison as the dominant ecological force shaping the structure and composition of Minnesota's one million acres of pastures and hayfields (USDA, 2022).

Depending on how grazing is managed, it can have both negative and positive effects on the abundance and diversity of grassland birds. Intensive grazing often has harmful consequences, including the reduction of vegetative cover needed by ground-nesting species, which increases the risk of nest predation; trampling of nests by livestock; and the spread of non-native plant species that degrade native vegetation used for feeding and nesting (Wuerthner, 2012). Bird abundance is especially sensitive to grazing in riparian (riverbank) habitats (Barzan et al., 2021). Grassland species known to respond negatively to intensive grazing include northern harriers (*Circus hudsonius*), short-eared owls, and [Henslow's sparrow \(*Centronyx henslowii*\)](#) (Bock et al., 1993). Some studies have also found that cattle grazing may be more detrimental to bird populations than grazing by sheep or mixed livestock herds (Barzan et al., 2021).

Livestock grazing can also benefit grassland conservation by creating favorable conditions for certain grassland bird SGCN species. For example, moderate to heavy grazing that produces short-grass prairies or grasslands can support species like the [chestnut-collared longspur \(*Calcarius ornatus*\)](#) (Lebbin & Fenwick, 2010). However, very few grassland bird species in Minnesota's tallgrass prairie ecosystem are strictly dependent on short-grass conditions. In these landscapes, the absence of grazing can actually reduce habitat suitability for birds. Moderate grazing helps maintain the vegetative and structural diversity that many bird species, such as grasshopper sparrows and western meadowlarks, thrive upon (Barzan et al., 2021). Creating a mosaic of grass height and structure

across singular operations will support habitat heterogeneity (variety) for a greater diversity of grassland birds. A recent study concluded that rotational cattle grazing provides similar benefits to breeding birds as bison grazing. The authors concluded that the rotational cattle or bison grazing system used was less important to grassland bird diversity and abundance than other factors such as stocking rate, soil composition, precipitation, topography and woody vegetation (Boyce et al., 2021). Grazing on private “working lands” also helps to maintain grassland habitats and prevents conversion to other land uses.



Mining and Quarrying

Habitat loss is the primary negative effect of mining and quarrying operations. This has been especially evident along the former Lake Agassiz beach ridges in northwestern Minnesota. The beach ridges not only support some of the best and largest remnants of native prairie in the state that provide habitat for many declining grassland birds, they also are a significant source of sand and gravel to growing communities in the Red River Valley (DNR, 1997). Potential effects on birds in sensitive wetlands from proposed mines have been raised as a concern. Although peat mining in Minnesota is limited in scope to a small percentage of area (approximately 8,000 acres in active leases in 2025, of an estimated 7 million acres [[State mineral leases](#)]), peat mining can alter hydrology and other attributes of peatland habitats valuable to some SGCN species.



Wind and Solar Energy Infrastructure

Renewable energy site development can negatively affect birds through habitat degradation and direct collision (also see discussion of window and tower collisions under the Development stressor). Loss and his colleagues (2013b) estimated between 140,000 and 328,000 birds are killed annually at wind turbines across the contiguous United

States. Based on data collected at wind turbines supported by a single vertical tower they demonstrated that mortality increases with the height of the turbine hub. Mortality also differed geographically with the lowest risk in the Great Plains.



Roads, Trails, and Railroads

Bird species that depend on large tracts of habitat that are not fragmented (e.g. [American goshawk](#) [*Astur atricapillus*] and [red-shouldered hawk](#) [*Buteo lineatus*]) can be affected by creation of new roads which decrease the amount of unfragmented forest and increase the level of disturbance in nesting areas, especially during the breeding season. Ortega and Capen (2002) found that habitat quality for a suite of forest-interior songbirds may be higher when territories are located more than 150 meters (492 feet) from a road. While smaller in width and often unpaved, trails can also pose problems. The higher the density of trails in an area, the more invasive plant species can be spread due to increased human access during and after trail building. These invasive species may outcompete native plant species and degrade habitat.

Vehicle collisions pose another threat to birds that use roadside fence lines, utility lines, and poles as perches. Car collisions have been noted as a significant cause of mortality for species such as the [loggerhead shrike](#) (*Lanius ludovicianus*) and red-headed woodpecker (*Melanerpes erythrocephalus*) (Pfanmuller et al., 2024).



Utility Corridors

Grassland bird species and forest interior songbird species can be affected by the creation and maintenance of utility and service corridors that traverse large tracts of habitat. As these areas are cleared regularly and kept in an early state of succession, they can create habitat sinks that bring in breeding birds that are then

more prone to nest predation or nest failure when the area is sprayed or cleared during the breeding season. Mortality can also result from collision with the lines. Powerlines, for example, present a risk to waterfowl when situated between feeding and roosting areas. This is especially true for lines near lakes, rivers and wetlands. Less agile birds, such as [American white pelicans \(*Pelecanus erythrorhynchos*\)](#), are particularly susceptible to collision with overhead lines located near waterbodies (APLIC, 2012). Mortality can result from the collision with wires or from electrocution from both wires and poles (Loss et al., 2015).

Pipelines used to transport oil and gas fragment habitats across the state and pose a risk of spills, which can lead to water-borne pollution.



Hunting and Collecting Animals

Lead poisoning in birds resulting from the consumption of lead shot is well-documented (Tranel & Kimmel, 2009; Haig et al., 2014; Pain et al., 2019). It can result from ingesting spent lead shot or from ingesting food that contains lead shot. Among bird species documented with lead poisoning in Minnesota are bald eagles and trumpeter swans. Data from the Raptor Rehabilitation Center at the University of Minnesota document that over 150 bald eagles are admitted each year. Between 80-90% of these birds have some level of lead in their blood; 25-30% have lead toxicity and either die or are euthanized. Many more bird species are susceptible to the effects of lead poisoning by consuming lead shot, including many SGCN. A few examples include bufflehead (*Bucephala albeola*), canvasback (*Aythya valisineria*), Northern pintail (*Anas acuta*), Northern harrier (*Circus hudsonius*) and American goshawk (Kimmel & Tranel, 2007; Pain et al., 2009). Lead shot use has been banned in some areas in Minnesota, including federal Waterfowl Protection Areas, National Wildlife Refuges, state Scientific and Natural Areas (SNA) that regularly allow hunting, and in state parks and SNAs that hold special

hunts. Lead shot may be used in all other areas, including most state Wildlife Management Areas (WMAs).

Although falconry is also tightly regulated by Minnesota rules and federal regulations, concerns remain regarding the illegal take of young raptors from nests.



Timber Harvest

Forest management at the landscape scale includes timber harvest as a tool for maintaining a diversity of forest composition, age classes, and patch sizes. At a site-level, timber harvest can change species composition, seral stage, and habitat structure. Forest-dependent birds, including woodpeckers, owls and hawks, grouse, and warblers, can be affected positively or negatively depending on the specifics of the timber harvest. Some species would not be present in Minnesota's dense northern forests without the presence of large disturbances such as fire, timber harvest and windstorms. Changes that increase the amount of young forest (approximately 20 years old) benefit some species including song sparrows, indigo buntings, American goldfinches, chestnut-sided warblers, and veerys. Rarely are these Species of Greatest Conservation Need, although golden-winged warblers (*Vermivora chrysoptera*) may be found in young aspen stands. Changes that decrease the amount of older forests (i.e., stands that have more complexity in their structural layers and more diversity in the forest canopy) negatively affect forest birds dependent on these forest components, including such SGCN as the American goshawk, boreal chickadee (*Poecile hudsonicus*), Swainson's thrush, and black-throated blue warbler.

Numerous studies document the relationship between forest cover and bird distribution and abundance in Minnesota forests. The most comprehensive studies have been conducted by the [University of Minnesota's Natural Resources Research Institute's Avian Ecology](#)

[Lab](#) (e.g. Niemi et al., 2016). Most logging occurs during the winter months to reduce the potential for impacts on roads and trails. Winter harvesting, however, can affect resident species that often begin nesting in late winter, such as the American goshawk and great gray owl. When spring and summer timber harvests occur, they can destroy nests, kill nestlings, and cause birds to abandon their territories. Regardless of the time of year harvesting occurs, rare species need to be considered when silvicultural practices are implemented at either the site or landscape level.



Photo: Black-throated blue warbler, Bob Dunlap



Fishing

Waterbirds and fish-eating raptors can all be affected by lead fishing tackle, and by fishing lines left behind by anglers. The effects of lead sinkers and jigs have been most extensively studied in loons and swans but also documented in multiple waterfowl species, colonial waterbirds, bald eagles and osprey. In addition to common loons, other SGCN species that have been documented ingesting lead sinkers include the American black duck (*Anas rubripes*) and black-crowned night-heron (*Nycticorax nycticorax*) (Rattner et al., 2008; Grade et al., 2018; Slabe et al., 2019).

Fish consumption by some waterbirds is often perceived by the angling public to be a threat to local fish populations. Although double-crested cormorants (*Nannopterum auritum*) are the most commonly perceived threat, one SGCN, the American white pelican, is also frequently implicated. Field studies, however, have shown that pelicans forage primarily on fish that have little economic value.



Recreation

The effect of recreational activities depends on factors such as their proximity, duration, intensity, frequency, visual screening, and time of the year as well as individual species sensitivity and habituation. Nature-based recreational activities, such as cycling, hiking, and boating, can negatively affect birds by affecting reproductive success, causing behavioral changes, or decreases in populations (Steven et al., 2011). Wave actions from recreational boats, for example, can disrupt nesting areas for overwater and shoreline nesting species while high levels of boating traffic also can disrupt waterbird and shorebird nesting activity. Recreational vehicles can cause nest abandonment, nest desertion, and reduced nest survival (Barton & Holmes, 2006; Spaul & Heath, 2016). Human activity near or within colonial waterbird nesting sites may result in colony abandonment or reduced nesting success, especially when events occur early in the nesting season (Vennesland, 2010).



Fire Management

Many forest birds utilize large open habitats created by recent fires; some would not be present in Minnesota's dense northern forests without the presence of fire or other large disturbances (such as timber harvest and windstorms). A field study of the response of forest birds to the Little Sioux fire on the Superior National Forest reported a variety of species attracted to the 15,000 acre burn including the killdeer (*Charadrius vociferus*), Northern flicker (*Colaptes auratus*),

Eastern bluebird (*Sialia sialis*), and indigo bunting (*Passerina cyanea*) and three SGCN including the black-backed woodpecker (*Picoides arcticus*), red-headed woodpecker and American kestrel (*Falco sparverius*), the latter two being more common in agricultural regions farther south in Minnesota (Niemi, 1978).

Disturbance (fire or grazing) is critical to maintaining suitable habitat for many grassland birds; without disturbance grasslands become shrublands and forests. Although grassland bird species each require vegetative cover that may differ in composition, density, and height at different times of year, they each depend on some level of active management, from [greater prairie-chickens \(*Tympanuchus cupido*\)](#) and upland sandpipers (*Bartramia longicauda*) to western meadowlarks and grasshopper sparrows (Wilsey et al., 2019).



Dams and Water Management

Wetland/marsh birds, shorebirds, and waterbirds are all affected by changes in water management regimes. Dams, for example, may permanently flood seasonal wetlands that provide nesting, feeding and resting areas, eliminate the periodicity of floods and droughts that may provide critical signals to birds, and destroy the connectivity of associated wetland habitats in a large wetland complex (Abreu et al., 2020). Stream channelization projects can affect avian habitats by increasing downstream sedimentation and bank erosion and decreasing in-stream riffles and pools and stream-side vegetation. For example, habitat improvement projects that stabilize eroding stream banks, may eliminate microhabitat features that are critical to [Louisiana waterthrushes \(*Parkesia motacilla*\)](#) in southeastern Minnesota (Stucker & Cuthbert, 2000).

The installation of underground tiles and the construction of ditches to remove water from poorly drained soils provide many benefits to agricultural production but also

cause significant environment effects. With approximately 19,150 miles of drainage ditches and an extensive, untallied system of subsurface tiles ([Minnesota Board of Soil and Water Resources](#)), the hydrology, water quality, and abundance of wetland habitats across much of Minnesota's original prairie landscape have been negatively affected ([University of Minnesota Extension](#)). Removing water from poorly drained soils not only results in the loss of wetland habitats, including wet meadows, that provide habitat for LeConte's sparrows (*Ammospiza leconteii*), [yellow rails \(*Coturnicops noveboracensis*\)](#), and sedge wrens, but can also cause higher flows into streams after high rainfall events. For example, decades ago, extensive tiling in southwest Minnesota caused untimely surges in water levels during the nesting season, ultimately leading to the demise of many waterbird nesting colonies and waterfowl nesting populations. Fortunately, many best management practices and water management options now are available to help mitigate many of these effects.



Invasive Species (Problematic Non-native Species)

Grassland species are negatively affected by the spread of non-native plant species in their habitat, including common buckthorn (*Rhamnus cathartica*), glossy buckthorn (*Frangula alnus*), and invasive honeysuckle species (*Lonicera* spp.). Although many studies investigating the effects of common non-native shrubs such as buckthorn (*Rhamnus cathartica* and *Frangula alnus*), and non-native honeysuckles (e.g. *Lonicera tatarica*) have been equivocal, others have pointed to "altered nest site availability, habitat heterogeneity, and food supplies" (Nelson et al., 2017) and increased predation (Schmidt & Whelan, 1999). The increasing prevalence of garlic mustard (*Alliaria petiolata*) in riparian and floodplain forests decreases the diversity of native flora, instead creating a dense carpet of herbaceous vegetation and potentially affecting riparian species like the Louisiana waterthrush (Stucker pers. comm.).

Thick stands of purple loosestrife (*Lythrum salicaria*) can similarly affect wetland SGCN such as black terns and least bitterns. Many of the most widespread species, such as smooth brome (*Bromus inermis*) and Kentucky blue grass (*Poa pratensis*), can outcompete native vegetation resulting in a decline in vegetative diversity. Although some grassland birds will use these habitats, studies have shown that “non-native vegetation cover is correlated with reduced nesting success and post-fledging survival” (Bernath-Plaisted et al., 2023). One hypothesis for the observed decline is that non-native plants attract fewer insects (Narango et al., 2018).

Ground nesting forest birds are negatively affected by non-native, European earthworms used as bait for fishing (Loss & Blair, 2011). The worms’ consumption of leaf litter and other organic materials reduces the amount of ground cover and plant diversity, increasing the vulnerability of ground-nesting species.

Several non-native invasive forest insects and diseases can cause defoliation and mortality. Currently the most significant threat is from the emerald ash borer (*Agrilus planipennis*), which has affected 6,100 acres in central Minnesota. Like many forest disturbances, some birds will benefit from the increase in dead trees (such as woodpeckers; Koenig et al., 2013) while others that depend on a healthy tree canopy may decline. Given the current distribution of [emerald ash borer](#) in Minnesota, this could affect such SGCN as the cerulean warbler and Acadian flycatcher. Neither species is entirely dependent on ash, but it is a canopy tree in many of the forests they inhabit. The fungal disease oak wilt (*Bretziella fagacearum*) is now common throughout southeastern and east-central Minnesota. Because oaks decay very slowly, the dead oaks will provide benefits to some birds for many years. Ultimately, however, the loss of oaks will result in the absence of acorns, an important food source

for many birds, such as wood ducks, turkeys and blue jays and the SGCN, red-headed woodpeckers who are especially dependent on hard mast during the winter months (Frei et al., 2020).

Waterbird and marshbird nesting habitat also can be diminished by the spread of non-native vegetation. Non-native species such as common reed (*Phragmites australis* subsp. *australis*), can crowd out native vegetation and reduce accessibility and availability of open water habitat, especially for birds that utilize short wetland grasses (Benoit & Askins, 1999).

Two birds are officially classified as invasive species in Minnesota, the European starling (*Sturnus vulgaris*) and the Mute Swan (*Cygnus olor*). Starlings can cause damage to agricultural crops and aggressively compete with native birds for nesting cavities. Mute swans are also fiercely competitive with other waterbirds, including trumpeter swans, aggressive to people, and consume huge amounts of native aquatic vegetation daily (Pfanmuller et al., 2024).



Problematic Native Species

In Minnesota, open sand and gravel beaches are a rare resource so species that share that habitat are often in competition for nest sites. Common terns, a state threatened species, compete for these sites with ring-billed gulls (*Larus delawarensis*) and ground-nesting double-crested cormorants. Because adult gulls and cormorants arrive on the breeding grounds weeks before the terns, the prime nesting sites are already occupied. Intensive management efforts are underway at most Minnesota’s tern breeding colonies to deter the gulls and cormorants (Pfanmuller et al., 2024).



Photo: Common tern colony on Interstate Island

Three native forest insects can affect large tracts of songbird breeding habitat in northern Minnesota. The eastern larch beetle (*Dendroctonus simplex*) has caused the death of mature tamaracks in more than 1.1 million acres since 2001. Many birds that are found in conifer dominated peatlands are likely affected by this loss. The forest tent caterpillar (*Malacosoma disstria*) and spruce budworm (*Choristoneura fumiferana*) can also affect broad swaths of forest land, but their negative effects are more short-lived. Some birds positively respond to this sudden increase in insect populations. Cuckoos are best known for their voracious appetite for tent caterpillars, but the list of avian predators includes at least two SGCN, evening grosbeaks (*Coccothraustes vespertinus*) and Philadelphia vireos (*Vireo philadelphicus*), while several warblers, including the SGCN warblers, bay-breasted (*Setophaga castanea*) and Cape May (*Setophaga tigrina*), are well-known consumers of spruce budworm.



Diseases and Pathogens

Birds are subject to a variety of diseases and pathogens that cause disease. Many birds naturally carry these diseases while showing few, if any, of the symptoms until they are stressed and lose their resilience. Many of the stressors listed above, such as problematic non-native species and habitat loss that causes overcrowding on

migratory stopovers, can instigate an outbreak. Bird flu, caused by the H5N1 virus, has resulted in the death of at least 11,000 wild birds nationally since 2022 (Yates, 2025), with die-offs most pronounced in waterfowl. The virus's effect on Minnesota SGCN is unknown. It has generated widespread concern because of its effect on both high-density domestic poultry operations and backyard flocks. In just a two-month period, from December 2024 through January 2025, 41.4 million domesticated chickens were culled nationwide because of the flu.

West Nile Virus can affect many bird species but members of the Corvidae bird family are especially susceptible. Transmission was so high in the eastern United States in the early 2000s that some local populations of American crows declined nearly 70% (Reed et al., 2009); although not as severe, declines were also noted in Minnesota. West Nile Virus has been documented in 250 bird species including the SGCN American goshawk, Northern harrier and Cape May warbler (Taieb et al., 2020). The virulent Newcastle disease has been reported in several bird species, including the SGCN the American white pelican (Wisconsin DNR), but double-crested cormorants and pigeons appear to be most susceptible. Without precautions they can spread the disease to poultry farms where chickens are considered the most vulnerable. The most recent outbreak in Minnesota was in 1992 when more than 20,000 cormorants collectively died in North Dakota, South Dakota and Minnesota (DNR, 2025). Pelicans commonly co-nest with cormorants and were likely part of the loss documented in 1992. Another pathogen, avian botulism, occurs world-wide and affects many birds but predominantly waterfowl and other species common to wetland habitats. Shallow waters with low oxygen levels are most susceptible. It is not spread from bird to bird but by the consumption of aquatic invertebrates that carry the toxin or by birds that filter bottom sediments or organic materials where the toxin is embedded. Ultimately resulting in the bird's paralysis, thousands, often millions, of birds

succumb to the disease each year (Gutierrez-Arnal & Marin, 2024). Botulism outbreaks are expected to only increase in frequency and magnitude with warming temperatures (Lafrancois et al., 2011).

Water-borne Pollution



Many water-borne pollutants that have been banned or strongly regulated for years, such as PCBs (polychlorinated biphenyls), dioxins and dibenzofurans, are persistent chemicals that have remained in the environment for decades. Their continued presence in fish-eating birds in the Great Lakes Basin was recently documented and included evidence of reduced reproductive success, physical deformities, and compromised immune function (Grasman et al., 2025). Other sources of water pollutants including “wastewater, heavy metals, chemicals, plastics, water from agricultural fields, and oil spills are considered among the most important factors responsible for mortality and population declines in freshwater birds (Shahid & Nadeem, 2021). One impactful water pollution event occurred in 2010 when the Deepwater Horizon oil rig exploded in the Gulf of Mexico, an area of coastal waters where at least one Minnesota SGCN, the common loon, winters (see Minnesota Common Loon Restoration Project Case Study in the Lakes sub-chapter). New concerns also are being raised about the effects of PFAs (perfluoroalkyls), brominated flame retardants and neonicotinoids and their persistence in aquatic environments.

Air-borne Pollutants



Mercury’s effect on fish-eating birds (waterfowl, shorebirds, loons, and wading birds) has been well-documented (Seewagen, 2010). Airborne mercury enters aquatic ecosystems primarily through atmospheric deposition, where it settles onto land and water bodies via rain, snow, or dry particles, and is carried into water bodies by rain events. Deposition of mercury on soil and foliage also affects terrestrial species.

Recent studies that examined approximately 50% of the songbirds in the U.S. and Canada documented reproductive problems attributed to mercury exposure in 41% of the species (Evers & Cristol, 2020). The risks are highest among birds that consume predatory invertebrates such as spiders.

Among grassland birds, the major population declines that began in the 1960s were coincident with a period of agricultural intensification across the Great Plains, including heavy pesticide use (Stanton et al., 2018). Studies have consistently demonstrated the negative effects of aerially applied pesticides on birds, including mortality, reduced reproductive success, and disrupted migratory behavior (Bernath-Plaisted et al., 2023). Carbamates and organophosphates have been the most widely studied pesticides. As their use has decreased there is growing concern about the use of neonicotinoids (Stanton et al., 2018). Studies conducted to date point to both lethal and sublethal effects (e.g. declines in reproductive success, growth, chick survival, etc.) from ingesting seeds treated with neonicotinoids (Wood & Goulson, 2017). Reductions of arthropod food resources for grassland birds have been associated with soybean aphid insecticide applications up to 5 days after spraying (Goebel et al., 2024).



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). Because most of the nation’s large urban areas (with multiple artificial light sources every night), are embedded in the

Temperate Deciduous Forest biome, biota occupying temperate forests are the most vulnerable to these effects (Aubrecht et al., 2010).

Effects of light pollution include disrupting the behavior of amphibians whose breeding calls are delivered at night, drawing nocturnal insects to artificial lights that increase their predation risk, and disorienting birds using environmental cues to guide nocturnal migration (DarkSky International, 2025). Bright day and dark night cycles synchronize the internal clocks of plants and animals; alterations to these cycles can 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 (human-caused) 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 elevated 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 & 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](#)). 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, refer to the Climate Adaptation section in Chapter 6: Implementation.

Many bird species will be affected by habitat shifts and alterations due to warming temperatures and the accompanying effects. Warmer winters may change the diversity, distribution and abundance of birds that overwinter in the state, with fewer Canadian species moving south and more short-distance migrants remaining through the year.

Predictive models developed by the National Audubon Society (2019) forecast the most significant negative effects on Minnesota's avifauna will fall on boreal forest species (see Climate Change Profile). More than 21 of the 27 species the models predict will be extirpated in the state should the temperature rise by 1.5 degrees Celsius are restricted to Minnesota's northern forest (Pfanmuller et al., 2024). Even more species are lost should the temperatures rise even further. The breeding range of most

of these species is predicted to move farther north across Canada, providing suitable habitat is available.



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. Increased flooding and high winds will negatively affect ground-nesting waterfowl, waterbirds, and shorebirds by eroding nesting habitat and flooding nests. Nesting failures in canopy dwelling waterbirds (herons and egrets) could increase given the vulnerability of their highly exposed nests. Flash floods, tornados and hail can cause adult and chick mortality, blow down nests in trees and shrubs, flood ground nests or nests embedded in wetland vegetation, delay migration, and alter habitat.

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). Droughts will likely decrease insect abundance and increase the occurrence of fires, especially in northern counties. Grassland birds, wetland birds, and waterbirds may be negatively affected if habitat quality degrades and food supplies decline. Drought conditions and low water levels also are predicted to increase the spread of infectious diseases and pathogens that affect birds. For more information and resources for climate-adapted management strategies, see the Climate Section in Chapter 6: Implementation.

Case Study: Modeling Climate Effects on Breeding Birds

In 2019 the National Audubon Society (NAS) published a report titled [Survival by Degrees: 389 Bird Species on the Brink](#). The report documented a comprehensive effort to model changes in the distribution of 640 North American birds that could result from warming temperatures. More than 70 data sources and over 140 million bird records were used as input, along with information on vegetative cover, land use, and climate. Using the most current climate modeling methods available at the time, the researchers assessed the distributional changes to birds under three global warming scenarios based on the 2014 Intergovernmental Panel on Climate Change. They include a 1.5°C warming above preindustrial levels (which is considered imminent between 2030 and 2052 if no climate change mitigation measures are taken); a 2°C warming (which could happen as soon as 2050); and a 3°C warming scenario (which could occur by 2080). These models are predictive models, meaning that they may or may not occur.

Distribution maps for each species for each of the three warming scenarios are available and can be used to assess effects at the national, regional and state level. Pfanmuller et al. (2024) assessed the predicted results for Minnesota species. They designated a species as extirpated at a given warming scenario when the NAS models portrayed the absence of any current or newly available “thermal breeding range” for the species in Minnesota. At the lowest warming scenario (1.5oC), the models predicted the extirpation of 27 breeding birds from Minnesota. The vast majority of these species are dependent on the northern boreal forests of the Laurentian Mixed Forest Province. They include such SGCN as the spruce grouse (*Canachites canadensis*), great gray owl, olive-sided flycatcher (*Contopus cooperi*), and Cape May warbler. At the 2oC warming scenario Minnesota may lose a total of 41 breeding birds including the SGCN American goshawk, evening grosbeak, and LeConte’s sparrow and a total of 66 species at the 3oC warming scenario including the SGCN lesser scaup (*Aythya affinis*), red-necked grebe (*Podiceps grisegena*), and Franklin’s Gull (*Leucophaeus pipixcan*).



Photo: Great gray owl, Bob Dunlap

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 partnership 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 strategies.

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 “NA” in the stressor column.

Potential Conservation Actions for Birds





















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
	Increase monitoring of grassland birds on both public and private lands to improve our understanding of statewide population levels. Conduct response/effectiveness monitoring to assess their response to different grassland management regimes, including prescribed burning, grazing, and prairie restoration efforts. Rigorous effectiveness monitoring is necessary to develop improved evidence-based management recommendations and avoidance measures for SGCN (Binley et al., 2025) as part of adaptive management. This information can then be used to help devise and guide new options for incentivizing bird-friendly management.
	Monitor population trends of rare forest species, including the effect of forest management activities on forest birds. Quantify spatial use needs and territory size requirements of birds to help guide management decisions.
NA	Promote participatory science opportunities such as the Minnesota Loon Monitoring Program , and eBird . See Chapter 4: Public Engagement and the DNR’s Wildlife Diversity and Community Science webpage for more bird-related opportunities.
NA	Actively support and promote continued funding for long-term bird monitoring programs, including the Minnesota National Forest Breeding Bird Monitoring Program , the Hawk Ridge Bird Observatory , Minnesota Breeding Bird Atlas , North American Breeding Bird Survey , and monitoring surveys conducted by the DNR to track the status of colonial waterbirds, waterfowl, and upland game birds.



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
	<p>To reduce window collisions, apply decals to windows or use UV paint visible to birds. Require or incentivize collision mitigation for new construction builds. Increase public outreach/ education on collision prevention. The American Bird Conservancy and Audubon's Bird Friendly Buildings initiative provide more details.</p>
	<p>Protect and restore shoreline habitat. Advocate for stricter community planning and zoning. Increase public outreach about the value of natural shorelines and provide guidance for shoreline owners. Provide guidance regarding artificial nesting platforms, such as for loons.</p>
	<p>Encourage agricultural producers to enroll in conservation programs that incentivize integrating bird conservation efforts into their working farms or ranches such as by restoring and managing grasslands, improving water quality, reducing erosion and sedimentation, and conserving ground and surface water. Promote conservation grazing and prairie restorations on both public and private lands with incentives to accommodate Best Management Practices proven to benefit native birds, especially SGCN. Add buffers around agricultural fields. Encourage cover crop and no-till farming practices. Support private lands biologists to assist landowners in enrolling in Farm Bill and other similar programs and learning about conservation easements. Encourage livestock producers to explore other creative options such as Audubon's Conservation Ranching Program, a collaborative effort between the National Audubon Society and ranchers to protect and restore grassland habitats for declining bird populations. This program focuses on sustainable ranching practices, particularly rotational grazing, and provides a market connection for "bird-friendly" beef and bison. Additional opportunities to link agricultural production with bird conservation can be found at the Natural Resources Conservation Service and the Board of Soil and Water Resources.</p>
	<p>Integrate habitat requirements into permits for mining and quarrying. Work with appropriate government agencies to restrict mining and quarrying in areas of known and historical leks (grouse/prairie chickens).</p>
	<p>Consider requiring native vegetation in energy development areas and prohibiting renewable energy development in remnant prairie areas. Influence wind farm siting to avoid flyways. Advocate for policies to improve reporting of mortality and implementation of mitigation strategies required under state and federal laws. Seek collaborative opportunities to work with wind energy companies to publicly acquire habitat adjacent to wind towers for conservation.</p>
	<p>Minimize new roads and trails and damaging recreational activities in important habitats, including Important Bird Areas delineated by Audubon Minnesota.</p>
	<p>Co-locate utilities when possible to reduce negative environmental effects and consider wildlife in siting plans. Mow utility areas outside the breeding and nesting season. Avoid routing lines near or across lakes where feasible. Provide technical guidance to utility companies related to reducing avian collisions with powerlines (such as by marking lines). Support research related to reducing avian collisions with powerlines</p>

Stressor	Action
	Encourage collaboration among all stakeholders and across ownerships to promote effective management for the health and resilience of forests and their ability to provide ecological, wildlife habitat, and other values. Aim to provide diversity across the landscape and over time. Explore opportunities to emphasize connectivity and corridor creation. Encourage use of best management practices such as winter harvest; the maintenance of snags, downed logs, and leave trees; and protecting sensitive areas to incorporate species-specific bird habitat requirements, including forest structural and age-class diversity.
	When conflicts arise regarding the effects of fishing-eating birds on local fish populations, apply science-based decision making to conflict resolution processes. Ensure mitigation strategies sustain regional populations and avoid effects on non-target species. Monitor effects of any management actions. Provide educational opportunities related to "nuisance" species.
	For shorebird and colonial waterbird SGCN, consider restricting recreational access to significant locations during breeding season and peak migration. Seasonal beach restrictions protect nesting and foraging areas of sensitive birds such as piping plovers and common terns (Hillman et al., 2015). Wildlife sanctuary signage placed around breeding habitat reduces recreational disturbance to these sites. Local support from landowners, conservation partners and enforcement officers is important in supporting these closures.
	Consider establishing and enforcing no wake zones around key nesting areas, especially for colonial nesting waterbirds, and conduct public outreach to promote wildlife-friendly boating behavior.
	Integrate seasonal timing of water management, especially wetland drawdowns, relative to the bird nesting season. Provide sufficient water levels, especially in non-forested wetlands that support bird SGCN, from spring through July. Encourage the application of best management practices for installing new or upgrading old drainage systems (Board of Soil and Water Resources and the Natural Resources Conservation Service).
	Support Lights Out programs. Advocate for mandates and bylaws to change city lighting (downward facing and off after a certain time). Promote artificial light guidance from the International Dark Sky Association and implement their best practices for wildlife-friendly outdoor lighting.
	Leave some dense vegetation structure in conifer forests to provide thermal refuges for spruce grouse.
	Increase buffers around wetlands and increase the size of wetlands to mitigate wind and water level rise. Provide more upland nesting habitat on higher ground. Protect lake shoreline habitat. Create artificial nesting habitat. Stop island erosion and flooding.
	Continue and support efforts to provide suitable nesting habitats for common terns with actions that reduce the access of other waterbirds, such as ring-billed gulls and double-crested cormorants, that compete for the limited nesting habitat that is available.
	Increase the use of prescribed fire. Proactively apply prescribed fire and grazing in ways that sustain native ecosystems and support SGCN birds 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).
	Support and promote efforts to control problematic non-native species, placing a special emphasis on restoration of native vegetation in grasslands and wetlands.



Strategy 3. Develop and disseminate 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
	<p>Provide land managers (including private landowners) with information on bird-friendly landscape design, yard certification, and forest management. Audubon’s “How to Make Your Yard Bird-Friendly”, National Wildlife Federation’s “Create a Bird-Friendly Habitat”, and the “Forestry for Minnesota Birds” guide offer suggestions. Support programs providing financial incentives for woodland owners to create bird-friendly habitat, such as the Sustainable Forest Incentive Act which provides payments to landowners to keep woodlands undeveloped.</p>
	<p>Share information with land managers, including private landowners, about habitat needs of rare forest species.</p>
	<p>Promote the use of non-lead fishing tackle options to anglers and increase public outreach on negative effects on wildlife. Encourage anglers to recycle lead tackle at hazardous waste facilities and/or encourage local communities to hold tackle collections days. The Minnesota Pollution Control Agency has additional information and suggestions.</p>
	<p>Promote non-toxic ammunition options to reduce exposure of wildlife and humans to lead. For example, the Non-Toxic Working Group of the Minnesota Chapter of the Wildlife Society, along with partners, distributes information and holds hands-on demonstration events to inform and encourage the use of copper ammunition for hunting.</p>
	<p>Initiate an information campaign to raise awareness of the effects of seed coatings on the health and sustainability of grassland birds.</p>
	<p>Support Lights Out programs. Advocate to change city lighting practices (downward facing and off after a certain time). Promote artificial light guidance from the International Dark Sky Association and implement their best practices for wildlife-friendly outdoor lighting.</p>
	<p>Support and promote efforts to control problematic non-native species, placing a special emphasis on restoration of native vegetation in grasslands and wetlands.</p>
	<p>Promote programs such as Audubon’s Bird City Minnesota which helps birds by restoring, protecting and improving bird habitat; reducing threats such as window collisions and toxins; and engaging people in learning about and helping birds thrive.</p>

Case Study: Linking Grassland Birds to Profitable Livestock Production

A monitoring team was launched by the Land Stewardship Project and the Minnesota Institute for Sustainable Agriculture in the 1990s to create a set of sustainability indicators to link healthy grassland habitat to profitable livestock production. At the core of the team were six farm families in southeastern Minnesota who used rotational grazing for dairy and beef production and wanted to learn more about its effect on the land and its wild inhabitants. Farmers worked with University of Minnesota environmental scientists, an economist, a sociologist, and experts from the Minnesota DNR and the U.S. Fish and Wildlife Service, to develop indicators that could be easily implemented while carrying out livestock management. The farmers learned the basics of monitoring soil health, water quality, forage viability, birds, and frog and toad populations.

By far the most popular, and effective, indicator for the farmers was the presence of grassland birds. It became a user-friendly method for the farmers to link the productivity of their pastures, and their animals, with the presence of species that rely on healthy, heterogeneous, grassland habitat. Because it can be worked into chores like moving cattle and fixing fences, birding is a handy way to gauge some of the key effects a farmer is having on the land. Indeed, by the third year of the monitoring initiative, bird sightings were among the first items farmers mentioned during their monthly reports. When they got together, they were not bragging about their corn yields, milk production, or improvements in soil structure. Instead, they were quick to share the number of successful bluebird or bobolink nesting they had observed. As they became more aware of the birds on their farms, the farmers took the next step: they started wondering what effects their livelihoods were having on the life cycles of their feathered neighbors. They began discussing with wildlife biologists concerns they had about nesting disruptions caused by haying, pasture clipping, and even grazing.

Although several farmers observed that cattle were sometimes able to graze a paddock with an active nest without destroying the eggs or nestlings, it became clear that the hay fields and managed pastures could become avian “population sinks,” rather than “population sources.” As a result, several farmers reduced or delayed pasture clipping to allow fledglings to become more mobile before the mower disrupted the nests. Dairy producer Art Thicke also eliminated clipping on some of his paddocks one year and found, “You couldn’t tell where you clipped and where you didn’t.” In other words, despite the lack of clipping, the cows still found the grass palatable.

A management technique that improved nesting success was the establishment of rest areas within their grazing paddocks. One year, each farm held one paddock out of grazing from the beginning of the season until at least the end of July. The densely vegetated rest areas provided a place for birds to nest undisturbed by cattle or machines. They also allowed birds disturbed in adjoining paddocks to retreat to the lush cover and re-nest. Farmers noticed greater concentrations of bobolinks and dickcissels in the rest areas during the first year of the experiment. As an added bonus, the rested paddocks gave the vegetation an opportunity to mature so it could re-seed directly or through the livestock’s digestive systems. Allowing the longer growing period also increased the plant’s root structure, thus improving soil structure, which is important when a farm is exposed to extreme drought or precipitation events.

These management practices both benefit the farm financially, as well as improve the environment. In short, more bobolinks can equal more beef. If the farmers had been told right out of the gate that their farming methods were threatening grassland bird species, defenses would have gone up, reducing opportunities to implement even minor management changes. But monitoring took them through a process starting with newfound knowledge and ending with appreciation and action that improved grassland bird habitat without negatively affecting their profits (DeVore, 2003).



Photo: Bobolink, Bob Dunlap

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