

MINNESOTA WOLF MANAGEMENT PLAN

2023-2032





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Front cover photo, International Wolf Center



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Executive summary

Minnesota's wolf legacy is unique: The state's northeastern corner of lakes and forest once sheltered the last remaining wild wolves in the lower 48 states. Today, wolves are distributed across half of the state in numbers (2,700) well above Endangered Species Act recovery plan goals (1,251–1,400) for the wolf in Minnesota. Wolf population growth in Minnesota has contributed significantly to the expansion of wolf range in other parts of the upper Great Lakes region that includes Wisconsin and Michigan, and Minnesota's wolf population represents nearly half of the current wolf population within the lower 48 states.

Wolves are important to Minnesota's natural and cultural heritage. Wolves capture the attention of Minnesotans from all backgrounds. Minnesotans differ greatly in how they value wolves and want them conserved and managed. The Ojibwe tribes have a significant cultural tie to wolves, and the state works with tribes in a government-to-government relationship on wolf management. The benefits and challenges of living with wolves are numerous and diverse. Benefits of wolves in Minnesota include their ecological function, the positive economic impacts they generate through tourism, and the opportunities they afford for people to appreciate, see, hear and share wild spaces with wolves. Challenges include Minnesotans' concerns about predation on other resources they value like deer, moose and livestock, and the impacts they have on livestock producers. Although there are differing perspectives on wolf management, Minnesotans support the long-term persistence of a healthy wolf population.

The Minnesota Department of Natural Resources (DNR) began the process of updating the 2001 Minnesota Wolf Management Plan in 2019, with a goal to incorporate new information and the diverse views of Minnesotans into this next phase of wolf management in Minnesota.

Plan purpose and development

The purpose of this plan is to communicate a vision for wolves in Minnesota. The plan:

- provides background information on Minnesota's wolf population and distribution, Minnesotans' attitudes toward wolves and wolf management, management authority and public involvement, and wolf management activities;
- summarizes fundamental policy questions, critical opportunities and challenges the DNR seeks to address through this plan, human values and beliefs about wolves;
- outlines strategic direction by describing goals, objectives and strategies for Minnesota's approach to wolf stewardship that will be used to prioritize agency resources and activities; and
- identifies performance measures that will be used to track and report progress during plan implementation.



U.S. Fish and Wildlife Service

Importantly, the goals contained in this plan seek to incorporate the diverse views of Minnesotans, while adhering to the statutes guiding Minnesota wolf management. The plan emphasizes cooperation and collaboration with tribal, federal, state and local governments, nongovernmental organizations, and other partners. This plan will guide wolf management for 10 years and will be evaluated and revised if necessary five years after adoption.

Management activities in support of wolf conservation are diverse. Some readers might be surprised to find that this plan does not prescribe Minnesota's approach to wolf hunting or trapping. The plan is intended to be relevant and inform state management regardless of the wolf's status under the federal Endangered Species Act. In recognition of public interest in how the state would approach decisions about hunting or trapping if the wolf is delisted federally, Appendix 2 includes a framework that describes guiding principles and criteria that would inform future wolf hunting and trapping decisions.

Background and current conditions

The background and current conditions section of this plan provides an update on wolves in Minnesota, Minnesotans' attitudes toward wolves and key management activities since the development of the 2001 Minnesota Wolf Management Plan.

Recognizing that some readers might desire additional information on wolves and wolf management in Minnesota, Appendix 3 to this plan includes links to informational resources and citations for scientific publications that can provide more in-depth understanding about wolves in Minnesota.

Strategic considerations

The plan describes several critical opportunities and challenges that influence wolf management. In particular, the DNR considers and responds to diverse human values and acknowledges the benefits and challenges of living with wolves. Broadly, beliefs about how people relate to

wildlife are changing, and these beliefs will likely influence preferences for wildlife management over time. The plan also directly affects Native American tribal nations in and around Minnesota. Staff from several tribal resource management agencies participated in the technical committee that helped to inform this plan update. With the support of these tribal nations, this plan provides a brief description of the cultural and ecological significance of ma'iinganag (wolves) to the Ojibwe Dakota communities within Minnesota, who refer to wolves as *βuåktokça*, did not actively participate in planning but were kept informed throughout the update process.

Wolf management in Minnesota currently relies on revenue from deer and wolf license fees to support population management, research, damage control, enforcement, and education, according to Minnesota Statutes, Sect. 97A.075. As with all natural resource management activities, implementation of wolf plan components will depend on funding, which may require tradeoffs among plan priorities and other resource needs throughout the course of the 10-year plan. The DNR also relies on partnerships to conduct wolf management and monitoring that greatly enhances the ability of DNR to successfully implement wolf management and monitoring.

Wolf predation is an important consideration in Minnesota's wolf management. This plan describes the cooperative management program between the DNR and United States Department of Agriculture (USDA) Wildlife Services and the management tools available to address livestock depredation. Additionally, Minnesota is fortunate to have functioning predator-prey systems that include wolves, bears, moose and deer, among other species. The DNR strives to consider the needs of these species and the interests of Minnesotans, and this plan recognizes that management strategies need to address challenging tradeoffs.

Wolf population objectives are a critical consideration and component of wolf management. This plan provides background

on the United States Fish and Wildlife Service (USFWS) Recovery Plan for the Eastern Timber Wolf (revised in 1992), the minimum population level identified in the 2001 Minnesota Wolf Management Plan, current trends in population levels and geographic distribution over time and considerations for population management into the future.

Finally, population monitoring and research are critical for informing and evaluating wolf conservation and management. Principles to guide wolf monitoring are identified in the plan to ensure DNR decision-making is well informed.

Management direction: goals, objectives and strategies

The plan's six goals to support Minnesota's vision for wolves are to:

- Maintain a well-connected and resilient wolf population
- Collaborate with diverse partners to collectively support wolf plan implementation
- Minimize and address human-wolf conflicts while recognizing diverse wolf values

- Inform and engage the public about wolves in Minnesota and their conservation
- Conduct research to inform wolf management
- Administer the wolf program to fulfill agency responsibilities and public and partner needs.

Objectives and strategies are nested within each goal. Objectives include activities that can be tracked to determine progress through the life of the plan. Strategies include specific, actionable statements describing how the DNR will achieve its goals and objectives.

Monitoring performance measures

Finally, this plan includes quantitative measures the DNR will use to track and report progress on implementing strategies in the plan. Specific performance measures were selected to reflect the full scope of goals in this wolf management plan, with an emphasis on objectives anticipated to have broad public interest, as well as information that is critical to inform wolf management.



I. Introduction

Vision for wolves

Minnesota's wolf population will continue to be healthy, widespread across a suitable range, and stable after decades of recovery from historical lows. The DNR supports the presence of a healthy wolf population in the state, where many Minnesotans appreciate wolves for their intrinsic value and for their ecosystem and social benefits. State management will recognize the relationship between wolves and tribal people in Minnesota. Wolves on the landscape require collaborative solutions to address human-wolf conflicts when they arise. The DNR recognizes that wolves exist in relationship to other wildlife species valued by Minnesotans. The best available ecological, social and cultural knowledge will inform wolf conservation.

Plan purpose and structure

To support the DNR's vision for wolves, this plan describes goals, objectives and strategies for Minnesota's approach to wolf stewardship. Wolves connect with all parts of the DNR's mission.

The DNR "shall adopt a wolf management plan that includes goals to ensure the long-term survival of the wolf in Minnesota, to reduce conflicts between wolves and humans, to minimize depredation of livestock and domestic pets, and to manage the ecological impact of wolves on prey species and other predators."
–Minnesota Statutes, Sect. 97B.646

The mission of the DNR is to work with Minnesotans to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life.

This plan describes current knowledge of Minnesota's wolf population, Minnesotans' attitudes toward wolves, the history and legal status of wolves in the state, and a management approach to support human coexistence with a healthy and resilient wolf population integral to Minnesota's overall biodiversity, while minimizing conflicts between humans and wolves. The plan's goals seek to incorporate the diverse views of Minnesotans, while adhering to the statutes guiding Minnesota wolf management and supporting the DNR's mission. Importantly, the plan emphasizes cooperation and collaboration with tribal, federal, state and local governments, nongovernmental organizations, and other partners. The plan will guide wolf management for 10 years and will be evaluated and revised if necessary five years after adoption. In support of the plan's goals, management actions are continually adapted to current conditions, trends and the best scientific information.

Following this introduction (section I), section II provides a summary of Minnesota wolf population information and describes current conditions helpful to understanding wolves in Minnesota. A summary of basic wolf information, including the 2001 Minnesota Wolf Management Plan and additional resources that informed this plan, are listed in Appendix 3. Section III details significant and more recent strategic issues surrounding wolves. Section IV contains goals, objectives and strategies for addressing issues described in section III.

Plan context

The DNR is responsible for conservation and management of the state's wildlife, including wolves. Although the state had been actively supporting wolf conservation for decades, the DNR, in consultation with the Minnesota Department of Agriculture (MDA), adopted its first wolf management plan in 2001. The 2001 plan was initiated in response to the USFWS recommendation to remove federal Endangered Species Act protections for the gray wolf. In 1992, the USFWS set a population recovery goal for Minnesota at 1,251 to 1,400 wolves. By 2001 the population was roughly double the upper end of that goal. The 2001 plan provided a framework to accomplish a goal of "ensuring the long-term survival of the wolf in Minnesota, and also to resolving conflicts between wolves and humans." Although it was developed in response to federal action, the 2001 plan has guided wolf management through multiple Endangered Species Act listing and delisting decisions.

The USFWS published a rule removing wolves from the endangered species list in 2021, and this decision was overturned by a federal court ruling in 2022. The DNR's update of the 2001 plan began in 2019 before these federal wolf policy decisions. Regardless of the wolf's status under the federal Endangered Species Act, it is critical that Minnesota approach the state's contributions to wolf management with knowledge of contemporary challenges and the changing social, economic and ecological contexts of wolf management today.

Planning process

Throughout the planning process, Minnesotans had several opportunities to share their perspectives, including through a scientific survey of their attitudes toward wolves and wolf management; an advisory group comprised of wolf stakeholders; and public comment and meetings open to all. A Wolf Technical Committee of university, tribal, state and federal wildlife managers and scientists also provided support to the planning process, including through the identification of research and management needs and challenges, and potential solutions. Consultation and coordination with Native American tribal governments occurred throughout the process before final adoption of the plan.



Table 1. Plan update development process

Date	Process component	Description	More details
2019	Internal project scoping and planning	DNR leadership, Division leadership, and staff developed project framework	
2019	Public attitude survey	Statistically representative survey of values, beliefs, attitudes and behaviors of three stakeholder groups on wolves and wolf management – livestock producers, deer hunters and residents statewide	Appendix 5: Minnesotans' Attitudes Toward Wolves and Wolf Management (2020)
2019-2022	Tribal coordination and consultation	Tribal governments were engaged early and throughout the plan update process, including consultation with tribal leaders. Tribal natural resources staff served on the Wolf Technical Committee, were engaged by DNR staff at multiple points during plan development, and provided revisions to the draft plan.	Appendix 1: Input report
2020	Public input process	Online questionnaire, discussion forum, and three online open houses (due to COVID-19 restrictions) allowed members of the public to provide input on wolf management preferences.	Appendix 1: Input report
2020-2022	Wolf Plan Advisory Committee	A committee of Minnesotans representing diverse perspectives about wolves was convened to provide input throughout the process and review the draft plan. Committee members represented perspectives including hunting and trapping, wolf advocacy and animal rights, livestock and agriculture, natural resource conservation and environmental protection, and local government.	Appendix 1: Input report
2020-2022	Wolf Technical Committee	State, federal, tribal and nongovernmental organization experts convened to review the previous wolf plan and recommend plan update strategies.	Appendix 1: Input report
2022	Public comment and review process	Draft plan was posted for public review and comment	Appendix 1: Input report
2022	Final adoption of plan		

II. Background and current conditions

Minnesota's wolf population

Wolf population size and distribution

Based on what we know of the relationship between wolves and wild ungulate (hoofed mammal) populations, it is reasonable to conclude that Minnesota may have had more than 4,000 wolves prior to European colonization. Historically, wolves ranged throughout Minnesota but by 1900 were rare in the south and west of the state. By 1930, the state's wolf range was restricted to northern counties, and primarily forested areas bordering Canada.

Early estimates indicate that the wolf population likely never dropped below 300-400 and may have been closer to 400-800 during a period of limited protection from the 1930s to 1960s. By 1970, the population was rebounding, estimated at 700-1,000. However, these earlier population point estimates prior to the late 1970s derive from different methods than those used currently and the margin of error is not known.

From the late 1970s until the late 1990s, the wolf population expanded in number and distribution. The highest population estimate of 3,020 wolves occurred in the winter of 2003-2004, which coincided with high deer populations. With federal Endangered Species Act protections and a growing

deer population, wolves in Minnesota increased from the 1970s to late 1990s. Since the late 1990s, the population of wolves in Minnesota has stabilized with relatively little change in number or distribution.

Since the late 1970s, Minnesota has conducted standardized monitoring to delineate wolf distribution and estimate average territory and winter pack size. To define the wolf range, delineation surveys were conducted at approximately 10-year intervals (1978, 1988, 1997) before transitioning to approximately 5-year intervals (2003, 2007, 2012, 2017). Results indicate range and population expansion from 1978 until the 1997-1998 survey, no range expansion from 1998-2007, and then some range expansion in both 2012 and 2017 (Erb et al. 2018; Figure 1). Current occupied wolf range (the area within total range occupied by wolf packs) is estimated to be 28,561 square miles, approximately one third of the state. From 1978-2008, winter population size increased from around 1,200-3,000, an average rate of 3% per year. Although not statistically different, population point estimates have been lower in the last decade, with the winter population remaining stable the last five years at around 2,700 wolves (Figure 2, also Appendix 7 has a description of population estimation methods).

Figure 1. Wolf range

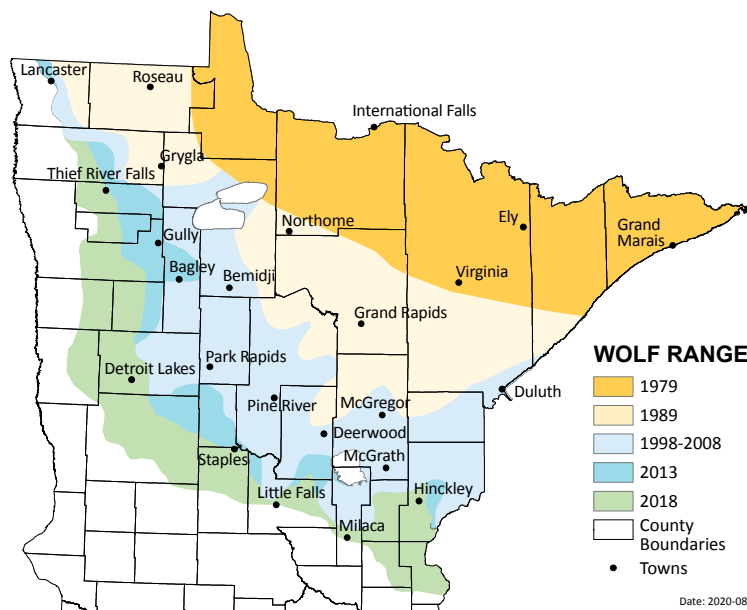
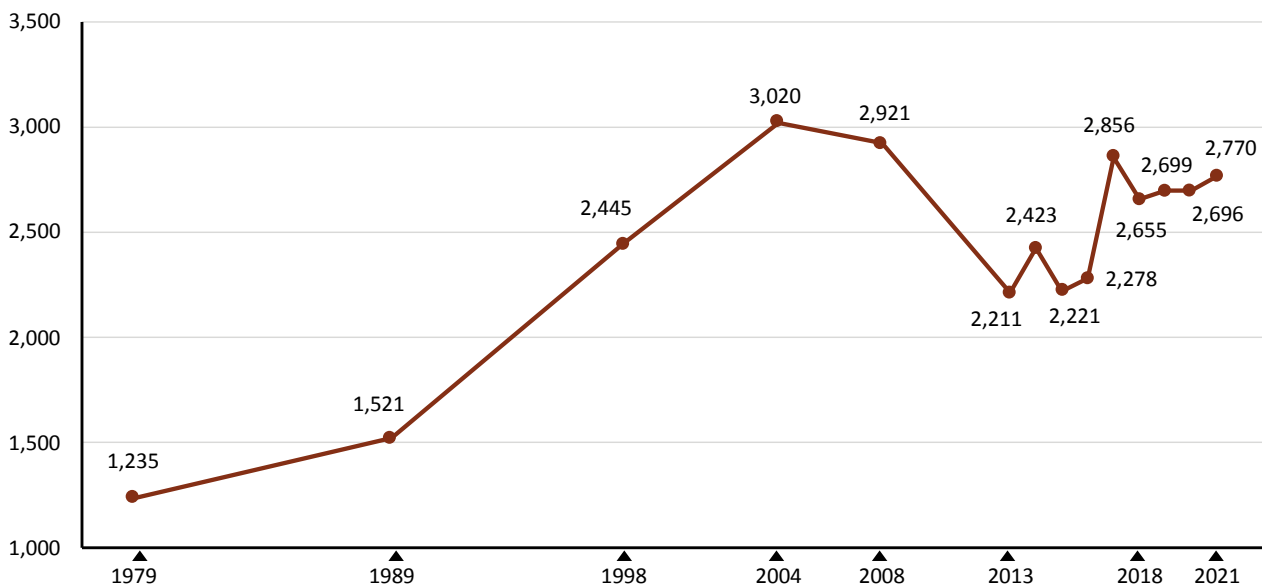


Figure 2. Wolf population estimates



Historical protection status and future outlook

Soon after the establishment of the Minnesota territory in 1849, the Minnesota Legislature authorized counties to pay individuals for any wolf they killed. This wolf bounty system remained in place until 1965. From 1946-1964, residents could also obtain permits to shoot wolves from airplanes. In addition to the bounty program, state personnel were involved in wolf removal from the late 1940s through the mid-1950s, including via aerial shooting. Aerial shooting over the Boundary Waters Canoe Area Wilderness was eliminated in 1950, but continued elsewhere until 1954, and other forms of wolf control (shooting and trapping) by state personnel ended in 1956. In 1969, the Legislature authorized a predator control program that permitted private, state-certified trappers to locally remove wolves based on evidence of livestock depredation. After wolves received federal Endangered Species Act protection in 1974, management of wolf depredation on livestock and other domestic animals shifted to the USFWS.

Prior to Endangered Species Act listing, the wolf population in the lower 48 states declined from historical levels because of habitat loss, low wild ungulate populations, and widespread federal and

state sponsored killing (e.g., through unlimited or subsidized trapping, shooting, aerial gunning, and poisoning). The first federal protection for gray wolves (referred to as “eastern timber wolf” in the Great Lakes region at the time) occurred with the passage of the Endangered Species Preservation Act of 1966, a precursor to the Endangered Species Act of 1973. In 1970, some federal protections began for the eastern timber wolf, and taking of wolves was prohibited on most of the Superior National Forest. Wolves in all of Minnesota received complete Endangered Species Act protection in 1974 under a subspecies designation for the eastern timber wolf. In 1978, USFWS issued a final rule reclassifying “the gray wolf in the United States and Mexico” to threatened in Minnesota and endangered in the remainder of the lower 48 states.

Despite historical eradication efforts, wolves that persisted in northern Minnesota facilitated wolf recovery following passage of the Endangered Species Act. Given the simultaneous increase in deer numbers, the Minnesota wolf population responded quickly with an increase in wolf numbers through range expansion, approaching its current distribution by 1998.

Wolf recovery in Minnesota has contributed significantly to wolf recovery in other parts of the upper Great Lakes region (Minnesota, Wisconsin and Michigan). In 1978, the USFWS Eastern Timber Wolf Recovery Plan called for implementing wolf management zones, reestablishing wolves in other states, and reclassifying wolves in Minnesota from endangered to threatened under the Endangered Species Act. The recovery team recognized the viability of the Minnesota wolf population at that time, but the Eastern Timber Wolf Recovery Plan recommended establishing at least one other viable population. Emigrating wolves from Minnesota subsequently recolonized portions of Wisconsin and Michigan, resulting in a self-sustaining regional population now numbering more than 4,000 wolves and connected to the larger wolf population in Canada. Today, of the estimated 6,000 gray wolves in the lower 48 states, nearly one-half are in Minnesota.

The regional population appears to be resilient and robust, with no immediate or serious population threats in Minnesota. However, as with any wildlife population, future threats may emerge. Wolves require large amounts of space, and despite their ability to disperse long distances to suitable habitat, they can be sensitive to habitat loss, degradation or fragmentation caused by pressures like urbanization and agricultural landscapes or other human activities. These pressures can affect wolves directly (for example, loss of habitat, increase in diseases or parasites) or indirectly (for example, loss of moose, changes in deer distribution or density), and they remain difficult to predict. Some potential changes (for example, more deer due to milder winters) may also have positive effects on wolves.

Influences on wolf population and range

Multiple factors interact to influence wolf distribution in Minnesota.

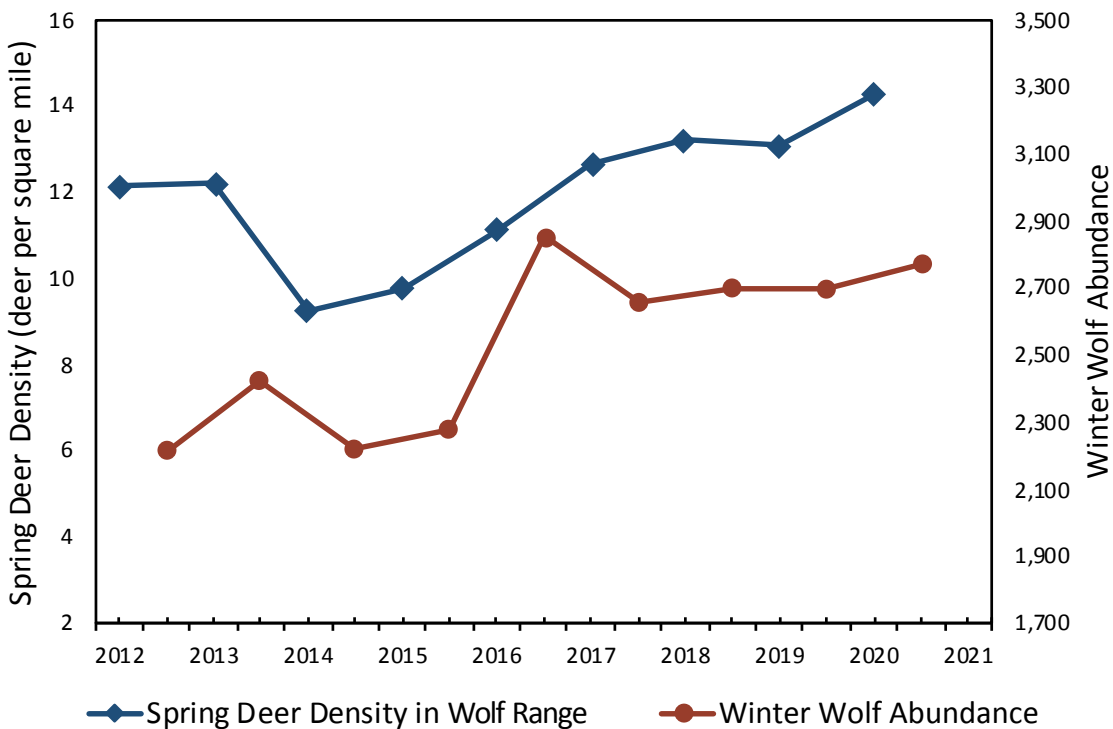
Human density: Modeling conducted in the 1980s suggested higher densities of humans and roads correlated with fewer wolves. However, as wolves recolonized their former range, they

demonstrated more tolerance of humans and roads than was previously assumed. From 1988-2018, the percentage of townships that exceeded the presumed “suitable” human-road density thresholds, but nonetheless had confirmed wolf pack use, increased from about 10% to 30% (Erb et al. 2018). Animals changing their behavior in response to changing conditions is called “behavioral plasticity.” Although suitable human-road density thresholds may be higher than originally thought, they remain a useful predictor of wolf distribution.

Landscape context: Recent analyses specific to Minnesota and the broader Great Lakes region wolf population demonstrate that wolf habitat suitability is higher in landscapes with more natural cover and farther from agricultural crops. In addition, the connectivity of Minnesota’s wolf population to wolves in Manitoba and Ontario supports an extensive area for long-term wolf persistence.

Prey availability: Wolves are habitat generalists and can live anywhere with sufficient prey, as long as human-caused mortality is limited. Although wolves may supplement their diet with smaller animals such as beavers and snowshoe hares during periods of the year, viable wolf populations require large ungulates (hoofed mammals) for prey. With the loss of elk, bison and caribou in most of Minnesota associated with European colonization, wolves in Minnesota today primarily rely on white-tailed deer, and moose where they occur. Although wolf-prey dynamics can be complicated, particularly in areas with multiple prey or multiple large carnivore species, recent data suggest that wolf population size is closely associated with deer density (Figure 3).

Figure 3. Comparison of estimated spring (pre-fawn) deer density and winter wolf abundance in Minnesota, 2012-2021



Research in Minnesota strongly suggests that wolves have not caused large-scale or long-term declines in deer. In recent decades, deer population estimates in the wolf range have substantially declined following severe winters and intensive hunter harvest. However, deer can and have rebounded quickly, despite relatively high wolf numbers, in response to milder winters and deer harvest strategies that reduce hunting pressure. In some cases, wolf predation may prolong declines in local deer populations caused by poor habitat and winter severity, which cumulatively may have reduced deer hunting opportunities or success at local levels. These effects are not evident in deer population trends throughout the entirety of the wolf range.

Where they occur, moose can be important prey for wolves. Although range contraction of Minnesota's moose has been observed since the late 1800s, with periodic expansion in the northwest, population declines have been exceptionally steep in the recent past, particularly from 2009-2014.

In 2005, for example, Minnesota's northeastern moose population was estimated to exceed 8,000, while today it is about 3,000-4,000. Northeastern Minnesota moose appear to have declined primarily due to high mortality, fewer breeding age females and reduced numbers of calves surviving to adulthood. Recent DNR research indicates health-related causes account for about two-thirds of non-hunting adult moose mortality, with brain worm—a parasite normally carried by white-tailed deer—being the leading cause. Wolf predation is the second leading direct cause of adult moose mortality in the northeast, but with predisposing health conditions identified in nearly half of the predation events. In the northeast, wolf predation is the leading cause of death for moose calves during their first 30-50 days of life.

A major decline in the northwestern Minnesota moose population began in 1984. The conclusion from a 1995-2000 study was that climate acting in tandem with pathogens and chronic malnutrition caused that decline. Although wolf predation was documented in the northwestern Minnesota moose population, it was not identified to have played a role in the moose population decline there.

Minnesotans' attitudes toward wolves

Wolves are important to Minnesota's natural and cultural heritage. They are highly valued and sometimes maligned, but capture the attention of Minnesotans from all backgrounds. This section describes the DNR's understanding of the values different people and groups assign to wolves, as well as their perspectives on wolf management and key benefits and challenges of living with wolves.

2019-2020 study: Minnesotans' values, beliefs and attitudes

To prepare for the update of the 2001 wolf plan, the DNR, in collaboration with the Minnesota Cooperative Fish and Wildlife Research Unit at the University of Minnesota, conducted a study from 2019-2020 to assess Minnesotans' values, beliefs, attitudes and behaviors toward wolves and wolf management (Appendix 5 contains links to a summary report of key findings and the full report). Given the logistics of conducting scientific surveys, three groups were identified as study populations to represent a range of interests in wolf management: Minnesota residents, deer hunters and livestock producers in the wolf range. Selection of survey study populations does not reflect the importance of those groups in decision making about wolves. The Minnesota resident study population is representative of all Minnesota residents and results are statistically representative estimates of variables of interest for each study population. Although the study did not specifically survey tribal members and other indigenous Minnesotans, it is necessary to appreciate the importance of wolves for tribal nations within—and with connections to—Minnesota. Some context on the cultural significance of wolves as well as tribal perspectives on tribal communities' relationships with wolves is provided in section III.

Social benefits and costs associated with wolves

Across Minnesota, individuals and groups hold a wide range of perspectives about wolves and seek different outcomes in wolf policy. However, results from the 2019-2020 attitude study show there are values common to most. For instance, Minnesotans support the long-term persistence of a healthy wolf population. Most state residents (87%)—in a survey sample including all potential stakeholders—agreed with the statement “it is important to maintain a wolf population in Minnesota,” and over 50% strongly agreed. Minnesota residents similarly value having wolves in the state because they are “an important part of the ecosystem” (87% agree), “because they have a right to exist” (83% agree), and “so that future generations can enjoy them” (78% agree), among other reasons.

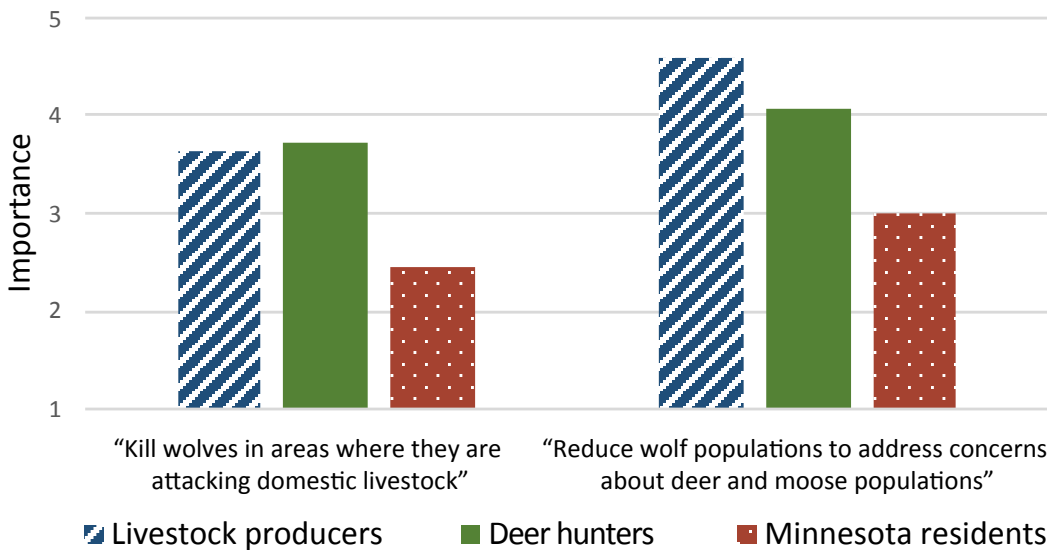
There are myriad social, ecological and economic benefits that stem from wolves. For example, many Minnesotans spend time in nature viewing wildlife, an activity gaining in popularity nationally. Survey results showed that 75% of residents felt it was important to have wolves in the state for the opportunity to see and hear them. While most wolf sightings or detections are opportunistic, meaning people are pursuing another activity in the wolf range when they hear howling or observe wolves or wolf sign (for example, tracks, scats, kill sites), Minnesotans still believed the viewing opportunity was a reason to value wolves. Wolves also affect ecological processes by influencing prey species abundance, distribution, and movements with implications for forest regeneration and health, and by influencing the dynamics of other co-existing carnivore species. Minnesotans, on average, value wolves for their contributions to the functioning of healthy ecosystems.

Minnesotans have different experiences of the costs and concerns associated with a healthy wolf population. Livestock producers in the wolf range deal with the risk, and sometimes the reality, of wolves killing livestock. Wolves also prey on culturally and economically significant species like white-tailed deer and moose, and sometimes injure and kill pets, primarily dogs. Survey results show marked differences in attitudes toward wolves and wolf policies, stemming in part from these costs, in addition to personal values, ideologies, experiences and places of residence. For instance, residents, deer hunters and livestock producers

have different opinions regarding the importance of killing wolves that are attacking domestic livestock and reducing wolf populations to address concerns about deer and moose populations. Responses were recorded on a scale from 1 to 5 (1=not at all important and 5=very important). Hunters and livestock producers believed it is more important to reduce wolf populations to address concerns about deer and moose impacts, on average, than Minnesota residents surveyed. A similar pattern held concerning the killing of wolves to reduce livestock depredations (Figure 4).

Figure 4. Minnesota residents’, deer hunters’ and livestock producers’ perceived importance of wolf management priorities

Survey respondents were asked to rate the importance of “reducing wolf populations to address concerns about deer and moose populations” and “killing wolves in areas where they are attacking domestic livestock” as potential management priorities for the DNR. Responses are on a scale of 1 to 5 where 1 is not at all important and 5 is very important. The blue hashed bars are livestock producers in wolf range, the green bars are Minnesota deer hunters, and the red dotted bars are Minnesota residents.



Minnesotans were also asked about the risks they perceive from wolves, including to their personal safety. Residents, deer hunters and livestock producers did not perceive wolves to be a significant public safety risk. In fact, over 78% of residents believed wolves to either pose “no risk at all” or “very little risk” to their personal safety, although these values were lower for livestock producers and deer hunters.

There are very few documented incidents of a wolf attacking a human in North America. These incidents usually occur in association with wolves exhibiting other abnormal behaviors, sometimes associated with wolf injury or illness, or human “conditioning” of wolves. Although these incidents are rare, such interactions with wild wolves warrant serious attention. People should not intentionally attract or approach wolves, and wolves should be discouraged from areas of high human activity through non-lethal means and respected from a distance. A wolf exhibiting abnormal behavior that is not deterred by human presence might be killed when agency guidance identifies a threat to public safety.

Wolf governance

Government agencies hold wildlife and other natural resources “in the public trust,” meaning wildlife is managed for the benefit of the resource and the public, now and into the future. Authority for wolf conservation and management rests in several tribal, federal, and state agencies.

Tribal authority

Seven Ojibwe bands and four Dakota communities exist as sovereign tribal nations within the boundaries of the state of Minnesota. The DNR recognizes and respects these federally recognized tribes’ sovereignty and treaty reserved rights. Tribal nations’ inherent right to self-governance of their members and territory pre-dates establishment of the United States. The tribes’ unique legal status requires that federal and state agencies participate in government-to-government relations. Minnesota Statutes, Sect. 10.65, confirms this relationship and directs consultation, coordination and cooperation between state agencies and tribal governments in

Minnesota. Consultation, as defined in this statute, “means the direct and interactive involvement of the Minnesota Tribal governments in the development of policy on matters that have Tribal implications.” State statute further clarifies “matters that have Tribal implications” means rules, legislative proposals, policy statements, or other actions that have substantial direct effects on one or more Minnesota tribal governments. The DNR affirms that most issues relating to wolves and wolf management in Minnesota require consultation, coordination and/or cooperation with tribal governments.

Tribal staff participating on the Wolf Technical Committee explained to the DNR that tribes similarly respect one another as sovereign nations that have management authority within their respective boundaries. In the wolf range, Ojibwe bands conserve wolf habitats and prey species, monitor wolf populations, and conduct wildlife research. Wolf research and monitoring, depredation management and plan implementation are often coordinated among tribal, state and other partners. Wolf management plans developed by tribal nations for wolves in Minnesota are referenced in Appendix 6.

Outside of reservation boundaries, a number of tribes in and beyond Minnesota retain interests in territory ceded through treaties to the U.S. in the mid-1800s in exchange for payments, services and confirmation of rights. In the wolf range, this includes some Ojibwe bands with treaty-protected rights to off-reservation hunting, fishing, and gathering, and with recognized agreements made between the band and state regarding natural resource management in ceded territory.

Federal authority

The USFWS administers the Endangered Species Act to conserve species with vulnerable populations and ensure their long-term survival and recovery. Species can be listed as threatened or endangered, and the USFWS then develops a recovery plan for the species. When a species or sub-population receives Endangered Species Act protections, the federal government has additional

regulatory oversight, working collaboratively with states and tribes to achieve recovery goals. Protections for threatened or endangered species include designation and protection of critical habitat and prohibition on their take (for example, harming or killing).

Although the 2001 plan was developed with the recognition that wolves in Minnesota had exceeded federal recovery goals and could be removed from federal Endangered Species Act listing, a comprehensive plan for wolf stewardship in Minnesota is important regardless of federal or state status. In 2007, the USFWS removed Endangered Species Act protections for wolves in Minnesota. Litigation resulted in the decision being overturned, and there have been several listing and delisting decisions since. Endangered Species Act protections for wolves were removed in January 2021, triggering transition of certain responsibilities from the USFWS to the DNR and tribes. In February 2022, however, a federal court ruling reinstated Endangered Species Act protections, placing wolves again under the protection of the USFWS as a threatened species in Minnesota. The DNR was already engaged in an update to the 2001 wolf management plan prior to either of these actions and will continue to manage wolves in Minnesota regardless of their federal listing status.

State authority

The DNR is a Minnesota executive branch agency that manages natural resources through wildlife habitat management, population monitoring and management, research, education, and more. The MDA is another executive agency, which oversees Minnesota's wolf depredation compensation program. Through this program, livestock owners may be reimbursed for domestic livestock losses resulting from verified wolf depredation. The MDA receives an annual legislative appropriation, from general funds that all Minnesotans contribute to, for response to depredation claims.

Public involvement

Reflecting Minnesotans' longstanding and substantial interest in wolves, public involvement has occurred regularly in recent decades. For example, an extensive public process supported the 2001 plan. Funded largely by what is now the Legislative-Citizen Commission on Minnesota Resources, the DNR held 12 public information meetings throughout the state in 1998, drawing more than 3,000 attendees. Also in 1998, the DNR convened environmental, agricultural, hunting, trapping and wolf advocacy organizations; government agencies; and members of the public to generate consensus-based guidance for development of the wolf plan. This "roundtable" group's recommendations greatly informed the DNR's initial 1999 wolf management bill, which was revised and passed by the Legislature in 2000.

Minnesota Statutes, Sect. 97B.645, subd. 9 requires the DNR to provide an opportunity for public comment before opening a wolf season. In 2012, the DNR collected public input regarding the establishment of a potential wolf season using an online questionnaire anyone could complete. There was significant out-of-state and even international participation, with Twin Cities metro residents comprising the majority of Minnesota respondents. Although not a representative survey, almost 80% of respondents to the online input opportunity said they did not support hunting and trapping of wolves in Minnesota.

The USFWS held public meetings in Minnesota in 2004 and 2006, and the agency proposed and finalized several rules to discontinue Endangered Species Act protections for the species. In 2019, the USFWS again held a public comment period and a public hearing, informing its 2020 decision to remove the gray wolf from the endangered species list.

Wolf management is a high-profile topic even in the context of other DNR issues, commonly arising during public involvement efforts regarding deer and moose management. Nongovernmental organizations (for example, environmental, agricultural) also play a role in involving the public across the spectrum of wolf interests through

dissemination of information, coordination of membership actions and advocacy to represent organizational interests.

Public education and information

Minnesotans have a strong interest in engaging on and learning about wolves and wolf conservation and management. The DNR strives to ensure that timely and accurate information about wolf conservation and management is available to the public through its programs and in communication and educational materials.

Many other organizations provide educational resources and programs about wolves. Notably, the International Wolf Center in Ely is a destination for people to learn about and experience wolves through programs on wolf biology, population status, and the complex interactions with people and the environment. The International Wolf Center and other partner organizations in the state reach broad audiences and play an important role in wolf conservation. The DNR supports these organizations by providing accurate information on population status, research findings and management information.

Regulated wolf hunting and trapping

Historically, hunters and trappers pursued wolves for their fur, for bounty payments (1849-1965) or at

other times when wolves interfered with livestock. With limited state protections and no regulated season for wolves in the 1960s, about 200 wolves were taken annually through these activities.

The wolf plan adopted in 2001 included a 5-year waiting period prior to implementing a wolf season in Minnesota, consistent with a 2000 Minnesota law. In 2011, the Legislature classified wolves as small game in statute and authorized the DNR to implement a wolf season following removal from the Endangered Species Act. The 2012 Legislature established wolf hunting and trapping licenses and further clarified authority to implement a season starting no later than the beginning of the firearms deer season.

Prior to the 2012 season, there had never been a regulated wolf hunting and trapping season in Minnesota. From 2012-2014, the state held limited and highly regulated hunting and trapping seasons (Table 2). Unlike seasons for other species, the DNR implemented a program for daily harvest monitoring to enable closing the season when the number of wolves killed reached a set limit. In addition, as a requirement at wolf registration, hunters and trappers had to present wolves for the collection of biological information useful in assessing population status and trends and harvest impacts.



Photo courtesy of Terry Sohl

Table 2. Minnesota wolf season information

This table shows summary results of Minnesota wolf seasons that occurred from 2012-2014.

Season	Licenses issued	Season length (days)	Target harvest	Harvest
2012	6,123	57	400	413
2013	3,434	45	220	238
2014	3,920	28	250	272

Wolf hunting and trapping remains a contentious topic. Appendix 2 contains the framework for the DNR to use in deciding whether and how to establish a season if federal Endangered Species Act protections are again removed. Tribal governments must be consulted regarding the potential for a season consistent with Minnesota Statutes, Sect. 10.65. The framework in Appendix 2 also incorporates the legal requirement for the DNR to provide opportunity for public comment if there is a proposed wolf season in Minnesota.

Some states and Canadian provinces with wolves have held regulated hunting and trapping seasons, in some cases for decades. When seasons are in place, agencies evaluate the impacts of harvest on wolf populations and the connection between

harvest and wolf conservation and management objectives. Agencies also typically collect biological samples that are incorporated into population monitoring programs that track metrics on reproduction, age and disease prevalence, among others. Any potential wolf season in Minnesota would incorporate robust evaluation and monitoring methods, providing safeguards to ensure goals articulated in this plan are met.

If a season is proposed in Minnesota, the objectives used as a rationale would be communicated transparently. For example, possible objectives could include managing wolf-livestock conflicts, aiding ungulate population recovery, reducing wolf disease outbreaks, or providing regulated hunting and trapping opportunities.

Wolf depredation management

Minnesota's depredation management program has been in place since the late 1970s, involving coordination of multiple state and federal agencies that work closely to address impacts of wolf predation on livestock and pets. In the 2001 plan, the DNR adopted many of the practices in place while wolves were listed under the Endangered Species Act. In 2007 the DNR initiated a cooperative agreement with USDA Wildlife Services, in consultation with MDA. Wolf depredation management involves multiple entities, including the DNR Fish and Wildlife and Enforcement divisions, the MDA, University of Minnesota Extension, and private certified wolf control trappers. Roles of each agency may be adjusted as a result of the Endangered Species Act listing status of wolves in Minnesota.

Many livestock producers use prevention and mitigation techniques to reduce the risk of wolf depredation, including husbandry practices, guard animals, fencing and removal of dead livestock carcasses. Cooperating agencies across the wolf range provide technical guidance on these practices to help reduce wolf damage.

Wolf conflicts and predation on livestock and domestic animals generally increased from 1978-1998, concurrent with increases in the wolf population. Since that time, verified wolf complaints have occurred at about 100 locations annually, and in response approximately 180 wolves are killed annually. In addition, over the last 10 years the MDA has paid between 80-140 claims each year at a cost of \$100,000-\$250,000 per year.



A wolf with a radio-collar.

Wolf research and monitoring

Thanks to state, federal, tribal, university, and other agencies and individuals, Minnesota has a long history of wolf research and monitoring. Minnesota wolves are the subject of hundreds of peer-reviewed articles in scientific literature. Recent monitoring of wolves in Minnesota has included the following:

- Annual estimation of the statewide wolf population size
- Two (fall and winter) annual track surveys for use in population trend assessment
- Annual documentation of various metrics associated with verified wolf depredations
- Localized research projects by the DNR, collaborators, and other agencies or organizations.

The DNR's research and monitoring program conducts population estimation, including documentation of changes in wolf distribution and pack dynamics (for example, average territory and pack size). Since the writing of the 2001 plan, the DNR has focused on collaring more wolves, and especially on expanding the spatial distribution of wolf-collaring areas to ensure results are more representative and robust. This effort has

also included increased collaboration with tribal partners to expand monitoring on reservations and in treaty areas. The DNR has also explored other approaches to wolf monitoring, including an aerial-survey approach used in Ontario, Canada. However, this method was not practical at the statewide level in Minnesota due to time and cost constraints of large-scale aircraft operations and the unpredictable nature of the required snow conditions. In addition, DNR researchers working with university collaborators explored the use of remote trail cameras to monitor carnivore trends, potentially expanding this technique to monitoring of other wildlife species. Finally, the DNR uses a newer monitoring technique on bears, fishers, and martens referred to as statistical population reconstruction, which could be a low-cost and reliable approach to estimating wolf abundance if a harvest season were reestablished. For wolves, data collected from hunters and trappers (for example, from mandatory tooth submissions and harvest effort surveys) can inform population estimates using this reliable yet low-cost method.

Beginning in 2016, the DNR also began exploring options for monitoring wolf pup survival, including use of implantable microchips and expandable radio-collars. Pup survival and its variability remains under-studied and has potential value as a monitoring index or in development of population models that require data on age-specific survival. These data also provide information on wolf den selection and variation in pup survival.

Collaborations with tribal, federal and academic partners enable the DNR to explore best practices for acquiring these data and improving annual monitoring protocols. These collaborations also support wolf research. Since the publication of the 2001 plan, peer-reviewed research (Appendix 3) has addressed wolf genetics and taxonomy; reproduction; survival and causes of mortality; disease prevalence; depredation dynamics and control methods; wolf-beaver, wolf-deer and wolf-moose dynamics; and wolf capture and other research (for example, acoustic and camera trapping) methods.

A live wolf captured for research to put a radio-collar on before being released.



III. Strategic considerations

With the background and current conditions described above, this section summarizes the fundamental policy questions and critical opportunities and challenges the DNR seeks to address through this plan’s goals.

Diverse and changing wildlife values

Humans assign diverse values to wolves, and some believe wolves possess intrinsic value outside their utility to people. The DNR’s management responds to these diverse values, appreciates that wolves’ existence in Minnesota is meaningful and a reason for their conservation, and acknowledges both the positive and negative experiences (Table 3) Minnesotans have related to wolves and wolf management.



U.S. Fish and Wildlife Service

Table 3. Example benefits and challenges of living with wolves

	Benefits	Challenges
Social/cultural	<ul style="list-style-type: none"> • Intrinsic value of wolves • Wildlife viewing • Hunting and trapping opportunity • Cultural significance to Ojibwe and others 	<ul style="list-style-type: none"> • Public safety concerns • Emotional impacts (for example domestic animal predation or death of wolves) • Concerns of impacts to game species
Ecological	<ul style="list-style-type: none"> • Ecological function • Predation (which can reduce degradation of vegetation by over browsing and disease prevalence) 	<ul style="list-style-type: none"> • Predation (which might limit recovery of game species)
Economic	<ul style="list-style-type: none"> • Ecotourism 	<ul style="list-style-type: none"> • Livestock depredation

There are numerous factors shaping individuals’ attitudes toward wolves and wolf management, and the factors that shape those attitudes have and will continue to evolve. Among these factors are personal values or beliefs about how humans relate to wildlife. Researchers have termed these beliefs a “wildlife value orientation” (Fulton et al., 1996). Beliefs about humans’ relationship with wildlife can be described along a spectrum of “mutualism” (wildlife are deserving of rights similar to humans,

and humans and wildlife are part of a single community) to “domination” (wildlife are resources that can be used to achieve specific human-oriented goals). How strongly a person agrees with each of these dimensions often correlates with their preferences for wildlife management. For instance, individuals with strong mutualism beliefs often oppose killing wolves as a solution to depredation conflicts, while those with strong domination beliefs often support lethal control.

Wildlife value orientations link to larger social trends like urbanization and demographic change (Manfredo et al., 2020a). For example, the United States is urbanizing, and beliefs about wildlife, on average, are moving closer to mutualism than domination (Manfredo et al., 2020b). The Twin Cities metro population is likely to increase by nearly 1 million by 2053, while greater Minnesota may see a reduction over the same time (Minnesota State Demographic Center, 2020). While individual differences will persist, it is likely that mutualism beliefs will increase in Minnesota over time, with implications for how the majority of residents view state wolf policy and the attitudes and interests of those in the minority.

Tribal wolf interests

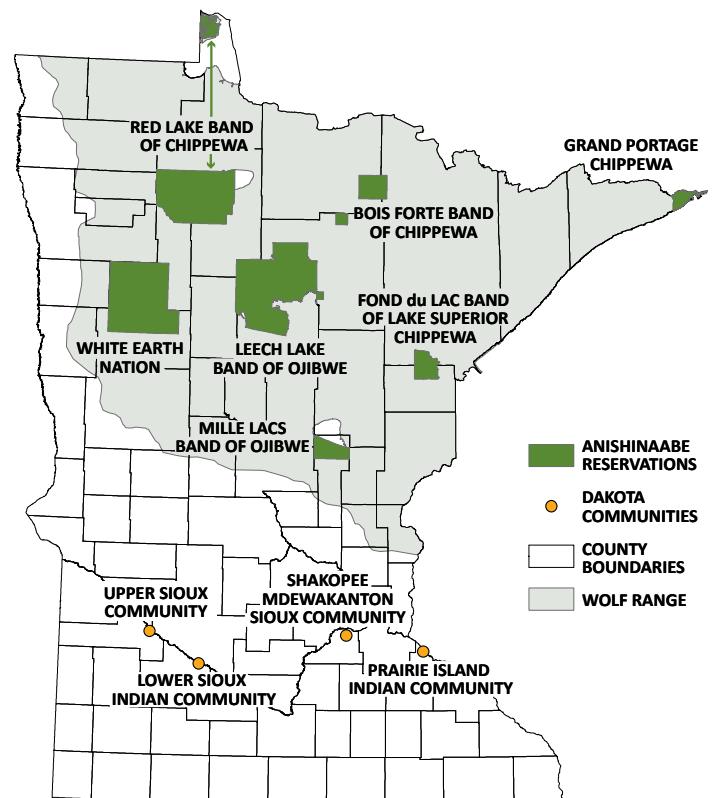
This plan directly affects tribal nations in Minnesota and has a connection to tribes outside Minnesota with interests in and rights to ceded territory within the state. Tribal staff involved in developing this plan explained that elders, cultural and religious leaders, and other knowledge holders must guide how tribal knowledge and perspectives are shared with others; the DNR is working to be attentive to that guidance and offers the following discussion in cooperation with the tribes.

Tribal Nations and Wolf Range in Minnesota

There are 11 federally recognized Indian tribal nations in Minnesota. Anishinaabe (Chippewa, Ojibwe) people have a significant cultural relationship with wolves, and the seven Anishinaabe reservations in Minnesota occur across the wolf range. The Anishinaabe have spent centuries sharing this landscape with wolves, and this relationship with ma'iingan informs tribal policy positions and plans.

The map is not to scale and should be used for general purposes.

Tribal members and other indigenous people of Minnesota, like all Minnesotans, have diverse views on wolves and the wolf-human relationship. Similarly, individual tribal members may hold perspectives that differ from those of tribal governments. As this plan was developed, Dakota communities, who refer to wolves as *Buåktokça*, were kept informed but did not actively participate in planning. The Upper Sioux Community shared a preference to defer to Ojibwe tribes' involvement. As a result, this discussion focuses on the perspectives expressed by the governments of Ojibwe tribes located in Minnesota, with involvement from the Great Lakes Indian Fish and Wildlife Commission, which also represents Ojibwe tribes in Wisconsin with legal rights on ceded lands in Minnesota. Ojibwe tribes in Canada and other parts of the U.S. were not consulted in development of this plan. Tribal representatives participated in the Wolf Technical Committee, observed Wolf Plan Advisory Committee meetings, and held separate meetings with DNR staff. DNR leadership also conducted consultations with tribal leaders. Finally, tribal wolf plans also contain a wealth of information that informed this section (Appendix 6).



Cultural and ecological significance of ma'iinganag (wolves) to the Ojibwe

Tribal representatives from GLIFWC collaborated with other Ojibwe bands in sharing the following information with the DNR on the significance of ma'iinganag (wolves, or singular ma'iingan) to the Ojibwe. Ma'iingan has a critical role in the Ojibwe Creation Story, and a primary teaching is that ma'iingan and the Ojibwe are brothers, with intertwined fates. While the state references wolf “management,” the term is inappropriate from an Ojibwe perspective, for one does not typically manage one’s brother. Terms such as “stewardship” or “protection” may come closer. However, Ojibwe often speak about their “relationship” with ma'iingan, reflecting reciprocity, the inherent right of ma'iingan to exist, and a sense of responsibility to their brother and to repay ma'iinganag for the benefits they provide.

In addition to the cultural relationship with ma'iingan, the Ojibwe have spent centuries sharing the North American landscape with wolves, imparting substantial traditional ecological knowledge to inform ma'iingan stewardship. Wolves are generally seen as presenting little threat to human health and safety, and they are appreciated for their ecological role in maintaining the long-term health of prey populations and the health and diversity of forest ecosystems. This in turn yields overall strong support for maintaining wolf presence on the land.

This relationship with ma'iingan informs tribal policy positions and plans (Appendix 6), reflecting that a tied fate means health is sought for the wolf community just as for the human community. It is generally felt that wolves should determine their own numbers and distribution on the landscape, rather than humans making these determinations. Taking a wolf’s life requires serious consideration and substantial justification. Recreational harvest does not meet this threshold, and policies regarding livestock depredation favor preventative actions and non-lethal approaches before consideration of lethal techniques.

Ojibwe tribes have rights related to resource stewardship in many parts of the wolf range in Minnesota, so it is important for the state and the tribes to share their knowledge, understandings and perspectives for the benefit of the wolf community. As sovereign nations, each tribe has unique views, and consulting independently regarding wolf stewardship in and around their own tribal lands and in ceded territories, while difficult at times, best supports cooperative stewardship of ma'iingan.

Additional tribal perspectives on wolves

In addition to the information above provided by GLIFWC, perspectives were provided by other tribal staff involved in plan development, and by documents consulted by the DNR. Ma'iingan were important historically in tribal customs—for some tribes this could involve occasional take as part of cultural or religious practices. The Ojibwe generally do not view ma'iingan as a threat to their personal safety, and population management and recreational harvest are incongruent with the relationship with ma'iingan.

Tribal representatives on the Wolf Technical Committee said these views remain dominant among tribal members, although some are increasingly concerned about localized impacts to prey. There is generally strong support among tribal governments or staff for nonlethal methods to prevent livestock depredation; however, some Ojibwe bands believe that lethal control is necessary in limited circumstances, especially in the context of competing wildlife management objectives like moose population recovery. While coexistence involves challenges, at least one tribal leader shared “we do not see ourselves in conflict with wolves.” These challenges can include domestic animal depredation, as mentioned, as well as views around ma'iingan being in competition with deer and moose.

Some Minnesota Ojibwe bands have formalized their positions against harvesting ma'iingan on tribal lands or have designated their reservations as ma'iingan sanctuaries. Although these interests did not arise during the DNR’s planning process

to update the 2001 plan, the USFWS in its 2019 Endangered Species Act proposed rule stated that there may be some limited interest among Ojibwe tribal members in harvesting ma'iingan as furbearers or for spiritual or other purposes.

Resources to support Minnesota wolf management

The DNR's wolf program requires dedicated staff and funding. Costs have increased over time, including for monitoring wolf populations, conducting research, and coordinating and implementing wolf management. Implementation of the various components of the wolf plan will depend on funding and will require tradeoffs among plan priorities and other resource needs throughout the course of the 10-year plan.

The DNR Fish and Wildlife and Enforcement divisions have direct responsibility for wolves, while other DNR divisions play an indirect role through their own conservation work. Positions including the large carnivore specialist, furbearer and wolf research scientist and conservation officers conduct specific wolf management functions at a cost of \$350,000-\$500,000 per year, as of 2021.

Current funding is primarily from the Wolf Management and Monitoring Account established by the Legislature in 2012 for wolf management, research, damage control, enforcement and education. Wolf license and application fees (2012-2014 only) and \$0.50 from each deer license sold fund the account. Legislation was amended in 2017 to remove the deer license portion as of July 1 the year after Endangered Species Act delisting. The account has roughly \$1,200,000 as of July 1, 2021. In the absence of the 2022 federal court decision to return Endangered Species Act protections to wolves in Minnesota, the Wolf Management and Monitoring Account would have been depleted by July 1, 2024, if it remained entirely dependent on revenue from deer hunting licenses.

The DNR also relies on partnerships to conduct wolf management and monitoring. USDA Wildlife Services is the primary agency conducting wolf depredation management through an annual

cooperative agreement and assists with wolf research trapping efforts as well. Wolf depredation control is augmented by state certified wolf control trappers under the Minnesota predator control program Minnesota Statutes, Sect. 97B.671.

Wolf monitoring and research have been conducted by organizations including the U.S. Geological Survey, National Park Service, University of Minnesota, DNR staff, and many tribal agencies in northern Minnesota. There is no estimate for the cumulative cost of this work, but without these essential partnerships, the DNR would have more limited data from which to estimate and conserve wolf populations.

Prior to the 2022 wolf management plan update, the DNR relied on an informal network of technical experts, including representatives from state, tribal and federal agencies; academia; and non-profit organizations, to inform and improve wolf management and conservation. The Wolf Technical Committee, established to inform the 2022 plan update, provided a valuable forum to coordinate ongoing work.

Wolf depredation and predation

Addressing loss of domestic animals and concerns over the impacts to big game species are important components of wolf management in Minnesota.

Livestock depredation

Since 2007, the DNR and USDA Wildlife Services have implemented a cooperative management program to address depredation conflicts. Livestock mortality rates inside and outside the wolf range are similar: according to USDA Wildlife Services and the MDA, less than 2% of farms in the wolf range experience wolf-livestock depredation annually; however, individual producers can experience significant losses. The level of depredation impact has been relatively stable since the late 1990s but fluctuates year to year.

As discussed in a previous section, livestock producers can implement strategies to prevent or minimize wolf depredation impacts prior to an active depredation event. Non-lethal practices have been adopted primarily through individual

investments, although there has been limited recent grant funding for conflict prevention through a pilot program funded and administered by MDA and USDA Wildlife Services. Additional public and private partnerships could better support implementation and evaluation of best practices for reducing or preventing wolf depredation incidents. To support some of the cost share or matching fund requirements for grants, contributions from nongovernmental organizations and other donations have helped support programs to purchase or install fences. When verified incidents do occur, lethal control and reimbursement of financial losses comprise the current response, augmented by non-lethal methods as appropriate.

Alternative approaches to mitigate livestock depredation, such as insurance and cooperative damage management programs, exist and should be considered among the suite of tools to incentivize coexistence of livestock agricultural practices and wolves, and to equitably distribute the costs of this coexistence. The current approach to wolf depredation management was established in 1978 when wolves were reclassified as threatened under the Endangered Species Act. Conflicts increased with a growing wolf population through the late 1990s, likely creating reliance on the current approach, which employs government-funded wolf control and compensation for livestock

losses. In contrast, most other wildlife damage programs in Minnesota emphasize technical guidance and individual practices. Given that wolf depredation management is more intensive than for most other species in the state, alternative systems should be considered going forward.

Predator-prey relationships

Minnesota is fortunate to have functioning predator-prey systems that include wolves, bears, moose and deer, among other species. How or whether these species should be managed often depends on one's point of view. These species are intricately linked, influencing each other's behavior, survival, and reproductive success, and contributing to annual variation in their numbers. Habitat and weather conditions, parasites, disease and many other factors also influence these interactions.

As the DNR strives to consider the needs of these species and the interests of Minnesotans, management strategies need to address challenging tradeoffs. These tradeoffs should be deliberated through public processes (for example, during the development of deer population goals). In addition, communication about management actions that benefit one species to the detriment of another should explain the impacts and the reasoning behind the decision.





Photo courtesy of Paul Sundberg

Wolf population objectives

Determining an appropriate population level and distribution is complex. While consistent statewide approaches are generally preferred, flexibility is needed to address regional or local issues.

Population level

The USFWS Recovery Plan for the Eastern Timber Wolf (revised in 1992) established a recovery goal of 1,251-1,400 wolves to ensure their continued survival in Minnesota. To provide a buffer above this, the DNR identified a minimum population level of 1,600 wolves in the 2001 plan. No maximum population goal was established. Feedback from the public, Wolf Plan Advisory Committee and Wolf Technical Committee indicated the origin and meaning of this previous wolf population objective was not clearly conveyed in the 2001 plan. To clarify, this number was not intended as a management objective (in other words, management activities would not be taken to reduce the population to that level). Rather, if the population were to decline toward 1,600, efforts would be made to identify the cause, and management actions would be implemented to reverse the population decline. It is also important to identify and understand declining population trends should they occur, regardless of the absolute population size.

The wolf population has not been below 1,600 in Minnesota since the late 1980s. It was estimated as high as 3,020 in the early 2000s but has stabilized at about 2,700 wolves. Minnesota's wolf population has likely occupied all larger patches of suitable habitat and faces no known major or immediate threats to population persistence. Wolves have slowly established a presence in new parts of the state during the last decade. Areas such as southeastern Minnesota could potentially support wolves, but only a few individuals have been observed on occasion. In addition to considering biological factors supporting long-term wolf survival, the state considers stakeholder preferences, local or regional issues, the ecological and cultural factors, and the importance of Minnesota's wolf population within the Great Lakes region. In the DNR's 2019 attitude survey, livestock producers and deer hunters preferred fewer wolves, while residents as a whole preferred more or the same number of wolves.

Population distribution

The geographic distribution of wolves is equally important and directly related to a numerical population objective. Minnesota's population is a regional asset, tied geographically to the wolf population surrounding the upper Great Lakes region and a southern extension of wolf

populations in Ontario and Manitoba, Canada. The wolf range in Minnesota has expanded slightly since the 2001 plan. Although not without challenges, wolves have demonstrated they can successfully inhabit a larger portion of the state than was recommended by USFWS recovery planning; however, a larger wolf range has the potential for increased human-wolf conflict. A well-connected and broadly distributed wolf population in Minnesota shows that long-term wolf conservation efforts have been successful and will need continued public support to have wolves in the places they currently occupy and new areas wolves may establish.

If desired, different approaches to wolf management could be employed in different areas of the state to support population and social objectives. Approaches in different areas could include the following:

- **Conservation and management:** Most of Minnesota could be where standard implementation of state laws and wolf management rules would be in effect. Management could include hunting or trapping if a season is established, and standard depredation policies would be in place.
- **Protection:** Large landscapes with a resource protection purpose could be restricted to taking wolves (for example, some like Voyageurs National Park and Minnesota state parks already restrict taking of wolves; others such as the Boundary Waters Canoe Area Wilderness, Scientific and Natural Areas, or tribal reservations as an outcome of government-to-government consultation, could be included). Areas established for this purpose would allow protection from take during open seasons but would still allow take for defense of human life, state laws that allow protection of domestic animals, or management of wolves that exhibit repeated abnormal or aggressive behavior.
- **Research:** Areas could be defined by permitted research where wolf take or other policies would be temporarily modified or restricted to assess effectiveness of management activities,

impacts on ungulate populations or livestock, or other specific research goals. Wolf hunting or trapping and depredation policies could vary from statewide management provided the deviations were consistent with all relevant laws and public process.

Wolf monitoring and research needs

Population monitoring is critical for informing and evaluating wildlife conservation and management. Monitoring can take many forms and needs can vary geographically, over time, and with different management objectives. Monitoring must be sufficient to inform decisions and it also needs to be flexible. The Wolf Technical Committee identified the following principles to guide wolf monitoring:

- Monitoring methods (for example, technologies, statistical analysis options) evolve frequently, so approaches should be adaptable and responsive to geographic and time-related changes and needs.
- Successful, large-scale monitoring requires collaboration among state, federal, tribal, university and other entities. However, funding sources and approaches vary widely and can be inconsistent—for example, some funding sources can depend on whether wolves are federally protected, or funding can take the form of occasional grants or gifts. Consistent and dependable funding should be available for agencies participating in the DNR’s agreed-upon wolf monitoring protocol.
- Distinct management areas may be established with different management objectives and should require monitoring and data collection protocols adequate to assess management effects.

State-funded wolf research should prioritize informing or reducing uncertainty associated with key conservation and management decisions, with research results timely conveyed to the public.

IV. Goals, objectives and strategies

The goals in this plan are long-term, outcome-oriented purpose statements. Public, tribal, and other stakeholder and partner input was instrumental in formulating these goals.

- **Goal 1.** Maintain a well-connected and resilient wolf population
- **Goal 2.** Collaborate with diverse partners to collectively support wolf plan implementation
- **Goal 3.** Minimize and address human-wolf conflicts while recognizing diverse wolf values
- **Goal 4.** Inform and engage the public about wolves in Minnesota and their conservation
- **Goal 5.** Conduct research to inform wolf management
- **Goal 6.** Administer the wolf program to fulfill agency responsibilities and public and partner needs

Below each of the goals, this plan lists objectives and strategies:

- Objectives are activities or outputs that support plan goals that can be tracked to determine progress through the life of the plan.
- Strategies are specific, actionable statements describing how the DNR will achieve its goals and objectives.

Goal 1: Maintain a well-connected and resilient wolf population

Objective 1A. Conduct wolf population monitoring and research

- **Strategy:** Annually and as needed with the Wolf Technical Committee, discuss monitoring results and make any recommended changes to wolf monitoring methods and plans, and discuss wolf research results and priorities (Goal 5).
- **Strategy:** Monitor the geographic distribution of wolves and population abundance.

- › During any period in which the federal post-delisting monitoring plan is in effect, monitoring frequency and methods will at least minimally meet those plan requirements.
- › For the first 2 years after this wolf plan is adopted, annual population estimates will be obtained using the methods that have been used since 2012.
- › Within 2 years of this plan's adoption, the Wolf Technical Committee will review current protocols and make recommendations regarding future monitoring methods and frequency.
- › If a harvest season occurs, hunters and trappers will be required to submit a tooth from any harvested wolf for aging and to participate in a hunter and trapper harvest effort survey.
- › Data on at least one independent population trend indicator will be collected annually (for example, an existing track survey or a new method).
- **Strategy:** If a population decline occurs, the Wolf Technical Committee will determine whether the decline poses a concern, and as necessary recommend management actions, research approaches, and potential solutions to understand and address the concern. This plan identifies a concern as a Minnesota wolf population that falls below 1,600 or a declining population trend below 2,000 wolves.

- **Strategy:** As opportunities arise, collect blood and tissue samples to assess wolf population status and health.
 - › The Wolf Technical Committee will develop protocols for collecting biological samples from wolves captured as part of monitoring, research or depredation control, to facilitate combined analysis using disparate information such as population genetics and wolf health.
 - › If a harvest season occurs, data requirements will be similar to those during the 2012-2014 seasons. Hunters and trappers will be required to submit all wolves to registration stations for carcass inspection and data collection. Data will be collected to identify location of harvest, sex of animal, and details on methods of harvest, as well as to collect biological samples (for example, teeth, reproductive tracts of females, other tissues or parasites), record body measurements, and to apply a pelt tag demonstrating that the wolf had been registered appropriately.

Objective 1B. Maintain a population comparable to recent estimates (2,200-3,000, well above the federal recovery goals) and distributed across the majority of current wolf range

- **Strategy:** Coordinate with the Wolf Technical Committee to evaluate population levels in relation to population thresholds and trends (Figure 5) and implement progressive mitigating actions if a multiyear declining statewide population trend drops below 2,000.
 - › Before the population reaches the minimum acceptable level, initiate research to understand contributing factors.
 - › Implement management actions designed to reverse trends.
- **Strategy:** Provide an opportunity for public input on wolf management if the statewide population point estimate exceeds 3,000 over multiple, consecutive years and public concerns about negative impacts attributable to wolves concurrently increase.

Figure 5. Population levels, distribution and responses

This chart shows DNR responses based on population levels. Population levels and trends are based on the previous mid-winter population estimate and other indices of population trends, while the distribution trend is based on the periodic range survey or other distribution surveys.

Population level and trend	Distribution trend	Response
<1,600 Trending downward	Steadily declining	Mitigation measures to reverse decline; still allows for control of wolves for public safety, livestock depredation
1,600–2,000 Trending downward	Local/short-term declines	Implement enhanced monitoring and research to determine population decline and contributing factors
2,000–2,200 Stable or trending upward	Present across range	Consider more frequent population monitoring, disease surveillance, or other research to assess population status
2,200–3,000 Stable	Present across range	Optimal population level with current occupied wolf range; more frequent monitoring if there is a season
>3,000	Expanding range	Consider additional public engagement and wolf management actions to address depredation or other public concerns

Goal 2. Collaborate with diverse partners to collectively support wolf plan implementation

Objective 2A. Coordinate and consult with sovereign tribal nations

- **Strategy:** Annually and additionally as needed, communicate with tribal biologists to plan wolf conservation and management. This includes representation of tribal technical experts on the Wolf Technical Committee and annual coordination according to established state and tribal agreements.
- **Strategy:** Consult with tribal nations before substantive changes in wolf conservation and management are made.

Objective 2B. Collaborate on research and monitoring activities with tribal and institutional partners

- **Strategy:** Through the Wolf Technical Committee and other key partners, leverage expertise across institutions involved in wolf research and monitoring to inform wolf plan implementation.
- **Strategy:** Work closely with the deer, elk and moose committees established by the DNR to evaluate the role of wolf predation on these populations to inform wolf management. Engage with DNR furbearer committee on topics that may be relevant to wolf management.

Objective 2C. Collaborate on wolf planning and management with tribal and institutional partners, private entities and nongovernmental organizations

- **Strategy:** Continuously improve wolf depredation coordination with MDA and USDA Wildlife Services and affected stakeholders to help minimize potential wolf-livestock conflict.
- **Strategy:** Work proactively with livestock producer organizations and interested parties to identify methods, resources, and funding to coordinate and implement preventative wolf depredation practices at key locations and identify best practices for livestock producers.

- **Strategy:** Communicate wolf conservation objectives so they are incorporated into habitat and other resource management planning, such as national, state or county forest management plans.
- **Strategy:** Communicate with wolf managers from neighboring states and provinces to exchange information about wolf populations and support wolf conservation across boundaries.
- **Strategy:** Ensure that wolf monitoring information adequately addresses the USFWS' 5-year post-delisting monitoring plan reporting requirements to evaluate recovery and listing status.

Objective 2D. Collaborate on wolf education with tribal and institutional partners and nongovernmental organizations

- **Strategy:** Annually, provide current and scientifically based information regarding wolves and wolf management in Minnesota, which can be used by the DNR and other organizations in Minnesota that conduct wolf education and provide information to a variety of audiences.
- **Strategy:** Partner with organizations to develop materials and programs that are available as resources to share and educate people about wolves.
 - › Email newsletters to subscribers with information about wolves and wolf conservation on a quarterly basis.

Goal 3. Minimize and address human-wolf conflicts while recognizing diverse wolf values

Objective 3A. Prevent and reduce human-wolf conflict

- **Strategy:** Provide information directly and through partners on avoiding human-wolf conflict, including on wolf ecology and behavior, and on human practices for successful coexistence.
- **Strategy:** Share best practices and provide technical guidance to livestock producers and pet owners on preventative and non-lethal wolf depredation deterrence methods.

Objective 3B. Implement statewide mitigation of wolf damage and related conflicts

- **Strategy:** Continue support for the MDA compensation program by providing best information for investigators to identify wolf damage for depredation claims. Ensure an adequate number of investigators and conservation officers trained by the DNR and USDA Wildlife Services.
- **Strategy:** DNR will consult with tribal governments individually on their preference for involvement in wolf damage management in and adjacent to tribal reservations. This will include discussions of options for co-investigation by DNR conservation officers and their tribal counterparts. The DNR will coordinate with tribal staff on depredation management to identify an approach for communication and information sharing of wolf damage activities within and adjacent to tribal reservation boundaries. Tribal involvement may include developing resources for staff to deploy preventative measures for wolf damage management.
- **Strategy:** Provide effective state-directed wolf control, including the use of private certified wolf trappers if wolves are delisted, in response to verified claims of damage to livestock or pets.

- › Remove the use of two different zones for wolf depredation control in Minnesota to enable consistent response to wolf depredation conflicts. Recommend legislative action to eliminate the distinction between current depredation zones. In other words, remove zone B depredation zone and apply wolf depredation management consistently across the state.
- › Following removal of zone B designations, identify provisions for control of wolves in areas where chronic wolf depredation conflicts occur and when prevention has been ineffective. Chronic depredation is defined as repeated depredations over two years or multiple incidents in a calendar year.

Objective 3C. Provide information on conflicts

- **Strategy:** Develop an online integrated wolf depredation conflict information system to inform the public of claims, compensation, nonlethal and mitigation strategies tracking, and wolf control numbers and details.

Goal 4. Inform and engage the public about wolves in Minnesota and wolf conservation

Objective 4A. Provide baseline information on wolves to diverse audiences statewide

- **Strategy:** Annually publish a wolf committee report to communicate wolf population monitoring activities, management actions and recommendations.
- **Strategy:** Provide through multiple platforms information on wolf biology, behavior and population dynamics, humans' values around wolves, wolf management activities, and living with wolves.
- **Strategy:** Provide information and program support for internal and external partners. An example includes developing DNR-branded wolf education programming for interpretive programs at Minnesota state parks and external environmental education organizations.
- **Strategy:** Transparently communicate with the public about wolf-related decision processes and outcomes.

Objective 4B. Involve communities in wolf research, monitoring and management

- **Strategy:** Identify the best ways to reach various audiences by understanding where they get information. Implement strategies that effectively communicate wolf information.
- **Strategy:** Identify public reporting (for example, an online wolf sighting application) and community science (sometimes called citizen science) opportunities related to wolves, to involve the public and contribute to research and monitoring.
- **Strategy:** Conduct regular public engagement on wolf management, using multiple methods involving diverse stakeholders, through wolf-focused opportunities and as part of related efforts such as deer, elk or moose planning.

Goal 5. Conduct research to inform wolf management

Objective 5A. Collaborate with agency and academic institutions and nongovernmental organizations to improve shared understanding and information about wolves

- **Strategy:** Engage the Wolf Technical Committee as a research collaborative for identifying information needs and research priorities and to work toward shared consensus on data collection and interpretation.
- **Strategy:** State-funded wolf research will prioritize projects designed to inform, or reduce uncertainty associated with, key wolf conservation and management decisions.

Objective 5B. Improve ability to estimate wolf population in response to management actions or changing conditions

- **Strategy:** Identify limitations with the current wolf population survey and assess opportunities for improvement.
- **Strategy:** Review, evaluate or develop potential alternative methods for monitoring the wolf population.

Objective 5C. Evaluate Minnesotans' values, beliefs, attitudes and behaviors regarding wolves, wolf management, and the economic value of wolves in Minnesota

- **Strategy:** Periodically conduct scientific surveys of relevant stakeholder groups, including all Minnesota residents, especially before major wolf policy decisions.
- **Strategy:** Pursue research opportunities to better understand the sources of human conflicts about wolves and methods to reduce them.
- **Strategy:** Conduct a study to estimate the economic impact and non-monetary value of wolves in Minnesota.

Objective 5D. Conduct research to more effectively address wolf depredation through non-lethal and cost-effective means

- **Strategy:** Design or support studies to address information gaps about tools to reduce or mitigate the impacts of wolf depredation (for example, conduct research on the effectiveness and return on investment of non-lethal and other depredation management methods).

Objective 5E. Conduct research to evaluate wolf management strategies that support healthy prey populations

- **Strategy:** When permitted, design or support studies to address information gaps about the impacts of wolf predation on moose and deer.
- **Strategy:** When permitted, evaluate wolf control in reversing trends in moose population declines.

Goal 6. Administer the wolf program to fulfill agency responsibilities and public and partner needs

Objective 6A. Deliver effective, transparent wolf governance and decision-making

- **Strategy:** Develop a transparent and scientifically-informed process to make decisions about potential wolf harvest seasons (see season decision framework in Appendix 2).
- **Strategy:** As included in the season decision framework, consult with sovereign tribal nations before any decisions regarding wolf hunting or trapping on nontribal land within reservation boundaries, land adjacent to reservations and ceded territories are made.

Objective 6B. Secure funds to implement agency wolf management and support synergistic partner efforts

- **Strategy:** Seek the funding necessary to support wolf management, aligned with department efforts.
 - › Investigate revenue sources in addition to license fees.
 - › Wolf program funding should come from a combination of sources that reflect the broad value of wolves in Minnesota.
- **Strategy:** Maintain current funding sources that support strategies defined throughout the plan.
- **Strategy:** Work with the Wolf Technical Committee to prioritize which program components to implement based on available funds.

Objective 6C. Explore policy and funding options for evolving wolf depredation control and compensation

- **Strategy:** Evaluate, and if found promising, propose new policies and actions to reduce damage compensation from state funds (some examples are compensation in lieu of control, premiums for wolf depredation compensation payments, pay for protection tax policies or incentives, or enhanced insurance policies).
- **Strategy:** Provide producer incentives for preferred, cost-effective strategies. Identify grant funding to support a certified wolf conservation farm program for implementing preventative strategies.
- **Strategy:** Practice continuous improvement of wolf depredation management techniques by identifying farms of highest risk, repeated damage and factors that increase risk of depredation.

V. Performance measures

The DNR will track and report publicly its progress implementing strategies in the plan.

Performance measures are quantitative metrics commonly used to foster transparency and accountability and can also inform management decisions. Specific performance measures (Table 4) were selected to reflect the full scope of goals in this wolf management plan, with an emphasis on objectives anticipated to have broad public interest. Selected measures were also chosen based on efficiency of measurement for regular

communication of management activities and tracking of overall progress toward goals in plan implementation.

Table 4. Key performance measures

Goal	Objective	Measure
Goal 1. Maintain a well-connected and resilient wolf population	Objective 1B. Maintain a population comparable to recent estimates (2,200-3,000, well above the federal recovery goals) and distributed across the majority of current wolf range	Annual or other regular estimate of wolf population Estimate of occupied wolf range (square miles)
Goal 2. Collaborate with diverse partners to collectively support wolf plan implementation	Objective 2A. Coordinate and consult with sovereign tribal nations Objective 2C. Collaborate on wolf planning and management with tribes, local, state, and federal agencies and institutional partners, private entities and nongovernmental organizations Objective 2D. Collaborate on wolf education with tribal and institutional partners and nongovernmental organizations	Annual communications and coordination with partners to assess development and implementation of strategies Biennial review and update of general wolf information coordinated through partners The number of referrals to partner websites



Photo courtesy of Paul Sundberg

Goal	Objective	Measure
<p>Goal 3. Minimize and address human-wolf conflicts while recognizing diverse wolf values</p>	<p>Objective 3A. Prevent and reduce wolf-human conflict</p>	<p>The number of farms with chronic wolf depredation</p> <p>The number of farms using non-lethal prevention strategies based on farms visited by USDA Wildlife Services</p>
<p>Goal 4. Inform and engage the public about wolves in Minnesota and their conservation</p>	<p>Objective 4B. Involve interested individuals in wolf research, monitoring and management</p>	<p>The number of opportunities for involving members of the public in wolf monitoring and research</p> <p>The number of opportunities for public input on wolf management</p>
<p>Goal 5. Conduct research to inform wolf management</p>	<p>Objective 5B. Improve ability to estimate wolf population</p>	<p>Analysis and report of wolf monitoring, with adoption of appropriate recommendations</p>
<p>Goal 6. Administer the wolf program to fulfill agency responsibilities and public and partner needs</p>	<p>Objective 6B. Secure funding to administer wolf management program</p>	<p>Development and recommendation of diverse and resilient funding mechanisms sufficient to administer wolf management, research and education as identified in this wolf plan</p>

Appendices

Appendix 1. Input report

Process overview

The DNR update of the 2001 Minnesota Wolf Management Plan relied heavily on engagement and outreach over the course of its development. From its conception, partner engagement, stakeholder participation, public input and the diverse viewpoints of Minnesotans were incorporated using a variety of strategies.

The engagement process began in 2019 with tribal notification. Tribes participated throughout the planning process through staff coordination and leadership consultation, and through committee involvement.

Two external committees were convened in 2020 to advise the DNR in the planning process. The Wolf Technical Committee was comprised of individuals from agencies and organizations involved in wolf conservation, management and research in Minnesota. The Wolf Plan Advisory Committee had members of various advocacy groups, at-large members representing the general public and ex-officio members representing tribal interests.

In September 2020, the public engagement process began with a series of virtual open houses. Concurrently, a questionnaire was posted on the “Engage with DNR” wolf plan engagement webpage, and a forum was opened to allow stakeholders to communicate with each other. The DNR carefully considered this public input in development of the draft plan. In June 2022, the draft plan was released for public review. A questionnaire was posted on the “Engage with DNR” webpage to receive feedback from the public. During the review period, an online webinar was held to provide a platform for stakeholders to respond to the draft plan. Responses were also accepted in the form of phone calls, physical mail and e-mails.

Many methods of engagement were used over the course of the wolf plan update. The DNR’s website featured webpages that were linked to by various partners. Fact sheets and news releases were sent out on a regular basis. Email newsletters shared background information, updates on the planning process and opportunities to participate. The DNR collaborated with the International Wolf Center to host three webinars. Updates were also posted on Facebook, Instagram, Twitter and YouTube throughout the process.

This appendix includes four summaries of engagement efforts that informed the plan, with additional details about each in appendix sections 1-4.

Public input

The DNR held three online open houses in 2020 (Sept. 29, Oct. 8 and Oct. 10) attended by 190 members of the public and 27 DNR staff. An online questionnaire was open from Sept. 29, 2020-Nov. 21, 2020, and 4,589 responses were recorded. In addition, a forum was open during the same time, receiving 708 visitors and 1,582 interactions (comments, replies and votes). Results of the public input process summarized below informed what topics were included in the preliminary outline of the draft plan, and the development of content in each section by staff and committee members.

Public review

The DNR held a webinar on July 13, 2022, to give members of the public an opportunity to interact with DNR staff regarding the draft wolf plan. There were 126 members of the public in attendance, out of 337 preregistered. There were 65 questions or comments submitted during registration, and 49 additional questions or comments were received during the meeting question and answer session. A draft plan review questionnaire was open from June 23-Aug. 8, 2022, that had 714 respondents. This questionnaire also included Likert scale questions regarding aspects of the draft, as well

as demographic self-identification. As a result of requests to allow comments through other methods, the DNR invited comments submitted by email or by postal service that generated 3,781 open-ended comments, six pieces of physical mail and 230 unique email responses. Results of the public review process summarized below led to multiple clarifications as well as the following key edits incorporated in the final plan:

- The vision was expanded to discuss wolves' impacts and dependence on other species.
- More background was added on Endangered Species Act listing and delisting over time.
- Clarification was added that the DNR considers all perspectives in its decision making, not just those of specific stakeholder groups.
- A commitment was added to conduct research on the value of wolves that include both economic impact and non-monetary value.

Tribal engagement and committee work

Wolves are significant culturally to tribes in Minnesota, and the DNR sought to incorporate the values of tribal communities and members into the plan. Government-to-government consultation, coordination with tribal staff and input from tribal community members occurred during the planning process.

The DNR also created two advisory groups to guide this process, the Wolf Plan Advisory Committee and the Wolf Technical Committee. The Wolf Technical Committee was composed of management partners and wolf researchers, and notably contributed to the wolf season decision

framework, as well as the recommendation to shift to a statewide depredation management strategy. The Wolf Plan Advisory Committee was composed of members of various advocacy groups, at-large members representing the general public, as well as ex-officio members representing tribal interests. Both groups met individually six times, with a seventh and final collaborative meeting held with both committees in January 2022.

Communication efforts

Communication efforts have allowed the DNR to reach many thousands of people interested in this planning process. Ten DNR webpages drew almost 60,000 views, with many coming from external sources redirecting to the DNR website. Five fact sheets, 18 news releases and news briefs, and 24 email newsletters (receiving an average of 7,200 unique email opens) were sent out. The International Wolf Center collaborated with the DNR for three online webinars that drew hundreds of viewers. Throughout the course of the planning process, posts were made on Facebook (19 posts), Instagram (four posts), Twitter (26 posts) and YouTube (four videos).

Section 1. Summary of public input (2020)

Online open houses

Process overview

Consistent with development of the previous 2001 plan and the DNR Fish and Wildlife Division's other significant planning processes, a number of public meetings were planned in the wolf range and in the Twin Cities metro area. These were adjusted to two-hour online meetings due to the COVID-19 pandemic.

Open houses

When	Regional focus	Registered public	Registered staff	Attended public (% of registered)	Attended staff
Tuesday, Sept. 29, 2020, 6-8 p.m.	Northwest	70	17	46 (66%)	15
Tuesday Oct. 6, 2020, 6-8 p.m.	Central/ Southern	215	17	76 (35%)	9
Thursday, Oct. 8, 2020, 6-8 p.m.	Northeast	177	14	95 (54%)	13
Total		412	36	190 (46%)	27
Attended multiple		Approx. 50		Approx. 26	

For each event, one or two counties within the region had high attendance. However, attendees' county of residence generally did not correlate well with the open house they attended; attendees at all events came from all parts of the state. Hennepin, Ramsey and St. Louis counties all had at least 10% of the attendees, and the population centers of Bemidji, Duluth and the Twin Cities metro area were highly represented at their respective events.

- Beltrami County had high attendance for the northwest region event.
- Hennepin and Ramsey counties had high attendance for the central/southern region event.
- Cook and St. Louis counties had high attendance for the northeast region event.

Summary of open house input

Questions and comments offered during the public speaking and question and answer segments of the wolf plan open houses focused heavily on the following key topics. Input has been paraphrased.

Key topic: Depredation (56 comments)

Well over half of comments related to depredation emphasized use of best management practices and the effectiveness of non-lethal methods of wolf management, and encouraged this focus in the plan update. Other observations shared include:

- Depredation claims are too difficult to prove,

and/or compensation is inadequate

- Conflicts are relatively rare
- Producers should be responsible for depredation risks
- Producers can falsify or exaggerate claims
- Methods of addressing depredation overall—and specifically baiting or targeted culling methods—are ineffective or counterproductive and believed to adversely impact pack structure
- Targeted methods (impacts to individual wolves) are preferable to overbroad methods (impacts to packs/populations)
- Requests to clarify program goals and components and use a term other than “removal” to describe killing wolves involved in livestock depredation.

Key topic: Wolf hunting and trapping season (29 comments)

About half of those who discussed a wolf hunting and trapping season spoke in opposition, citing concerns that hunting/trapping impacts pack structure, does not effectively manage conflicts, and does not reflect public opinion. Others cited concerns that the previous 5-year moratorium identified in the 2001 plan was disregarded. A sizeable minority of attendees spoke in support of a season, to manage high wolf populations,

address conflict, and offer recreational and economic opportunity.

Key topic: Wolf population (16 comments)

Most who touched on wolf population topics asked for clarification on assessment methods and population status. Some attendees described wolf populations as being too high while others said they are too low. There was also significant confusion about the meaning of the 1,600 wolf population threshold identified in the 2001 wolf plan (whether it was a goal, minimum, maximum, etc.).

Other topics

Questions and comments offered during the public speaking and question and answer segments also covered the following topics. Input has been paraphrased.

- **Public involvement and education (9 comments):** What resources are available, or there should be resources available to the public and producers on living with wolves, including from the DNR, not just nongovernmental organizations. Need to better engage non-hunter or non-producer values. How can the public get involved? Volunteers are important.
- **Trap/snare (9 comments):** Clarify trapping methods and purposes. How many wolves are accidentally or illegally trapped or killed? Trapping should be more humane.
- **Deer (8 comments):** Plan should account for deer and wolf interplay. Wolves are following deer south. Winter severity is impacting deer populations. Too many deer impact forest habitat and moose. Wolves could control chronic wasting disease.
- **Research (5 comments):** Questions about radio collaring and ecological niche or apex predator role of wolves. Is there a reporting system like bear spotting? Demographic questions on human dimensions surveys turn off participants.
- **Attitudes/values (4 comments):** Those not in the wolf range should not get a say. Other subgroups should be segmented to account for diverse values—ecotourism, ecosystem values.
- **Habitat (4 comments):** Wolves support healthy habitat and need protection because of their ecosystem niche.
- **Health (4 comments):** How does harvest or control impact wolf genetics, and are genetics resilient toward disease and environmental stress? How is pack health monitored when densities are lower? What is the relationship between wolves, deer and moose, and brainworm?
- **Climate (3 comments):** Plan should account for climate change. The plan needs to account for winter severity.
- **Conflicts (3 comments):** Humans are in wolf territory. Need to make room for wolves.
- **Plan (3 comments):** What will the plan cover and how does it compare to other states? Can management differ by geography?
- **Predator and prey (3 comments):** Plan should cover these relationships. Wolves are needed to control prey. Plan should correlate the impact of deer populations on wolves looking for food sources.
- **Safety (3 comments):** The public needs to be aware that wolves do not attack humans.
- **Species relationships (3 comments):** What is wolf-coyote interplay? What is connection to potential interagency plan to reintroduce elk?
- **Tribal (3 comments):** How does wolf management work on reservations? How do tribes view wolf management?
- **Domestic animals (2 comments):** Dogs are a threat to wolf pups. Depredation should cover pets.
- **Federal and state (2 comments):** What are Endangered Species Act next steps? The state should regulate wolves.
- **Enforcement (1 comment):** The DNR should enforce against poachers.

Online questionnaire and forum

Process overview

The questionnaire was posted on the “Engage with DNR” wolf plan engagement webpage, and registrants were asked to provide their responses to a limited number of questions. As an opt-in survey, responses are not representative of the broader population. The questionnaire was open for 53 days (Sept. 29-Nov. 21, 2020), and 4,589 responses were recorded. Topics evaluated in this questionnaire included respondents’ priorities for topics to consider in the wolf plan update, preferences for changes in wolf population size and distribution, importance of maintaining a wolf population, wolf management, values people have for wolves, demographics and experience with the wolf plan update process.

Summary of questionnaire results

- A majority of respondents indicated that the following were important topics to consider in the wolf plan update:
 - › Population monitoring
 - › Population management
 - › Depredation conflicts
 - › Wolf hunting and trapping
 - › Impacts on deer and moose
- Respondents were split between preferring an increase or decrease in future wolf populations, and an increase or decrease in the territory that wolves should occupy in Minnesota, compared to the present.
- A clear majority of respondents agreed that it was important to maintain a wolf population in Minnesota.
- A majority of respondents indicated that there are instances where it is appropriate to kill wolves to meet wolf plan objectives.
- Respondents expressed agreement with a variety of values for wolves, including that they have a right to exist and that they are an important part of the ecosystem.

Summary of forum results

The forum was opened Sept. 29, 2020. There were 708 visitors, and 138 contributors made 1,582 contributions (consisting of posts, comments and votes)

Forum boards were separated into five topics of discussion:

- **Impacts on deer and moose (23 comments)**
 - › The most highly “agreed” comment (15 agrees) details the experiences of a landowner and hunter in northeastern Minnesota. The respondent noted having been hunting in the area for 50 years, and that the deer population is currently the lowest the respondent has ever witnessed. The respondent’s extensive use of trail cameras allowed the observation of changing wildlife populations, and a notable rise in wolves since 2012. During this same time, almost no fawns reached adulthood in the wooded area on the respondent’s property. The respondent strongly advocated for a hunting and trapping season.
 - › The most frequently “disagreed” comment (14 disagrees) attributes declining moose populations to brain worm, and claims concerns over wolf predation are overblown. Their main argument was the importance wolves have in a healthy Minnesota ecosystem.
- **Population monitoring (83 comments)**
 - › The most frequently “agreed” comment (26 agrees) noted the respondent lived in northern Minnesota and has noticed a decrease in deer numbers due to wolves. They question why they can protect their property from humans but not wolves.
 - › The most frequently “disagreed” comment (17 disagrees) called for recognition of the wolf’s role in maintaining healthy ungulate (hoofed mammal) populations, as well as managing their own numbers.

- **Population management (46 comments)**

- › The most frequently “agreed” comment (11 agrees) claims that the existing science supports a hunting and trapping season, and that the emotions of uninvolved parties are preventing this from happening.
- › The most frequently “disagreed” comment (nine disagrees) expressed disagreement with trapping under any circumstances.

- **Wolf hunting and trapping (38 comments)**

- › The most frequently “agreed” and “disagreed” comment (13 agrees and disagrees) claims the Minnesota public is overwhelmingly against hunting and trapping.
- › Commenters asked about the previous 5-year moratorium for having a season and if policy stated in the updated plan will remain consistent or could similarly be changed by the Legislature in the future.

- **Depredation conflicts (12 comments)**

- › The most frequently “agreed” comment (six agrees) discusses using non-lethal depredation mitigation tools and proposes only providing reimbursement to farmers utilizing them. They believe killing wolves to defend livestock must be a last resort.
- › The most frequently “disagreed” comment (five disagrees) suggests livestock protection is only important during periods of vulnerability (birthing season, juveniles through adolescence, and at night).

Section 2. Summary of public review (2022)

Online webinar

A webinar was held on July 13, 2022, to give members of the public an opportunity to learn about, ask questions about, and comment on the DNR’s draft wolf plan. Of the 337 individuals preregistered, 126 members of the public participated. There were 65 questions and

comments submitted during registration, and 49 additional questions and comments received during the meeting question and answer session.

The meeting began with a presentation outlining the draft wolf plan: its goals, objectives and strategies, and the planning process to-date. Subsequently, a panel of DNR staff replied to written questions submitted by attendees. Topics covered include:

- Wolf regulatory status
- Wolf range
- Depredation
- Poaching
- Wolves, deer and moose
- Partner coordination
- Climate change
- Wolf harvest

Then, members of the public who preregistered were given the opportunity to voice comments or questions regarding the draft plan. Their responses related to:

- Criticism of past and present wolf management policy
- Criticism of past moose management policy and possible future experiments
- Fears regarding future federal delisting and the tourism benefits of wolves
- Alternative funding for non-lethal tools
- Creation of winter habitat for wolves and deer
- Concerns regarding deer populations
- Desire for more control efforts
- Avoiding other states’ mistakes and trapping concerns
- Concerns over survey bias
- Poaching and population estimates
- Concerns over smaller pack sizes

Online questionnaire

From June 23-Aug. 8, 2022, members of the public were encouraged to review the DNR’s draft wolf plan and take a public review questionnaire on the “Engage with DNR” webpage. This questionnaire asked about public support for the goals of the plan and provided an opportunity for respondents to share their opinions in open-ended responses.

Satisfaction with the plan overall, as well as with the six goals, was mixed. Most responses were satisfied, neutral or dissatisfied, with fewer respondents “very” satisfied or “very” dissatisfied. In the questionnaire, over 80% said they read the whole plan or most of the plan before taking the questionnaire. Half of respondents reported not participating in any prior input opportunities, while a third had completed the 2020 questionnaire. The three most common topics of interest among respondents were wolf protection, wolf impact on deer and deer hunting, and wolf research and ecology.

The open-ended comments were analyzed and sorted according to frequency. Comments generally ranged from support to opposition, reflecting the broad range of opinions on wolves among Minnesotans. There were also requests for clarification on some topics. Following is a summary of each topic and the number of responses it received:

- **Overall plan:** summary of open-ended comments **(626 comments)**
 - › Comments mostly related to opinion of plan, viewpoints on a hunting and trapping season, as well as general concerns related to wolf management
- **Vision:** summary of open-ended comments **(591 comments)**
 - › Comments mostly related to opinions on the DNR’s vision for wolves and topics respondents felt should have been included.
- **Introductory content:** summary of open-ended comments **(480 comments)**
 - › Comments mostly related to which

stakeholders should be addressed by the plan, further discussion of a season, as well as many general concerns related to wolf management.

- **Goal 1.** Maintain a well-connected and resilient wolf population: summary of open-ended comments **(450 comments)**
 - › Comments mostly related to clarification of what “well-connected and resilient means” and disagreements over population numbers and goals, as well as whether a single-state management strategy is sufficient.
- **Goal 2.** Collaborate with diverse partners to collectively support wolf plan implementation: summary of open-ended comments **(414 comments)**
 - › Comments mostly related to greater clarity in how the DNR will collaborate and with whom, concerns stakeholder desires would supersede science and how partners could help achieve management goals.
- **Goal 3.** Minimize and address human-wolf conflicts while recognizing diverse wolf values: summary of open-ended comments **(422 comments)**
 - › Comments mostly related to discussions of non-lethal mitigation strategies, poaching concerns and concerns over future wolf populations damaging livestock.
- **Goal 4.** Inform and engage the public about wolves in Minnesota and their conservation: summary of open-ended comments **(393 comments)**
 - › Comments mostly related to lack of transparency from DNR, bias towards stakeholder groups and the DNR’s lack of responsiveness to public input.
- **Goal 5.** Conduct research to inform wolf management: summary of open-ended comments **(405 comments)**

- › Most comments related to suggestions or concerns regarding research methodology, the availability of information and suggestions to improve research validity.

Other input

Email, physical mail, and phone call responses were accepted by the DNR during the plan review process from June through August 2022. Most emails were form-letters that were essentially identical. A much smaller number of responses offered unique comments, and the range of opinions presented was in line with the other engagement responses above. Five pieces of physical mail were received, and the spectrum of input was also representative of the other forms of engagement. Phone calls received throughout the process were noted and mirrored the input topics summarized from the online questionnaire.

Emails

- **Total number of emails received: 3,546**
 - › 3,289 from “mass form” comment submission
 - › 244 unique individual submissions
 - › 13 official organizational submissions

Physical mail

- **Total number of physical mail responses received: six**
 - › Five individuals, one organizational

Phone calls

- Phone calls were allowed throughout the draft plan process and taken into account during plan drafting and editing.

Section 3. Summary of tribal engagement and committee work

Tribal coordination and consultation

Wolves are significant culturally to Ojibwe tribes in Minnesota, and the DNR sought to incorporate the values of tribal communities and members into the plan. Government-to-government consultation, coordination with tribal staff, and input from tribal community members occurred during the planning process.

In October 2019, leadership for all tribal governments in Minnesota were notified the state’s wolf plan update was being initiated and invited to participate. A follow-up letter in February 2020 was addressed to tribal natural resource directors or similar positions. Tribal staff were invited to observe any Wolf Plan Advisory Committee meeting. For the Wolf Technical Committee, all Minnesota tribes were invited to have staff participate in this group to advise on how tribal interests, concerns and values could be incorporated into the plan. Seven tribal governments elected to have staff participate on the Wolf Technical Committee. In general, Ojibwe tribes individually and represented through GLIFWC and the 1854 Treaty Authority were involved throughout the planning process on both committees. One Dakota band had a representative attend meetings of the Wolf Plan Advisory Committee as an ex-officio member. Ongoing meetings and other communications occurred throughout the planning process at the staff and leadership levels between DNR and tribal governments.

Specific opportunities for tribal staff coordination

The DNR held a meeting in April 2021, early in plan drafting, with interested tribal staff. The goals of the meeting were to explore opportunities to improve DNR staff and public understanding of tribal relationships and perspectives related to wolves and wolf management, and how to incorporate this information or other references into the wolf plan update. Tribal governments were provided an opportunity to review a full draft of the plan in late 2021, before the Wolf Technical Committee reviewed the draft, and multiple tribal staff provided comments.

Specific opportunities for tribal leadership consultation

DNR leadership and staff met with tribal council members and tribal staff from interested tribes in both consultation and coordination meetings during plan drafting in 2021 and draft plan review in 2022.

Participation by tribal community members

Tribal community members may have a unique cultural and historical connection to wolves, and there were multiple opportunities for those interested to directly contribute to the update of this plan. A public attitudes survey conducted in 2019 was statistically representative of all Minnesotans. For the Wolf Plan Advisory Committee, six applicants identified themselves as tribal members or of native descent, and one was selected for the committee. Finally, all Minnesotans were invited to respond to the 2020 public input questionnaire and 2022 plan draft review questionnaire through the “Engage with DNR” webpage.

Wolf plan committees

Wolf Plan Advisory Committee

The DNR created the Wolf Plan Advisory Committee to provide input to the DNR in updating the 2001 wolf plan by developing recommended wolf management options and preferences, with particular emphasis on controversial aspects of wolf management. Participants on this committee were members of various advocacy groups, at-large members representing the general public, as well as ex-officio members representing tribal interests. The makeup of this committee was aimed at having a diversity of viewpoints and backgrounds. Members were selected via an application process and convened for the duration of the plan update. There were six online meetings to discuss the plan, and a final collaborative meeting with the Wolf Technical Committee was held in-person.

Wolf Technical Committee

The DNR created the Wolf Technical Committee to provide external experts’ guidance in drafting an update to the state’s 2001 wolf plan. The group was composed of individuals from agencies and organizations involved in wolf conservation, management and research in Minnesota. The desired outcome of this committee was to identify best science related to wolf conservation, population monitoring and management to inform the wolf plan update. The Wolf Technical

Committee contributed to the DNR’s updated wolf season decision framework, as well as the recommendation to shift to a statewide wolf depredation management strategy.

Section 4. Summary of communication efforts

Agency communication and programmatic staff worked to plan and implement a robust public information effort throughout the plan update process. The following is an overview of those efforts:

- Webpages (10 pages, 58,000 views)
- Fact sheets (five)
- News releases and news briefs (18)
- Email newsletters (24, average of 7,200 unique email opens)
- Facebook (19, average 600-900 users “engaged”), Twitter (26), and Instagram (four) posts
- Webinars in conjunction with the International Wolf Center (three events, hundreds of views)
- Videos (four videos, 917 YouTube views)

In the 2020 post-event online survey, a small number of attendees shared their referral sources:

- DNR website (15)
- Email newsletter (six)
- Facebook (four)
- Friend or family member (four)
- International Wolf Center website (four)

Appendix 2. Wolf hunting/trapping season decision framework

A. Purpose

The mission of the Minnesota Department of Natural Resources is to work with Minnesotans to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life. Minnesota Statutes, Sect. 97B.646, directs the DNR to “in consultation with the commissioner of agriculture, ... adopt a wolf management plan that includes goals to ensure the long-term survival of the wolf in Minnesota, to reduce conflicts between wolves and humans, to minimize depredation of livestock and domestic pets, and to manage the ecological impact of wolves on prey species and other predators.”

Departmental decisions about future seasons will occur only after completion of the update to the 2001 wolf management plan and in recognition of any federal Endangered Species Act listing status.

Particularly complex social and biological factors underlie a future decision, so the DNR has developed this framework as an appendix to the plan update to describe in greater detail how the DNR's season-related decisions will be made in the future if wolves are once again removed from protection under the federal Endangered Species Act. Therefore, this document assumes overall wolf management is implemented per the plan itself, and does not reiterate the full suite of strategies independent of a season decision. The framework also proactively describes critical factors that require consideration and deliberation to hold a season, including communication, season design and harvest levels.

It is essential to emphasize that this decision framework does not prescribe an outcome (whether a season will ultimately be implemented). Rather it focuses on the factors that will be considered and the process that will be followed, supporting transparency and efficiency for making season-related decisions, including

public engagement, consultation with tribal governments and coordination with the DNR's management partners.

B. Background and context

Decisions to hold regulated wolf hunting and trapping seasons rest on DNR's legal authorities under state and federal statutes; information sufficiency about wolf population dynamics, harvest reporting and monitoring; public opinion about wolf hunting and trapping; tribal perspectives and rights; and the DNR's historical experiences pertaining to wolf harvest. The following information provides a starting point for any discussion about wolf hunting and trapping seasons.

- The DNR has authority to prescribe wolf seasons under Minnesota Statutes, Sect. 97B.645, if the wolf is not federally listed under the Endangered Species Act.
- There have been a number of delisting and subsequent listing decisions as a result of court rulings, including a 2022 court ruling that overturned a 2021 final rule delisting wolves. That 2022 court ruling, rejecting the 2021 delisting, is currently under appeal.
- There is an abundance of data and research to inform a decision about wolf season implementation.
- The DNR implemented a wolf season for three years (2012-2014) in a manner that maintained the wolf population above recovery levels.
- Harvest levels can be controlled through a regulated season structure.
- Wolves have significant cultural and social value in Minnesota. The value of and relationship with ma'iingan (Anishinaabe) or Țuâktokça (Dakota) is important for indigenous Minnesotans.
- Minnesotans are divided in their support for a wolf season.
 - › Nearly 50% of Minnesotans oppose and 41% support a wolf hunting season. Opposition is higher for a wolf trapping season with nearly

60% of Minnesotans opposed and 30% in support.

- › High support for a season exists among deer hunters and livestock producers.

C. Guiding principles

The DNR offers the following guiding principles for its approach to making a future decision about holding regulated wolf hunting and trapping seasons.

- Conservation and stewardship–Wolf season decisions will promote responsible stewardship, be consistent with long-term wolf population viability and maintain ecological function. Allowable harvest levels will be consistent with population levels identified in Objective 1b of the 2022 Minnesota Wolf Management Plan. If implemented, any harvest must be regulated and monitored responsibly.
- Tribal involvement–Tribal governments must be consulted regarding the potential for a season.
 - › Minnesota Statutes, Sect. 10.65, directs consultation, coordination and cooperation between agencies and Tribal governments. Consultation “means the direct and interactive involvement of the Minnesota Tribal governments in the development of policy on matters that have Tribal implications.” Statute further clarifies “matters that have Tribal implications” means rules, legislative proposals, policy statements, or other actions that have substantial direct effects on one or more Minnesota tribal governments. The DNR affirms that most issues relating to wolves and wolf management in Minnesota require consultation, coordination and/or cooperation with tribal governments.
- Science–The decision whether to have a season will be informed by best available science.
- Monitoring–Adequate population monitoring methods should be in place. Monitoring methods and principles will be developed by the Wolf Technical Committee.

- Public involvement and input–Perspectives regarding social, cultural, biological and economic considerations related to wolf conservation and management will be solicited and considered in the decision process.
- A wolf season proposal will define the purpose(s) and have measurable objectives.

D. Framework

This framework has been developed as a proposed means to publicly discuss, develop and communicate recommended principles and considerations that can be used by the state of Minnesota to inform a future decision about whether to hold a wolf season, and if a season is determined appropriate, to meet management objectives and frame how to structure and implement a season.

Decision phase I. The DNR will consider the following criteria in determining whether to implement a wolf season.

Criterion 1: Is there is a legal basis to implement a season?

- A season may only occur after wolves have been removed from Endangered Species Act protections.
- Minnesota Statutes, Sect. 97B.645 and 97B.647 establish the DNR commissioner’s authority to prescribe a season and provide a mechanism for implementation. Statute also requires an opportunity for public comment before prescribing open seasons and restrictions on taking wolves.
- Recognized treaty obligations must be met.

Criterion 2: Does adequate information exist to inform the decision?

• Available biological information should include:

- › Recent Minnesota wolf population survey data, including:
 - A population estimate, within the previous year with an associated margin of error.
 - Survey data that indicate no statistically significant declining trend in population size or distribution of wolves that is of current ecological concern.
 - The population estimate exceeds 1,600, which is a minimum population estimate in the 2022 wolf plan to consider a season and is a buffered amount above the Minnesota-specific 1992 federal recovery criterion of 1,251-1,400 wolves.
 - Any harvest would not negatively impact the state's ability to maintain a population consistent with the goals of the 2022 wolf plan.

• Available social information should include:

- › Recent representative attitude surveys and self-selected public input.
- › Public and stakeholder engagement has been conducted on a specific proposal or range of alternatives and the engagement must meet the requirement of Minnesota Statutes, Sect. 97B.645, subd. 9 to “provide opportunity for public comment.”

• Available intergovernmental information would include:

- › Under Minnesota Statutes, Sect. 10.65, meaningful and timely consultation with all tribes in Minnesota has occurred to facilitate mutual understanding and inform decision making on a proposed season, with the goal of achieving mutually beneficial solutions.

Criterion 3: Would the proposed season support one or more of the following objectives defined in the 2022 wolf plan, acknowledging there are tradeoffs among objectives?

- To reduce prey impacts and conserve prey species
- To reduce depredation on domestic animals
- To manage the wolf population (manage disease outbreak or local population concerns)
- To provide social and cultural opportunities.

Potential objectives of harvest could focus on providing outdoor opportunity and/or addressing conservation or management concerns related to wolves or species with which they interact. Harvest seasons undertaken to address a conservation or management concern should be designed, conducted, documented and monitored as part of a transparent management or research plan or proposal. At the same time, any season should maintain the ecological function of wolves and not affect the recreational opportunities of wildlife viewers.

Decision phase II. If the DNR implements a wolf season, the season structure will incorporate the following components.

- **Population components:**
 - › Wolf harvest will not cause long-term, statewide population decline.
 - › Localized declines may occur based on management objectives.
 - › Harvest rate will be dependent on statewide population size, trend and distribution. May be adjusted locally to address management objectives.
- **Geographic components:**
 - › Management areas may be established for different management objectives.
 - › Management areas may be established to manage harvest in relation to reservations and off-reservation treaty rights.
 - Harvest will be coordinated with tribal nations in a way that acknowledges and respects tribal sovereignty and tribes' roles in wildlife management within reservations and ceded territories.
 - › Management areas could be established for research purposes or to evaluate the impacts of wolf harvest.
- **Responsive management approach:**
 - › Each year, regulations and seasons will be modified if needed, based on population trends, previous season results, changes to harvest objectives or changing socioeconomic interests.

E. Implementation recommendations (only relevant if the state decides to hold a season)

The following are recommendations offered by the DNR to demonstrate transparency and facilitate dialogue, in the case of a future decision to implement a season.

Communication and continued engagement

- **Transparency:**
 - › Information used and any management objectives for a season will be communicated publicly, using a combination of communications tools (for example, through email announcements to subscribers or other appropriate contact lists, webpage postings and news releases).
- **Engagement:**
 - › Regular engagement opportunities will gather public feedback on the season decision and implementation.

Season design

- **Allocation:**
 - › Harvest allocation will be determined based on the harvest goal and reliable data on expected success rates of different groups/methods.
 - The tribal allocation of harvest within reservations or ceded territory will be determined based on governing treaties and court-recognized agreements, with the recognition that each sovereign nation has the authority to determine use or purpose of its harvest allocation.
 - › Equitable harvest allocation if different seasons or methods are permitted.
- **Timing:**
 - › Harvest seasons occur after Nov. 1 and before Feb. 1 (outside primary reproductive season with prime pelt conditions, and when potential conflict with other outdoor user groups is minimized to the extent possible).

- **Monitoring:**
 - › Post-season surveys are conducted to collect detailed data on harvest effort.
 - › Mandatory harvest registration and carcass collection are used to collect information on harvest date and method, and the age, sex, health, and location of wolves.
- **Closing season:**
 - › Ability to close season quickly when allowable harvest is reached.
 - › Harvest is monitored daily and season closed based on trends in registration that indicate harvest goal will be met.

Harvest levels

- **Allowable harvest levels will be informed by research:**
 - › Prior to implementation, harvest scenarios will be fully evaluated using best available information. Considerations of all human-related mortality will inform overall level allowed for wolf harvest.
- **Allowable harvest will correlate positively with population size within the following parameters:**
 - › No harvest if the population point estimate is less than 1,600, unless in specified zones as part of an approved research program.
 - › Maximum harvest rate based on Objective 1b of the 2022 wolf plan, except if part of an approved limited-duration or limited-area management program.
- The Wolf Technical Committee, in coordination with tribal biologists, will recommend harvest levels to the DNR annually. The committee will consider available data and clearly document its rationale.
- **Season evaluation and analysis:**
 - › Summarize data of metrics described in season design.
 - › Produce report of annual season information and outcomes.

Exceptions: If management-focused harvest objectives (e.g., see Criterion 3 in Section D above and adjustments in Section F below) are established and approved, deviations from Season Design and Harvest Level section guidelines above may occur. Table A.1 indicates potential levels of harvest that could be considered while also ensuring long-term viability of the wolf population.

Table A.1. Potential harvest rates, by population level, if season management is implemented

Studies have suggested <30% human-related mortality, relative to winter wolf population estimates, is generally sustainable for wolf populations to persist. Therefore, potential harvest rates would need to consider annual fluctuations in human-related mortality unrelated to a hunting or trapping season. Any actual proposed harvest rate would vary based on knowledge of other sources of other human-related mortality, such as wolves taken for depredation control, and the harvest rate would be vetted by the Wolf Technical Committee.

Population level and trend	Harvest level considerations
<1,600 Trending downward	0
1,600 – 2,000 Trending downward	< 5%
2,000 – 2,200 Stable or trending upward	5-10%
2,200 – 3,000 Stable	10-20%
>3,000	20%+

F. Adjustment to season framework

If significant adjustments are proposed to this framework, the DNR will consult the Wolf Technical Committee and conduct tribal consultation and public engagement as needed. Foreseeable adjustments significant enough to warrant this review could include changes to management objectives or harvest level guidance.

Appendix 3. Selected resources for more information on wolves in Minnesota (post 2001 wolf plan)

Websites:

[International Wolf Center webpage on basic wolf information \(wolf.org/wolf-info/basic-wolf-info\)](http://wolf.org/wolf-info/basic-wolf-info)

[International Wolf Center webpage on wolves in Minnesota \(wolf.org/wow/united-states/Minnesota\)](http://wolf.org/wow/united-states/Minnesota)

[DNR wolf management webpage \(mndnr.gov/wolves\)](http://mndnr.gov/wolves).

[MDA wolf depredation compensation webpage \(mda.state.mn.us/business-dev-loans-grants/wolf-depredation-compensation\)](http://mda.state.mn.us/business-dev-loans-grants/wolf-depredation-compensation)

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Appendix 4. Post delisting guidelines for addressing wolf-human conflicts in Minnesota

Note: Although much of this guidance applies while wolves are listed under the federal Endangered Species Act, not all options are available unless wolves are delisted because the federal law would supersede state laws. It is included to provide more specific guidance on wolf-human conflicts to consider for prevention and mitigation of wolf-human conflict that is not detailed in this plan.

The DNR, through engagement with the public and the committees formed to update Minnesota's Wolf Management Plan, developed these guidelines to provide an overview of policies and procedures to support wolf conflict situations. The purpose is to summarize policies and procedures that guide the DNR's efforts in addressing wolf-human conflict and to reduce conflicts between wolves and livestock. All parties have an interest in preventing and reducing the severity of conflicts when they occur. These guidelines suggest a variety of measures livestock producers can take to reduce the wolf-livestock conflicts and summarizes the procedures for directed wolf control when conflicts occur.

The guidance draws on a diversity of perspectives expressed by people throughout the state for protecting wolf populations and reducing conflict. These values include maintaining a healthy and resilient wolf population, providing technical guidance and resources for preventing conflict to support livestock producers where conflicts occur, and reducing loss of wolves and the potential impacts associated with wolves in areas that have conflict. The guidance in this document lays out the DNR approach to increase the transparency and accountability of the Department's activities and management actions related to wolves.

Although Minnesota law enables individuals and the DNR to take action to protect livestock and pets from wolf conflict, additional guidance is needed to provide detail on tools and actions the DNR uses to reduce wolf-livestock interactions

to support wolf conservation and address human-wolf conflict. The goal of the tools and approaches described in this document is to take steps to reduce the potential for wolf depredations on livestock while continuing to promote responsible wolf stewardship. To increase tolerance for wolves and encourage coexistence with wolves in a human dominated landscape, some tools will increase public awareness of the challenges associated with livestock production, living in wolf country and reducing conflict with recreational activities in parts of Minnesota where wolf populations occur.

Approximately two-thirds of Minnesota's wolf population shares a landscape where livestock occur and nearly all of the wolf range overlaps with places where people live and recreate. Everyone should be aware of the possibility of wolf-human conflict when living and recreating in Minnesota's wolf range. Proactive steps can be taken to be best prepared when participating in activities that could result in negative interactions with wolves.

These guidelines describe a variety of prevention measures that can assist livestock producers and pet owners to evaluate best methods to consider for their particular situation. Although no single or combination of prevention measures guarantee against conflict, the DNR supports the application of these methods to help reduce conflict. The guidelines also describe the criteria for and implementation of lethal removal of wolves, and the MDA's compensation program for livestock killed by wolves.

Wolf management responsibilities

The DNR Section of Wildlife has primary responsibility for the management of wolves in Minnesota, and the DNR Enforcement Division, in addition to protecting public safety and natural resources, enforces natural resource laws and regulations. Minnesota conservation officers are also primary investigators in wolf depredation claims. The DNR has entered into a cooperative services agreement with USDA Wildlife Services to assist with wolf depredation conflict. During periods when wolves are not under federal Endangered Species Act protection, DNR Wildlife

and Enforcement also administer a directed predator control program in which private certified trappers are authorized to take wolves where conflicts occur.

Tribal authorities have responsibility over all wolf management activities on lands owned or managed by the respective tribe within reservation boundaries. The DNR manages wolf conflicts occurring on properties that are within reservation boundaries owned by non-tribal entities in coordination with tribal staff. The 2022 wolf plan identifies a strategy to improve coordination with tribes on wolf depredation management that occurs within and adjacent to reservation boundaries. The DNR will work with the tribes to identify ways to improve communication and information sharing, options for co-investigation by DNR conservation officers and their tribal counterparts, and involvement in deploying preventative measures for wolf damage management.

The MDA administers a program to reimburse livestock owners for verified losses caused by wolves. Additionally, the MDA administers a grant program for Minnesota livestock producers to deploy strategies that help reduce wolf-livestock conflict.

Wolf conflict prevention measures

Minnesota's diverse landscape supports a robust wolf population. Sometimes challenges arise where human activities intersect with places where wolves live, whether on public land or on people's property. Most wolf-human conflicts in Minnesota, besides livestock interactions, occur in association with dogs.

Human safety

The likelihood of wolves attacking people is extremely low. Wolves typically avoid people and areas of human activity. Millions of people live and recreate in parts of Minnesota where wolves occur without incident. Incidents of wolf attacks on humans have involved wolves that were sick or habituated and these conditions contributed to the abnormal or unusual wolf behavior. Even though the risk of wolves attacking people is low, people should not intentionally attract or feed wolves, and should always maintain a safe distance.

Minnesota Statutes, Sect. 97B.645. Subd. 4.
Harassing wolves.

To discourage wolves from contact or association with people and domestic animals, a person may, at any time and without a permit, harass a wolf that is within 500 yards of people, buildings, dogs, livestock, or other domestic pets and animals. A wolf may not be purposely attracted, tracked, or searched out for the purpose of harassment. Harassment that results in physical injury to a wolf is prohibited.

Minnesota Statutes, Sect. 97B.645. Subd. 3.
Destroying wolves in defense of human life.

A person may, at any time and without a permit, take a wolf in defense of the person's own life or the life of another. A person who destroys a wolf under this subdivision must protect all evidence and report the taking to a conservation officer as soon as practicable but no later than 48 hours after the wolf is destroyed.

Wolves and pets

Wolves kill pets occasionally. A number of dogs are attacked or killed by wolves each year in Minnesota. Wolves are territorial and recognize dogs as competitors because they are a closely related species. Wolves can be most aggressive during the spring and summer months when they are raising pups at dens or rendezvous sites, or near locations where they make a kill, and can also be more aggressive during the winter breeding season.

There are ways to reduce conflicts between wolves and dogs by taking precautions.

DNR recommendations for keeping pets safe in wolf country:

- Do not leave dogs unattended in yards or allow them to range freely in areas where wolves occur.
- Keep pets on a leash or under verbal control when walking or recreating in areas with wolves.
- When hunting with dogs, avoid areas of high wolf activity and learn to identify wolf sign and avoid or leave areas when you observe it.
- Avoid feeding deer. Awareness of these actions will help protect dogs from attack by wolves.

Minnesota Statutes, Sect. 97B.645. Subd. 6.
Destroying wolves threatening domestic pets.

An owner of a domestic pet may, at any time and without a permit, shoot or destroy a wolf when the wolf is posing an immediate threat to a domestic pet under the supervision of the owner. A person who destroys a wolf under this subdivision must protect all evidence and report the taking to a conservation officer as soon as practicable but no later than 48 hours after the wolf is destroyed.

Wolves and livestock

Wherever the wolf range overlaps with areas where domestic animals are kept, some depredation occurs. In Minnesota, the conflict has been a management problem for livestock producers and agencies responsible for wolf conservation. Both opponents and supporters of wolf recovery have closely monitored the extent of the problem. Agencies' approaches to wolf conflict management in Minnesota have historically been primarily focused on killing depredating wolves to address recent or ongoing depredation events. Conversely, the proactive prevention of livestock losses has generally been left to individual livestock producers, although state (MDA) and federal (USDA Wildlife Services) funding has contributed to preventative conflict reduction efforts in recent years. This paradigm has been in place throughout the recovery phase of wolf conservation in Minnesota. A more formal integrated approach should provide broader acceptance for addressing future problems.

The University of Minnesota conducted a study in the late 1990s to assess management practices that could prevent wolf depredation. Although no methods were identified that are certain to prevent wolf depredation, the study illustrated that removing depredating wolves was effective at preventing additional losses at the farm. In addition, some farmers and ranchers support practices that they think help reduce livestock depredation by wolves, including maintaining a healthy herd, use of guard animals, and calving and lambing in areas where they can be closely monitored near human activity.

As wolf recovery has expanded to additional parts of the United States, more emphasis has been placed on the use of non-lethal wolf depredation prevention methods, especially in areas of small recolonizing wolf populations. As these tools have become more common in use, the pros and cons of many methods have become more evident. Although few if any will prevent all wolf-livestock conflict, any implementation that can reduce the

loss of livestock, economic impacts to producers, and number of wolves killed should be considered by wolf management interests.

The DNR encourages livestock producers in Minnesota to use preventative measures to reduce the likelihood for conflict. However, the best strategies for reducing wolf depredation incidents may not be cost effective or consistently effective in practice. Nonetheless, non-lethal methods that reduce the incidence of wolf-livestock conflicts can be implemented before conflict with livestock and wolves occurs. Implementation of these practices can be improved by providing technical guidance and identifying funding partnerships for farmers to help implement these strategies. Some strategies that have been found to be effective are listed here:

Wolf-livestock depredation prevention toolbox

1. Human activity

- Increase human activity in and around pastures occupied by livestock. Check on livestock on a daily basis and check perimeter for wolf activity. Monitor livestock for changes in behavior and condition. Human activity can be a disturbance to wolves and help detect the presence of wolves, allowing for further increases in human presence or implementation of additional strategies.

2. Proper carcass disposal

- Promptly remove any dead animals from farms to limit attracting wolves seeking to scavenge on carcasses.
- The Minnesota Board of Animal Health requires proper disposal of livestock carcasses within 72 hours by burying, burning or composting. Use a rendering service if available.



U.S. Fish and Wildlife Service

3. Fencing

- Use fencing that limits wolf movement in or out of a pasture.
 - › Permanent – woven-wire or electric
 - › Temporary or portable – fladry/turbo fladry

4. Guard animals

- Donkeys, guard dogs, or other animals may be appropriate depending on the application.

5. Scare devices

- Lights and audible devices that can be placed in pastures or calving and lambing areas to scare wolves away.

6. Calving and lambing activities near barnyard

- Concentrate activity in area where it is more protected and can be closely monitored.

State and federal wolf depredation prevention grants

The Minnesota Legislature first funded Wolf-Livestock Conflict Prevention Grants in 2017. The program is administered by MDA and is available to livestock producers through a competitive grant application process. Although the Legislature only funded these grants for two years, the MDA received a USFWS grant to continue to award grant funding to producers. The grants must be matched, depending on the grant application requirements, by the producer and can be utilized for measures demonstrated to effectively reduce wolf-livestock conflicts.

Wolf depredation compensation payments

In 1977, the Legislature established a compensation program to pay farmers for verified livestock losses by wolves. The MDA receives an appropriation each biennium to reimburse wolf depredation claims made by livestock producers. Over the last 10 years, the MDA has paid between 80-140 claims totaling approximately \$100,000-\$250,000 per year.

To be reimbursed for livestock lost to wolves, an assessment of livestock losses and eligibility for payment of compensation is completed that includes USDA Wildlife Services, conservation officers or approved investigators, the MDA and county extension agents.

Figure 1: Minnesota Department of Agriculture Wolf Claim Flow Chart



Wolf depredation control

From 1975-2011, while wolves were listed under the Endangered Species Act, wolf damage management was primarily conducted by the federal government, by the USFWS from 1975-1986 and by USDA Wildlife Services (under USFWS and DNR authorization) up to the present. While wolves weren't federally listed in 2012-2014, USDA Wildlife Services continued to be the primary agency to control depredating wolves under a cooperative agreement with the DNR. When the wolf isn't federally listed, private landowners can take depredating wolves under certain conditions and state-certified wolf controllers are authorized to assist livestock producers with wolf depredation control.

When conflict does occur, state law allows individuals to take wolves, under certain conditions, and use of targeted lethal control is authorized under state directed wolf control.

When dead or wounded livestock or other domestic animals are identified and the cause of the death or injury is suspected to be wolves, livestock producers can report claims to DNR conservation officers, USDA Wildlife Services, and, in Kittson County, to the Kittson County Sheriff's Office. Trained investigators play a crucial role in evaluating wolf claims and recommending management actions to reduce wolf damage to livestock. When a determination is made of active wolf depredation conflicts, targeted wolf removal is provided by USDA Wildlife Services or state-certified wolf control trappers. Where permitted under applicable regulations and federal, state or tribal authorizations, wolves are removed as humanely as possible using foot-hold traps, cable devices and shooting.

Minnesota Statutes, Sect. 97B.645. Subd. 5.
Destroying wolves threatening livestock, guard animals, or domestic animals.

An owner of livestock, guard animals, or domestic animals, and the owner's agents may, at any time and without a permit, shoot or destroy a wolf when the wolf is 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. A person who destroys a wolf under this subdivision must protect all evidence and report the taking to a conservation officer as soon as practicable but no later than 48 hours after the wolf is destroyed.

Appendix 5. Wolf attitudes summary report

To prepare for the update of the 2001 wolf plan, the DNR, in collaboration with the Minnesota Cooperative Fish and Wildlife Research Unit at the University of Minnesota, conducted a study from 2019-2020 to assess Minnesotans' values, beliefs, attitudes and behaviors toward wolves and wolf management. Both the summary report and full report are available on the DNR website.

Summary report (https://files.dnr.state.mn.us/fish_wildlife/wildlife/wolves/summary_attitude_report.pdf)

Full report (https://files.dnr.state.mn.us/fish_wildlife/wildlife/wolves/attitude_report_final.pdf)

Appendix 6. List of tribal wolf management documents

David, P. 2022. Ma'iingan Relationship Plan: 1837/1842 Ceded Territory: Version 1.0. Great Lakes Indian Fish and Wildlife Commission, Odanah, Wisconsin.

Division of Resources Management. 2012. Eastern Timber Wolf (Ma'iingan) Management Plan for the Leech Lake Reservation: Draft. Leech Lake Band of Ojibwe, Cass Lake, Minnesota.

Howes, T., and M. Schrage. 2012. Wolf Management Plan for the Fond du Lac Reservation. Fond du Lac Band of Lake Superior Chippewa, Cloquet, Minnesota.

Huseby, J. T., D. E. Price, S. J. Ruffing, F. L. DeFoe, and S. S. Strong. 2010. Wolf (Ma'iingan) Management Plan. Red Lake Band of Chippewa Indians, Red Lake, Minnesota.

Leech Lake Tribal Council. 1998. Resolution No. 99-33: Gray Wolf Resolution. Leech Lake Band of Ojibwe, Cass Lake, Minnesota.

Leech Lake Tribal Council. 2021. Tribal Wolf Perspective for the Leech Lake Band of Ojibwe. Leech Lake Band of Ojibwe, Cass Lake, Minnesota.

McArthur, D. 2015. Wolf (Ma'iingan) Management Plan. White Earth Department of Natural Resources, White Earth Band of Ojibwe Indians, Ogema, Minnesota.

Red Lake Tribal Council. 2010. Resolution No. 158-10. Red Lake Band of Chippewa Indians, Red Lake, Minnesota.

White Earth Reservation Tribal Council. 2012. Declaration Designating the White Earth Reservation as a Ma'iingan (Wolf) Sanctuary. White Earth Band of Ojibwe Indians, Ogema, Minnesota.

White Earth Reservation Tribal Council. 2000. White Earth Reservation Conservation Code. White Earth Band of Ojibwe Indians, Ogema, Minnesota.

Appendix 7. Current Minnesota wolf population survey methods

Included are the full methods currently employed as part of Minnesota's wolf population survey. Because some components of the survey (i.e., the wolf range survey) are currently conducted at 5-year intervals, these methods were extracted, with slight grammatical revisions, from the 2017-18 wolf survey report. For that full report, including methodological citations, find the online report at [DISTRIBUTION AND ABUNDANCE OF WOLVES IN MINNESOTA](https://files.dnr.state.mn.us/wildlife/wolves/2017/survey-wolf.pdf) (<https://files.dnr.state.mn.us/wildlife/wolves/2017/survey-wolf.pdf>). For current population estimates, see more recent reports found on the [DNR wolf management webpage](https://mndnr.gov/wolves) (mndnr.gov/wolves).

METHODS

The approach we used to delineate wolf distribution and estimate population size was essentially identical to the previous 5 wolf range surveys, and conceptually similar to the 1978-79 wolf range survey. Primary cooperators were similar to previous wolf range surveys and included natural resources staff within: 1) DNR; 2) U.S. Forest Service; 3) U.S. Fish and Wildlife Service; 4) U.S. Department of Agriculture - Wildlife Services; 5) U.S. Geological Survey; 6) Tribal and Treaty resource authorities; 7) county land departments; 8) Camp Ripley military facility; 9) Voyageurs National Park; and 10) various university collaborators and research projects.

We mailed instructions to participants in October 2017 and asked them to record a location and group size estimate for all wolf sign (e.g., visual, track, scat) observed during the course of normal work duties from November 2017 until snowmelt the following spring (about mid-May 2018). Participants could record locations on forms or maps then provided to us for later data entry, but most data were entered directly by participants in a web-based GIS survey application. As in previous wolf range surveys, we used the Public Land Survey township (36 square miles, with some exceptions) as the spatial scale for classifying wolf observations.

Although recorded estimates of wolf group size are not used directly for population enumeration, the assessment of township-specific wolf occupancy, as discussed below, treats observations of single wolves differently than pack (>1 wolf) detections. We conservatively assumed group size to be 1 in situations where sign was recorded but no group size was noted. If group size was recorded as 'numerous', it was set to 2 (a pack). We then combined this database with wolf observations recorded on other wildlife surveys during 2017-18 (for example, carnivore scent station survey, furbearer winter track survey, moose/deer/elk surveys, etc.). This combined database is hereafter referred to as 'WISUR18'. Locations of verified wolf depredations from 2013 to 2018, as well as locations of wolves harvested during the 2012-2014 regulated wolf seasons, were also consulted for purposes of delineating total wolf range, but they were not used in any assessment of townships currently occupied by wolf packs and are not part of the WISUR18 database.

Delineation of both total range and occupied range includes, but is not limited to, consideration of whether townships meet human and road density criteria defined by Fuller et al. (1992; that

is, townships within wolf range are presumed to be occupied by wolves if road density is <0.7 km/km² and human density is <4 /km², or if road density is <0.5 km/km² and human density is <8 /km²; hereafter termed 'modeled' townships). As in previous surveys, human density was calculated using the most recent (2010) U.S. Census Data as incorporated into the 2010 Minor Civil Divisions GIS layer produced by the Minnesota Legislative Coordinating Commission. Road density calculations are based on the Minnesota Department of Transportation's 1:24,000 GIS roads layer (excluding 'forest roads') and summarized within each township as the number of kilometers of road per km².

Delineation of total wolf range is intended to encompass those areas within the state where consistent or sufficient wolf detections occur (either singles or packs) more than might be expected from 'random' temporally-irregular dispersals. Total wolf range depicts the coarse distribution of wolves within the state and is useful for documenting larger-scale expansions or contractions of wolf range. Although Minnesota's wolf range has expanded south and west since the 1970s, it has remained essentially contiguous



with the Canadian border to the north and Lake Superior and Wisconsin to the east. Because systematic searches for wolf sign are not conducted south and west of the wolf range, and much of the southern and western periphery of wolf range in Minnesota is private land, there is some subjectivity in the approach used to delineate the south and west boundary of the wolf range. Using the previously delineated boundary as the reference point, we re-evaluated the south and west border based on the following data: 1) all WISUR18 observations; 2) modeled townships; 3) land use and cover; and 4) knowledge of wolf activities in the area since the last survey (e.g., wolf depredation sites, 2012-14 wolf harvest locations). While maintaining a contiguous total wolf range, the overall approach is designed to maximize inclusion of areas with periodic (since last survey) or recently abundant wolf observations and modeled townships, while minimizing inclusion of areas that neither fit the model nor contained numerous or consistent wolf observations.

We computed occupied range by subtracting from the total range all townships that neither contained current observations of a pack (defined as >1 animal) nor fit the human-road density model criteria. We also fully excluded lakes larger than 200 km² (n = 5) from calculations of both total and occupied range.

To radio-collar wolves for use in estimation of territory and pack sizes, we and various collaborators captured wolves using foothold traps (LPC # 4, LPC #4 EZ Grip, or LPC #7 EZ Grip) approved as part of research conducted under the Association of Fish and Wildlife Agencies Best Management Practices for trapping program. In addition, numerous wolves were captured using live-restraining neck snares during winter. Wolves were typically immobilized using a mixture of either Ketamine:Xylazine or Telazol:Xylazine. After various project-specific wolf samples and measurements were obtained, the antagonist Yohimbine and an antibiotic were typically administered to animals prior to release. Various models of radio-collars were deployed depending on study area and collar availability. Most GPS radio-collars were

programmed to take 3-6 locations per day, while wolves fitted with VHF-only radio-collars were relocated at approximately 7- to 10-day intervals throughout the year, or in some cases primarily from early winter through spring.

To estimate average territory size, we delineated territories of radio-collared packs using minimum convex polygons (MCP) for consistency with previous surveys. Prior to delineating wolf pack territories, we removed 'outlier' radiolocations using the following guidelines, though subjective deviations were made in some cases as deemed biologically appropriate: 1) for wolves with approximately weekly VHF radiolocations only, locations >5 km from other locations were excluded as extraterritorial forays; 2) for GPS-collared wolves with temporally fine-scale movement information, we removed obvious movement paths if the animal did not travel to that area on multiple occasions and if use of the path would have resulted in overly-excessive inclusion of obviously unused areas in the MCP; and 3) for consistency with the way in which the data is used (i.e., to estimate number of packs), points that result in notable overlap with adjacent territories are removed.

In past surveys where the majority of territories were delineated using VHF radiolocations, territory sizes were increased 37% to account for the average amount of interstitial space between wolf pack territories as estimated from several Minnesota studies where the number of radiolocations per pack typically averaged 30-60. Interstitial spaces are a combination of small voids created by landscape geometry and wolf behavior but are much more likely to be an artifact of territory underestimation when there are comparatively sparse radiolocations. Hence, for packs with <100 radiolocations (n = 9; mean number of radiolocations = 38) we multiplied the area of each estimated territory by 1.37 as in the past. For packs with >100 radiolocations (n = 36; mean number of radiolocations = 1,301), territories were assumed to be fully delineated and were not re-scaled.

To estimate the number of packs within occupied wolf range, the area of occupied range is divided by average scaled territory size. The estimated number of packs is then multiplied by average mid-winter pack size to produce an estimate of pack-associated wolves, which is then divided by 0.85 to account for an estimated 15% lone wolves in the population. Specifically,

$$N = [(km^2 \text{ of occupied range} / \text{mean scaled territory size}) * \text{mean pack size}] / 0.85.$$

Using the accelerated bias-corrected percentile method, the 90% confidence interval for population size was generated from 9,999 bootstrapped re-samples of the pack and territory size data, and does not incorporate uncertainty in estimates of occupied range or percent lone wolves.





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500 Lafayette Road
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888-MINNDNR or 651-296-6157
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